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PORT OF SEATTLE'S MEMO OPPOSING ACC'S MOTION FOR STAY

Declaration of Paul S. Fendt

Volume 2 of 3

AR 010824

SMP Volume 3

PREFACE

Comprehensive Stormwater Management Plan
Seattle-Tacoma International Airport
Master Plan Update Improvements

July 2001

This document contains replacement pages developed in response to comments received from the Washington State Department of Ecology (Ecology) on Volumes 1 through 4 of the December 2000 Comprehensive Stormwater Management Plan (SMP) for the Seattle-Tacoma International Airport Master Plan Update Improvements. A facilitated process was used to document specific revisions required by Ecology to the December 2000 SMP. Each SMP volume contains an itemized list of replacement pages, and the replacement pages are identified by a July 2001 footer.

SMP VOLUME 3
JULY 2001 REPLACEMENT PAGES

Note: Listed page totals do not include "guidance" pages (the guidance pages do not need to be inserted as replacement pages).

DES MOINES CREEK HSPF MODEL CALIBRATION REPORT

VOLUME 3—APPENDIX B1

Prepared for

PARAMETRIX, INC.

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Prepared by

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Roth Hill Engineering Partners, Inc.

AUGUST 2000
556-2912-001 (28)

AR 010827

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AR 010829

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APPENDIX B1

DES MOINES CREEK HSPF MODEL INFORMATION

1. INTRODUCTION

This appendix documents the modifications to and calibration of the Des Moines Creek HSPF model. The HSPF model used for the Des Moines Creek Basin Plan (King County 1997), was used as a basis for the modification of the model that was used in the preparation of the draft Preliminary Comprehensive Stormwater Management Plan (draft SMP) (Parametrix 1999). These modifications led to this current version of the model and its calibration results, presented herein. Calibration results are compared to results obtained using Basin Plan model parameters, U.S. Geological Survey parameters and the previous version of the Des Moines Creek model, used in preparation of the November 1999 draft SMP.

1.1 CHANGES FROM THE KING COUNTY BASIN PLAN MODEL

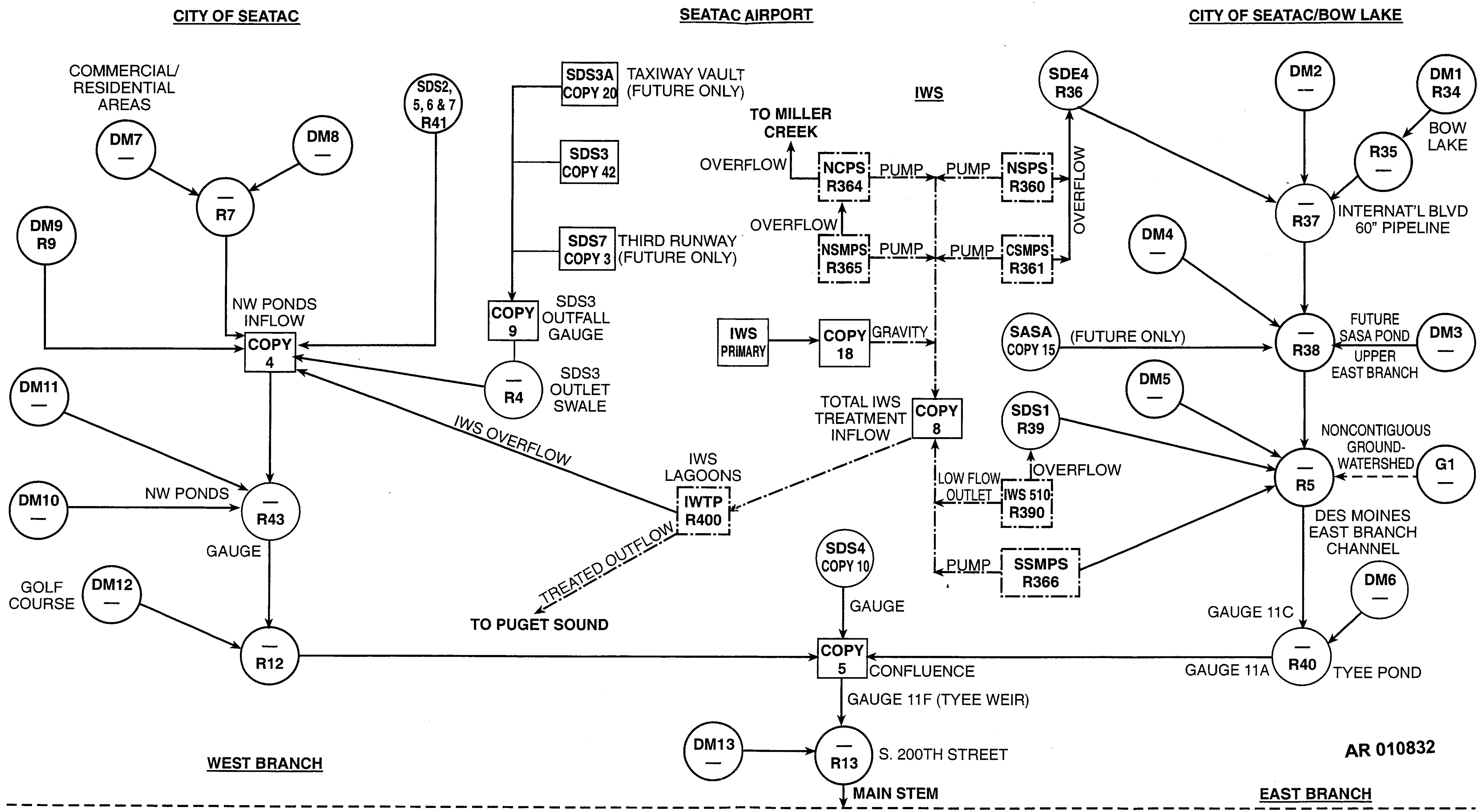
1.1.1 Model Origin

According to the Des Moines Creek Basin Plan, the HSPF model used to perform that analysis resulted from a modification and enhancement of the HSPF model developed by Montgomery Water Group (MWG 1995). The MWG model was also the basis for the previous version of the Des Moines Creek model used in preparation of the November 1999 draft SMP. This current version of the Des Moines Creek model is a modification of the November 1999 draft SMP model, incorporating the Basin Plan model and a number of additional modifications. A schematic representation of the model is shown in Figure B1-1. The HSPF input file for the calibrated model is included at the end of this Appendix.

Changes to the Model

The following changes were incorporated into the November 1999 draft SMP version of the model, to produce the current Des Moines Creek model:

- The drainage basin and subbasin boundaries were modified. Changes include modification of the boundary to subbasin D1, excluding an area south of Bow Lake from discharging through the lake, modifying D16 to exclude an area to the southwest of Executel Pond from discharging through the pond and modifying the boundary of D21 to match the location of flow recording gage 11D. Boundary modifications resulted from examination of topographic mapping and review of basin boundaries determined for the City of SeaTac Surface Water Plan (Earth Tech 1997), which incorporated extensive field examination and the effects of stormwater conveyance on boundary definition. The resulting boundaries are shown in Figure B1-2.



Continued on Sheet 2

Parametrix, Inc. Port of Seattle/HSPF Model/556-2912-001(028) 5/00 (K)

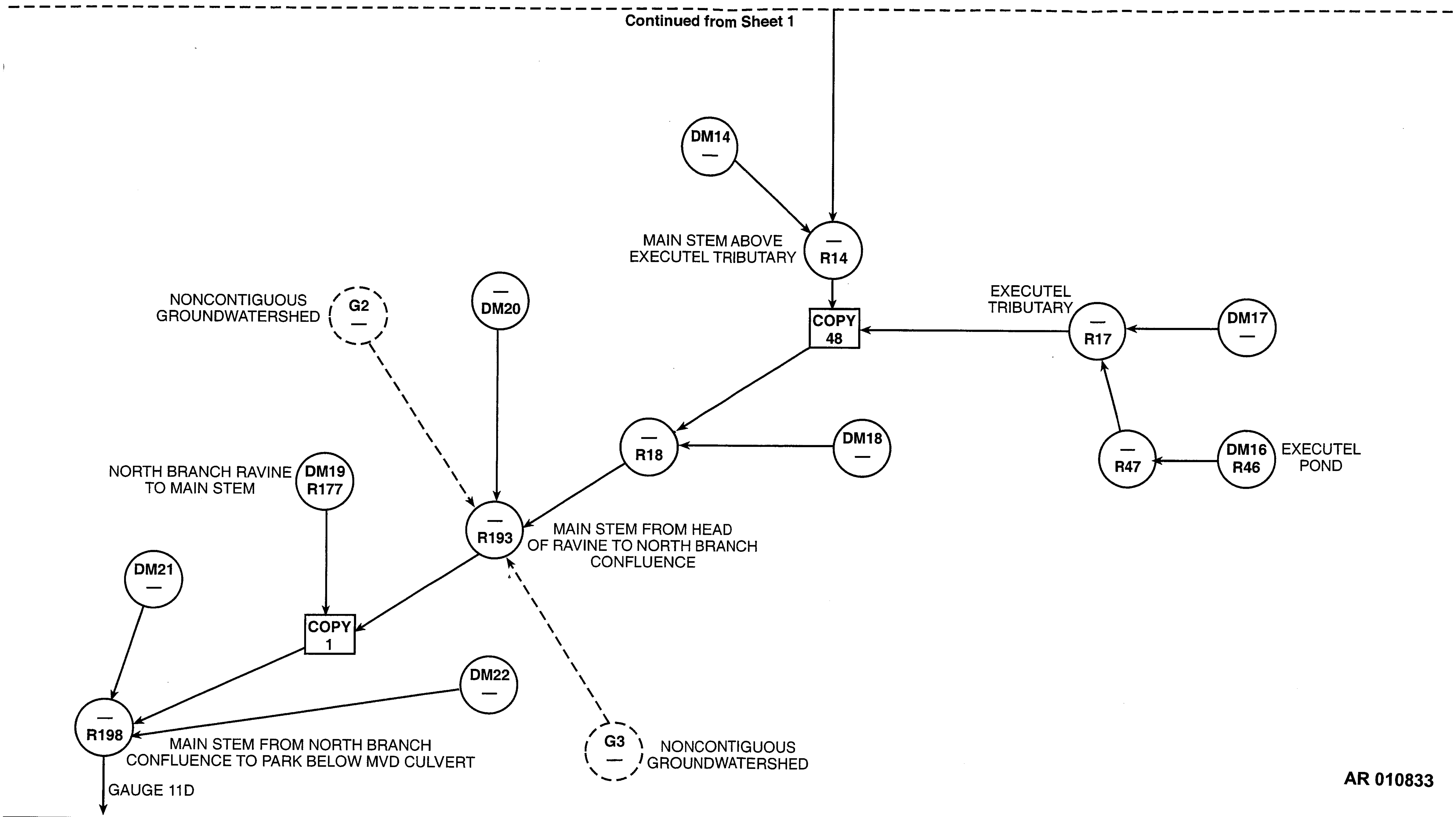
Stormwater
IWS
Groundwater

DM# = Des Moines Creek Subbasin Number
SDS# = Storm Drainage South Number
SDE# = Storm Drainage East Number
R# = Routing Reach Number (Channel or Storage Pond)

DM1 —Subbasin ID
R34 —Routing Reach Number

COPY 8 Summation of upstream flow

Figure B1-1
Des Moines Creek
HSPF Model Schematic
Sheet 1



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Parametrix, Inc. Port of Seattle/HSPF Model/556-2912-001(028) 5/00 (K)

Stormwater
IWS
Groundwater

DM# = Des Moines Creek Subbasin Number
SDS# = Storm Drainage South Number
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DM1 —Subbasin ID
R34 —Routing Reach Number

COPY 8 Summation of upstream flow

Figure B1-1
Des Moines Creek
HSPF Model Schematic
Sheet 2

- Land use acreage has been recomputed for the airport facilities and the area south of the airport, to South 200th Street. The process for updating the land use is discussed later in this Appendix. The resulting land use is summarized in the Table B1-1 provided at the end of this Appendix. Land use for the area within the Des Moines Creek basin, east of the airport and south of South 200th Street, was modified primarily so that the percentage of impervious area within those subbasins was consistent with Basin Plan values. Those impervious percentages were subsequently reduced for the subbasins south of South 200th Street as part of the calibration process.

- Assumptions about groundwater contributions to base flow have been modified, based on the regional groundwater study, discussed below. Figure B1-3 identifies the areas contributing groundwater to Des Moines Creek and the direction of groundwater flow.

- PERLND categories were not separated by slope, consistent with the Basin Plan model.

- Only the surface flow component of runoff is routed to airport subbasin discharge points. Interflow is routed to downstream discharge points, since runoff from airport subbasins is collected in the STIA stormwater drainage system (SDS) and it is assumed that runoff that becomes interflow cannot be collected in the SDS system. Groundwater from the majority of airport subbasins is routed to the Walker Creek drainage basin, as identified in Figure B1-3.

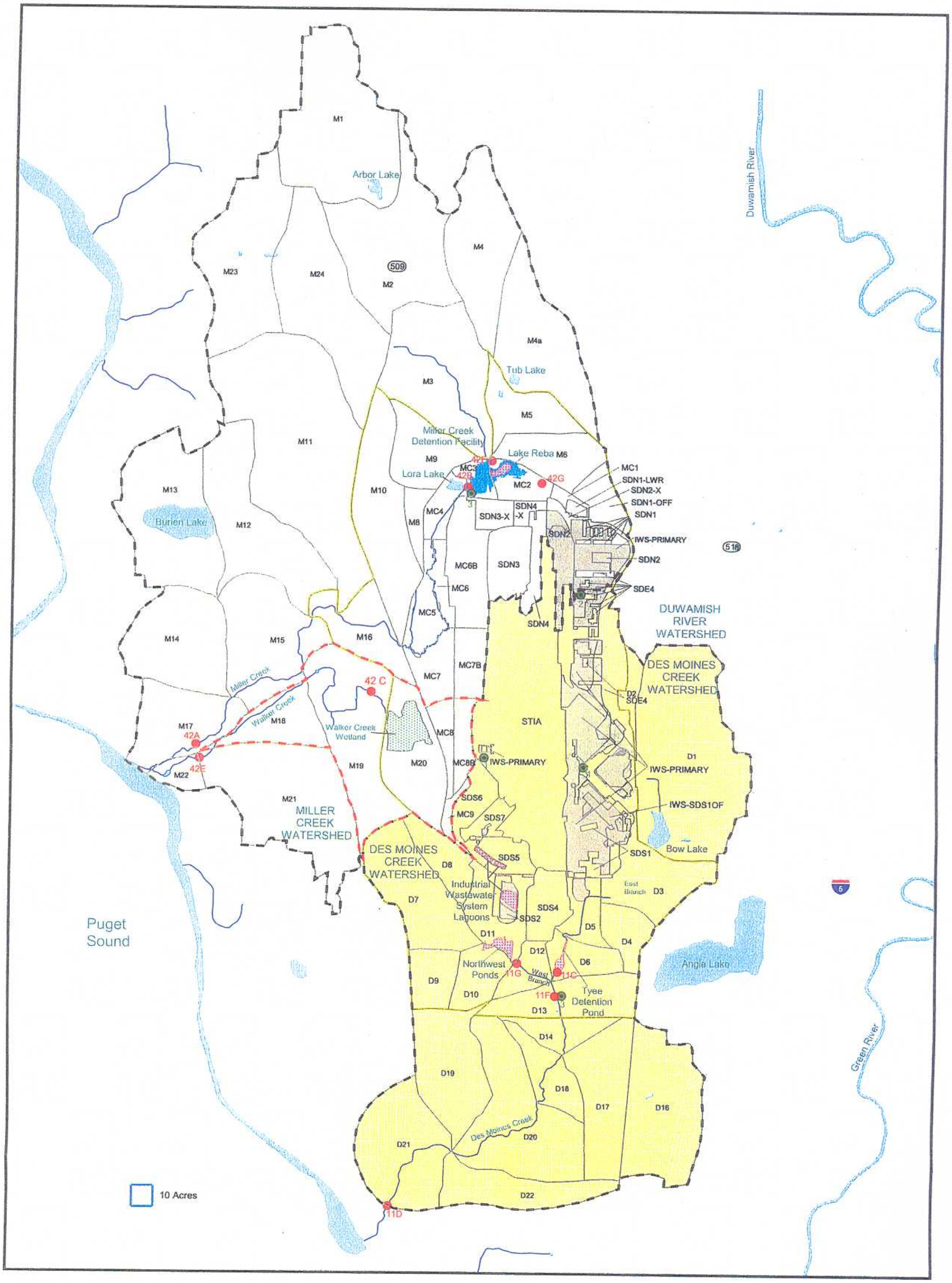
- FTABLES were not modified since they appear to have been previously reviewed by King County, as indicated by comment lines inserted in the calibration input file for the November 1999 SMP.

1.2 SUBBASIN BOUNDARIES, LAND USE, AND SOILS DATA

Subbasin boundaries, land use, and soils data used to develop the previous FEIS and draft SMP basin models were checked against available information sources. Additional data representing 1994 conditions in the STIA subbasin areas were used since land use changes may have occurred since development of earlier versions of the model. The land use information is presented for the STIA subbasin areas later in this Appendix. Figure B1-4 shows the STIA subbasins and the subbasins that comprise the remainder of the Des Moines Creek watershed.

Land use data for subbasins within the STIA area of analysis (Figure B1-4) were compiled using the ArcView 3.2 GIS coverage of airport land use from 1994 aerial photography. Data were developed for the 1994 base year drainage basin boundaries, soil, vegetation, and impervious surfaces. Land use was categorized as shown in Figure B1-4. Soil type was categorized as shown in Figure B1-5. Soil classification was obtained from mapping by the U.S. Geological Survey (Waldron 1962). Soil Conservation Service soil maps do not contain coverage of the area near STIA. Impervious area for the 1994 aerial photo coverage was digitized (Figure B1-6).

The STIA subbasin land use and soil/vegetation information used in the 1994 HSPF model was calculated using ARC/INFO GIS algorithms. The map layers of 1994 impervious areas, 1994 land use codes, 1994 soil codes, existing slope codes and lake areas were combined with the 1994 drainage subbasins using the mathematical concept of identity. A tabular file was output from the



Parametrix, Inc. Sea-Tac Airport Stormwater Management Plan/556-2912-001(28) 6/00 File: K:\Gis\2912\Arcview\mseatac-apdxa_may2001.apr
Source: Roads based on King County data. Water bodies derived from USGS hypsography data. Detention boundaries are approximate.
Note: Subbasin boundaries shown outside of STIA area are for illustration and reference only.
STIA subbasins assume existing (1994) conditions.

July 2001
556-2912-001 (28)

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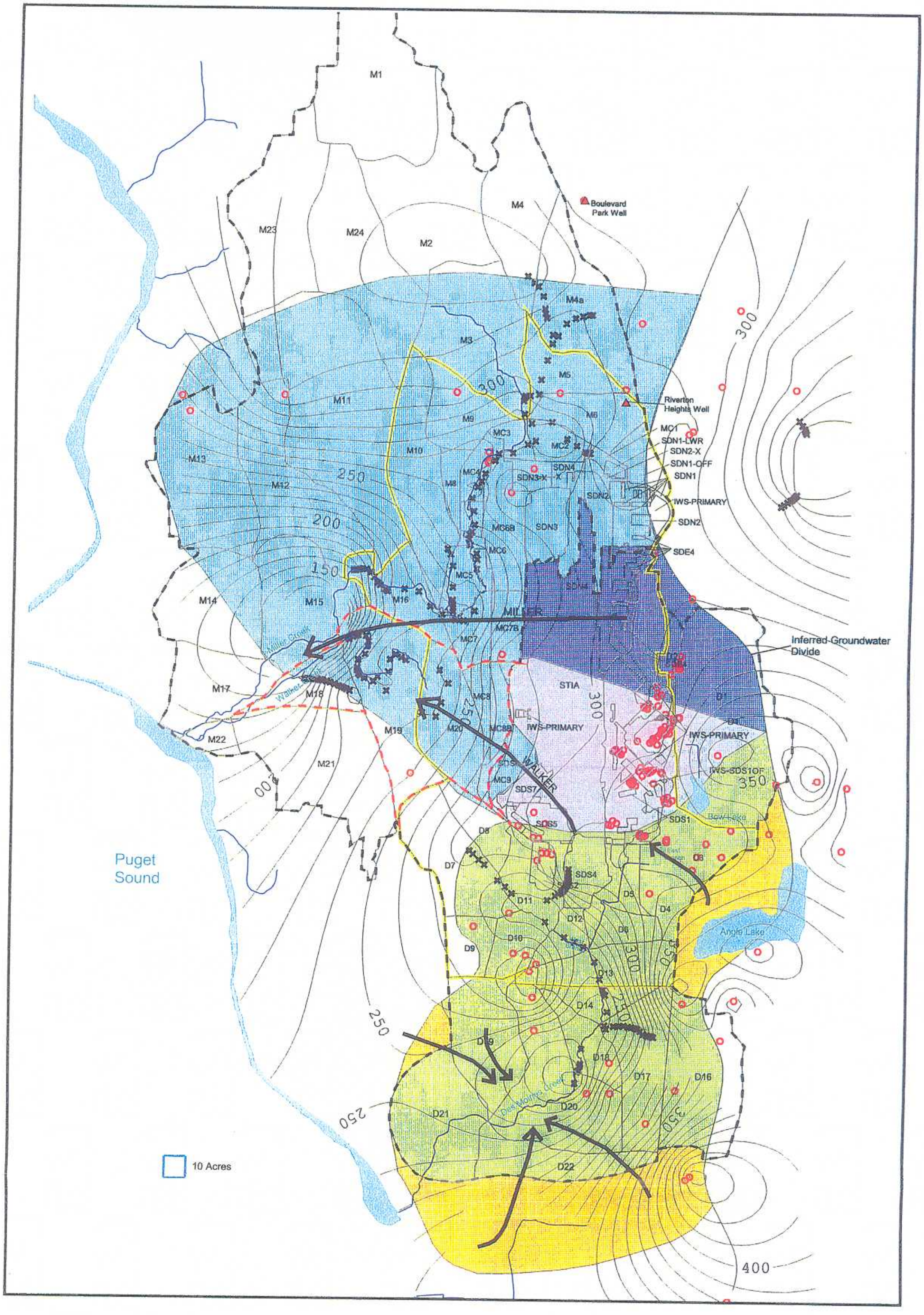
- Roads
- Existing (1994) Drainage Subbasins
- STIA Area (see note)
- Constructed Water Features
- IWS Drainage Area
- Subwatershed Boundary
- Watershed Boundary
- Rivers
- Water Bodies
- Detention Facilities (existing)
- Des Moines Creek Watershed

Precipitation Gaging Stations:
Type 1 - National Weather Service (Gage relocated 1996)
Type 2 - POS Rainfall Monitoring
Type 3 - King County Rainfall Monitoring

Streamflow
King County Gaging Stations:
42A - Miller Ck @ SW 175th Pl & 12th Ave SW
42B - Miller Ck @ Lake Reba/RDF Outlet
42C - Walker Ck @ 171st Pl
42E - Walker Ck @ 12th Ave SW
42F - Miller Ck @ SR518
42G - Miller Ck @ East Branch
11D - Des Moines Ck near mouth
11F - Des Moines Ck @ Golf Course
11C - Des Moines Ck @ Tyee Pond
11G - Des Moines Ck @ NW Ponds

Figure B1-2
Des Moines Creek Watershed Existing Conditions



Parametrix, Inc. Sea-Tac Airport Stormwater Management Plan/556-2912-001(28) 7/00 File: K:\Gis\2912\Arcview\rrseatac-apdxa_may2001
Source: Water bodies derived from USGS hypsography data. Ground water contours from Seattle-Tacoma International Airport Ground Water Study. Associated Earth Sciences, Inc., and S. S. Papadopulos & Assoc., 1999.
Note: STIA Subbassin GIS coverage obtained where conditions may change between 1994 and other conditions; subbasin boundaries shown outside of STIA area are for illustration and reference only.

- Existing (1994) Drainage Subbasins
- STIA Area (see note)
- Watershed Boundary
- Subwatershed Boundaries
- Rivers
- Roads
- Water Bodies
- Noncontiguous Miller Creek groundwater area
- Noncontiguous Walker Creek groundwater area
- Contiguous Miller/Walker groundwater area
- Noncontiguous Des Moines Creek groundwater area
- Contiguous Des Moines Creek groundwater area
- Ground water elevation contour (10 ft. interval) for shallow (C1) aquifer
- Data Point (e.g. monitoring well)
- Wells
- Locations where ground water elevation intersects stream channel
- General ground water flow direction

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Figure B1-3 Groundwater Flow Direction and Boundaries

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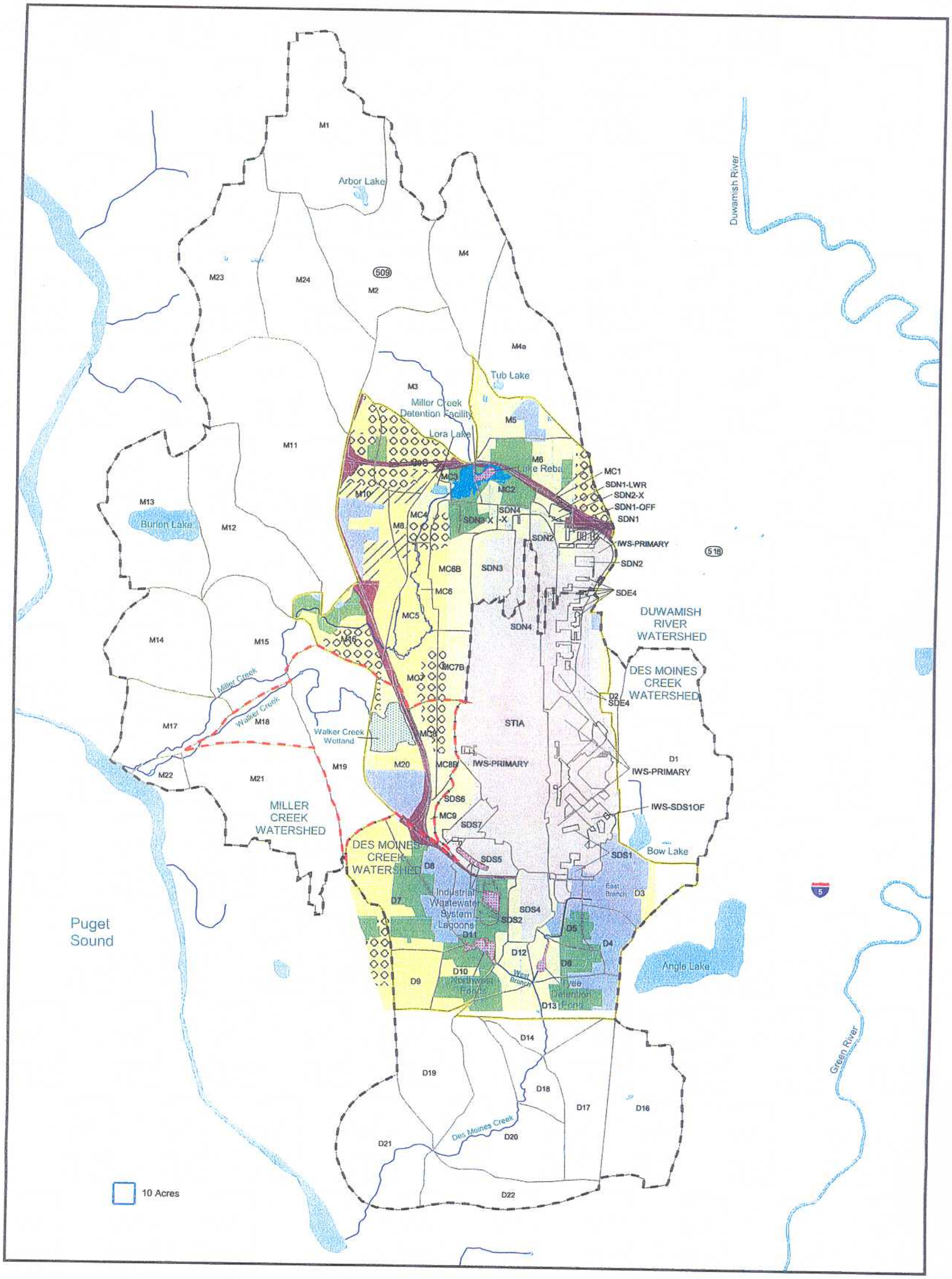

Parametrix, Inc./Sea-Tac Airport Stormwater Management Plan/556-2912-001(28) 6/00 File: K:\Gis\2912\Arcview\rrseatac-apdxa_may2001.apr
Source: Roads based on King County data. Water bodies derived from USGS hypsography data. Estimated wetland boundaries are based on field reconnaissance by Parametrix, Inc.
Land use data interpreted from 1993 STIA aerial photograph (Walker and Assoc. 1993).
Note Subbasin boundaries shown outside of STIA area are for illustration and reference only.

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Roads

- Existing (1994) Drainage Subbasins
- STIA Area (see note)
- Watershed Boundary
- Subwatershed Boundary
- Rivers
- Water Bodies
- Constructed Water Features
- Detention Facilities (existing)
- Sea-Tac Airport
- Commercial
- Open/Grass
- Transportation
- Low Density Residential
- High Density Residential
- Multi-Family Residential
- Forest

Figure B1-4
STIA Drainage Subbasins and 1994 Land Use

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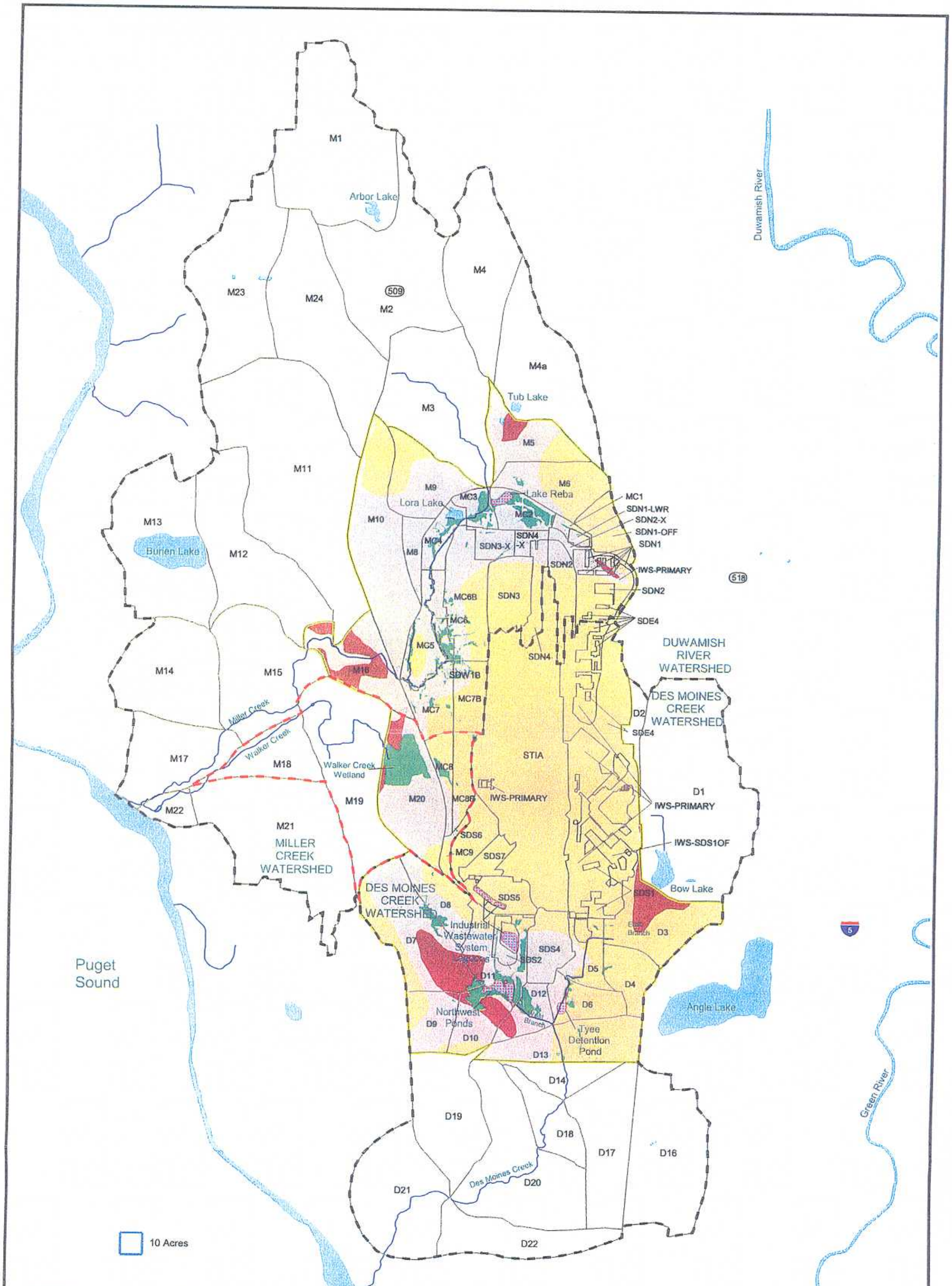

Parametrix, Inc. Sea-Tac Airport Stormwater Management Plan/556-2912-001(28) 6/00 File: K:\Gis\2912\Arcview\rrseatac-apdxa_may2001.apr
Source: Roads based on King County data. Water bodies derived from USGS hypsography data. Estimated wetland boundaries are based on field reconnaissance and interpretation of aerial photographs by Parametrix, Inc. Wetlands are approximate until verified by the ACOE. Soils based on Geologic Map of the Des Moines Quadrangle Washington, (Waldran,1962, U. S. Geological Survey).

July 2001
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Roads

Existing (1994) Drainage Subbasins

STIA Area (see note)

Watershed Boundary

Subwatershed Boundary

Rivers

Water Bodies

Constructed Water Features

Soils:

Till

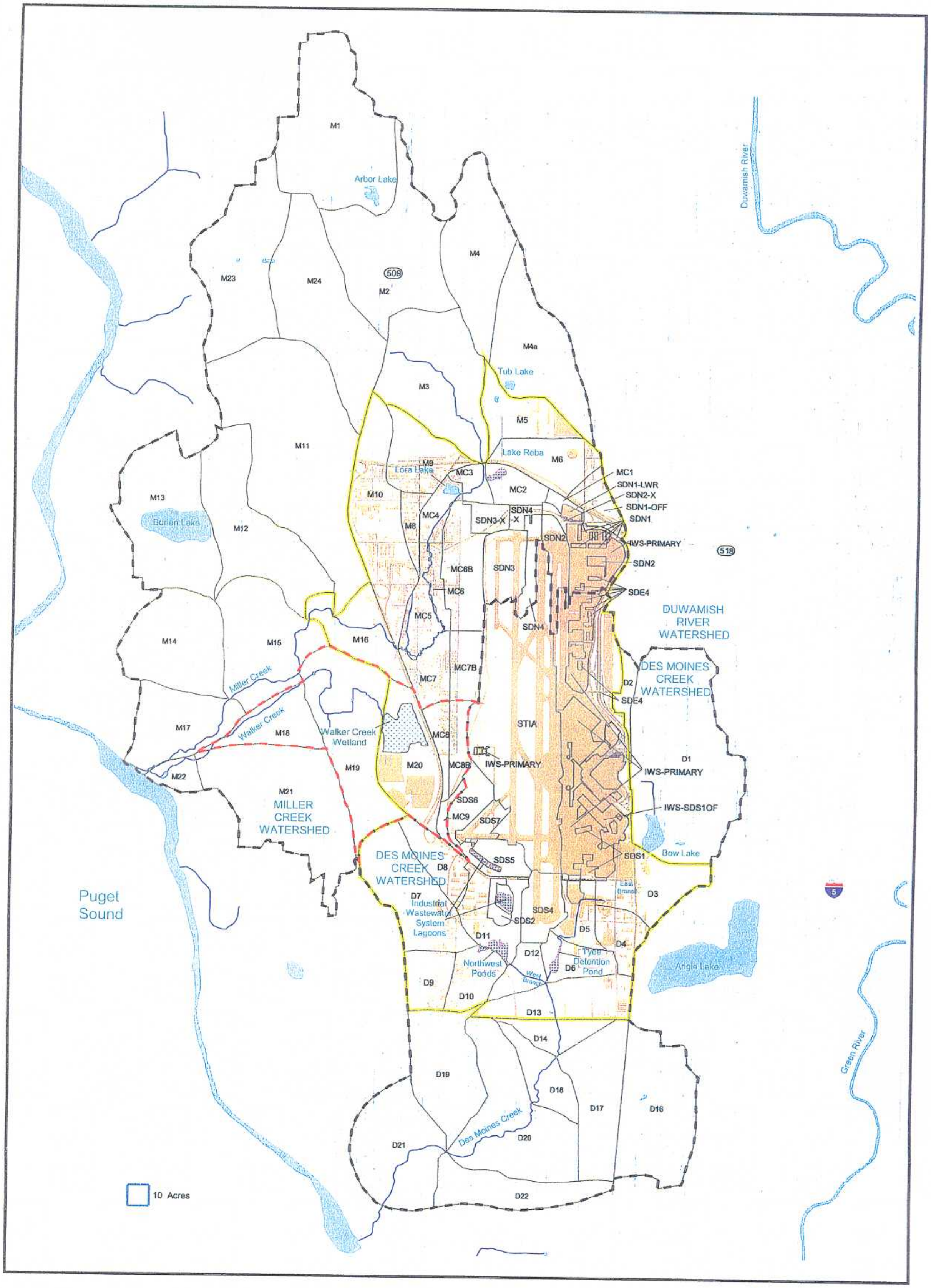
Wetland

Outwash

Lacustrine

Figure B1-5
STIA Drainage Subbasins and 1994 Soils

AR 010838



Parametrix, Inc. Sea-Tac Airport Stormwater Management Plan/556-2912-001(28) 6/00 File: K:\Gis\2912\Arcview\rrseatac-apdxa_may2001.apr
Source: Roads based on King County data. Water bodies derived from USGS hypsography data. Impervious surface data interpreted from 1993 STIA aerial photograph (Walker and Assoc. 1993).
Note: Subbasin boundaries shown outside of STIA area are for illustration and reference only.

July 2001
556-2912-001 (28)

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	Roads		Rivers		Impervious Areas
	Watershed Boundary		STIA Area (see note)		Constructed Water Features
	Subwatershed Boundary		Existing (1994) Drainage Subbasins		Water Bodies

Figure B1-6
STIA Drainage Subbasins and 1994 Impervious Areas

AR 010839

resulting 1994 GIS map. This map was used to create the 1994 table used in the HSPF model. The 1994 report figures were also created using the 1994 GIS map data.

Table B1-1, at the end of this Appendix, summarizes the land use information (by subbasin) used for the model calibration based on 1994 watershed conditions. Existing impervious surfaces were assumed to be 100 percent effective for airport drainage to the SDS systems.

Subsequent to the GIS analysis examination of aerial photography identified 23.2 acres within SDS3 that should be categorized as impervious. The results primarily from construction of interconnecting taxiways, during the calibration period. The model was modified to incorporate this.

1.3 REGIONAL GROUNDWATER STUDY

In conjunction with an assessment of potential groundwater movement in the vicinity of STIA, the Port of Seattle commissioned a regional groundwater study to be performed by Associated Earth Sciences (AESI) and S.S. Papodopulos and Associates (AESI 1999). As part of that study, a groundwater model is being developed. At this time, preliminary results are available based on water well monitoring that indicate the transport direction of shallow and intermediate groundwater in the vicinity of Miller Creek.

Figure B1-3 shows the inferred direction of groundwater movement within the vicinity of the Des Moines Creek watershed. Note that much of the flow is directed toward a region in the lower portion of the creek just south of South 208th Street. Discharging groundwater occurs in this region as evidenced by the drawdown of the groundwater surface potentiometric lines. These form the shape of concentric ellipses in the discharge region shown in Figure B1-3. Other discharges occur upstream of this region where the stream intersects the base of the shallow aquifer layer, as identified by the green x's.

Figure B1-3 also depicts how the shallow aquifer groundwater elevation map was used to estimate the non-contiguous groundwater area contributing to Des Moines Creek. The map was superimposed with an outline of the subbasins used in the Des Moines Creek HSPF model. The approximate 512-acre area that is <u>not contiguous</u> with the surface water drainage topography was identified as three contributing "groundwater sheds" for Des Moines Creek.

1.4 CALIBRATION PROCESS AND RESULTS

Calibration of the model was performed using data from three flow gages:

- 11D – Des Moines Creek near the mouth.
- 11C – East branch of Des Moines Creek/Tyee Pond inflow.
- SDS3.

The locations of the Des Moines Creek flow monitoring gages are shown in Figure B1-1. The location of the SDS3 gage is south of subbasin SDS3, between SDS-2 and SDS4.

Parameter value adjustments were made initially to match the total simulated runoff volume with the total flow monitoring volume, within the standard criteria of 10 percent. After a good volume calibration was achieved, parameter values were adjusted to achieve proper simulation of base flows. Finally, detailed storm hydrographs were calibrated, primarily by adjustment of the IRC parameter.

The flow duration curves and hydrographs included at the end of this appendix summarize the results of the calibration at all three locations. For purposes of comparison, additional graphs are included for the following alternative parameter value sets:

- U.S. Geological Survey Regional Calibration Parameters.
- Des Moines Creek Basin Plan parameters. The results of this scenario do not reflect the actual Basin Plan model, but rather the model parameter set in the current calibration model, for comparison.
- HSPF Model Used in Preparation of the November 1999 draft SMP.

Table B1-2 lists parameter values for the calibrated model and the three scenarios mentioned above.

Table B1-2. Parameter value sets.

		Value			
Parameter	**Category**	**Calibration**	**U.S. Geological Survey Regional**[1]	**Basin Plan**	**11/99 draftSMP**[1]
LZSN	Till Forest	4.5	4.5	4.5	4.5
	Till Grass	4.5	4.5	4.5	4.5
	Outwash Forest	5.0	5.0	5.0	5.0
	Outwash Grass	5.0	5.0	5.0	5.0
INFILT	Till Forest	0.2	0.08	0.2	0.2
	Till Grass	0.075	0.03	0.075	0.075
	Outwash Forest	2.0	2.0	2.0	2.0
	Outwash Grass	0.8	0.8	0.8	0.8
KVARY	Till Forest	0.5	0.5	0.5	0.5
	Till Grass	0.5	0.5	0.5	0.5
	Outwash Forest	0.3	0.3	0.3	0.3
	Outwash Grass	0.3	0.3	0.3	0.3
INFEXP	Till Forest	2.0	2.0	2.0	2.0
	Till Grass	2.0	2.0	2.0	2.0
	Outwash Forest	2.0	2.0	2.0	2.0
	Outwash Grass	2.0	2.0	2.0	2.0
DEEPFR	Till Forest	0.55	-	0.7	0.6
	Till Grass	0.55	-	0.7	0.6
	Outwash Forest	0.55	-	0.7	0.6
	Outwash Grass	0.55	-	0.7	0.6
BASETP	Till Forest	0.0	0.0	0.0	0.0
	Till Grass	0.0	0.0	0.0	0.0

Table B1-2. Parameter value sets (continued).

Parameter	Category	Value			
		Calibration	U.S. Geological Survey Regional[1]	Basin Plan	11/99 draftSMP[1]
	Outwash Forest	0.0	0.0	0.0	0.0
	Outwash Grass	0.0	0.0	0.0	0.0
UZSN	Till Forest	0.50	0.50	0.50	0.50
	Till Grass	0.25	0.25	0.25	0.25
	Outwash Forest	0.50	0.50	0.50	0.50
	Outwash Grass	0.50	0.50	0.50	0.50
AGWRC	Till Forest	0.996	0.996	0.996	0.996
	Till Grass	0.996	0.996	0.996	0.996
	Outwash Forest	0.996	0.996	0.996	0.996
	Outwash Grass	0.996	0.996	0.996	0.996
INTFW	Till Forest	3.0	6.0	3.0	3.0
	Till Grass	3.0	6.0	3.0	3.0
	Outwash Forest	0.0	0.0	0.0	0.0
	Outwash Grass	0.0	0.0	0.0	0.0
LZETP	Till Forest	0.70	0.70	0.70	0.70
	Till Grass	0.25	0.25	0.25	0.25
	Outwash Forest	0.70	0.70	0.70	0.70
	Outwash Grass	0.25	0.25	0.25	0.25
IRC	Till Forest	0.50	0.50	0.25	0.25
	Till Grass	0.50	0.50	0.25	0.25
	Outwash Forest	0.70	0.70	0.35	0.35
	Outwash Grass	0.70	0.70	0.35	0.35
AGWETP	Till Forest	0.0	0.0	0.0	0.0
	Till Grass	0.0	0.0	0.0	0.0
	Outwash Forest	0.0	0.0	0.0	0.0
	Outwash Grass	0.0	0.0	0.0	0.0

1 Since the calibration model does not distinguish between slope categories, parameter values for moderate slopes were input for comparison.

Parameter values summarized in Table B1-2 generally show consistency among the four parameter value sets. Calibration INFILT values for till soils are higher than USGS values but are consistent with Basin Plan values.

Table B1-3 compares monitored runoff to simulated total runoff volume near the mouth of the Creek for all four scenarios. The results indicate that the best overall volume match at this location is achieved using the calibration and Basin Plan model.

Table B1-3. Comparison of monitored and simulated runoff volume at the mouth of Des Moines Creek.

Scenario	Simulated Volume % Difference vs Monitored Volume
Calibrated Model	3%
U.S. Geological Survey Parameters	15%
Basin Plan Parameters	-3%
11/99 draft SMP Model	4%

Comparison of the flow duration curves and hydrographs for the four parameter value sets, near the mouth of Des Moines Creek shows that the calibration file provides the best overall match of peak flows. The other three parameter value sets over simulate peak flows at this location. The calibrated model and the Basin Plan parameters provide the best overall match of base flows near the mouth.

Comparison of hydrographs at SDS3 also shows that the calibration file provides the best overall match of peak flows. The other three parameter value sets over simulate peak flows at this location as well. Examination of the hydrographs indicates that a much better overall match occurs—assuming that only surface runoff is collected in the SDS and conveyed to the monitored discharge point.

Comparison of flow duration curves and hydrographs at the Tyee Pond inflow indicate that all four parameter value sets underestimate both peaks and base flow. Repeated efforts at parameter value and impervious percentage adjustment failed to result in significant improvement of the calibration at this location. Attempts at increasing Tyee Pond simulated peaks and base flow consistently resulted in a poor calibration near the mouth of the creek. Refer to Calibration Issues, below, for further discussion about flow monitoring at this location.

1.5 CALIBRATION ISSUES

1.5.1 Tyee Pond Inflow Calibration

Although a good calibration was achieved at the mouth, the Tyee pond inflow is under simulating both volume and large peaks. However, a reasonable match is achieved for smaller peak flows. INFILT & IRC were lowered in an attempt to match peaks, with only limited improvement at Tyee Pond, but resulting in a poor calibration near the mouth. Parameters were therefore left at their previous values. This appears to be a hydraulic routing or flow monitoring data problem that can not necessarily be solved by parameter adjustment. Comparison of monitored peak flows at Tyee Pond inflow versus the creek mouth, for the March 23, 1995 storm show that the Tyee Pond inflow peak (~ 62 cfs) is actually higher than the peak flow near the mouth (~ 57 cfs).

According to the Basin Plan, Des Moines Creek has a base flow of approximately 0.55 cfs near the mouth. Flow monitoring data at the Tyee Pond inflow location indicates a base flow of approximately 0.35 cfs. The land use contributing to the east branch of the creek at Tyee Pond is so heavily urbanized that it seems unlikely that enough rainfall can get into groundwater to support 0.35 cfs base flow. If the flow monitoring data is correct at both locations, then 18 percent of the basin pervious area is contributing 64 percent of the creek base flow near the mouth. Additionally, much more outwash soil is located in the west and downstream subbasins which contributes a much larger portion of rainfall to the groundwater supply and subsequently the base flow.

1.5.2 SDS3 Calibration

For SDS3/airport subbasins, preexisting airport fill is modeled as till soil since the underlaying soil is till. Results using Basin Plan model parameters indicate that total simulated runoff volumes are 11 percent greater than recorded volumes. Receding limbs of the hydrographs did not decrease nearly as rapidly as recorded data. Since runoff from SDS3 is collected in a piped system, simulations were performed assuming that only surface runoff discharges from the subbasin through the SDS piping. This produced a much better match with receding limbs.

Since only surface runoff is routed to airport subbasin discharge points, interflow is routed to Des Moines Creek, downstream of the SDS3 collection system. Mapping provided as part of the regional groundwater study referenced in Section 3.4 was utilized for determination of interflow routing. Des Moines Creek subbasins located in the eastern portion of the airport, including interflow from IWS subbasin pervious areas, were routed to Bow Lake. Interflow from SDS3 was routed to Northwest Ponds inflow.

Flow monitoring data from the SDS3 gage has not been observed to exceed approximately 61 cfs for the three largest storms during the calibration period. Since the flow-monitoring gage is at the end of a long pipe with a tee outlet, it is possible that the capacity of that structure is approximately 61 cfs. Parametrix staff observed flow from the discharge pipe to be pulsating during a large storm event, a potential indicator of air binding. Additionally, the upstream manholes on the discharge pipe had to be sealed due to surcharging; further evidence that capacity is reached.

Total simulated volume is only 78 percent of monitored volume;[1] however, SDS3 flow monitoring also indicates a consistent base flow of approximately 0.5 cfs. Since runoff is collected and discharged through a piped system, it is unknown what phenomenon could produce this base flow. One explanation is that the flow monitoring device will not register zero flow. This could account for the undersimulation of total volume at the gage.

Gage 11D (Near Mouth)

According to a discussion with King County staff gage 11D, is believed to be accurate up to approximately 200 cfs. Above 200 cfs a downstream flow restriction creates a backwater at the gage location. Under this condition, small increases in stream flow create larger increases in stage at the gage location. As a result the gage is believed to overestimate flows above 200 cfs.

---

[1] Calibration results for the period October 1, 1989 through September 20, 1996 showed the total simulated volume to be 97 percent of the monitored volume.

2. REFERENCES

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DES MOINES CREEK HSPF CALIBRATION MODEL INPUT FILE

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  ***  PARAMETRIX JUNE, 2000
  ***  Revised to include King County comments (March 2001)
  ***  1994 BASE CONDITION/CALIBRATION MODEL
  ***  REVISE AIRPORT PERLND = 30% IMP. ASSUMPTION
  ***  ADD 23.2 AC OF IMPERVIOUS TO SDS 3 THAT WERE LEFT OUT
  ***
  DES MOINES CREEK BASIN HSPF MODEL
  START       1948/10/01 00:00  END    1996/09/30 24:00
  START       1992/01/01 00:00  END    1996/09/30 24:00***
  RUN INTERP OUTPUT LEVEL    0
  RESUME     0 RUN     1
END GLOBAL

FILES
MESSU      24   DM94R.MES
WDM        25   Dmcalib.WDM
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      16
      PERLND      26
      PERLND      34
      PERLND      44
      PERLND      54
      PERLND      65
      PERLND      66
      PERLND      67
      PERLND      68
      IMPLND      14
      COPY        50
      COPY        51
      COPY        52
      COPY        53
      COPY        54
      RCHRES     360
      RCHRES     361
      RCHRES      36
      RCHRES     390
      RCHRES      39
***   COPY        20
***   COPY         3
      COPY        42
      COPY        41
      COPY        10
      COPY         9
      RCHRES       4
      RCHRES     364
      RCHRES     365
      RCHRES     366
      COPY        18
      COPY         8
      RCHRES     400
      RCHRES      41
      RCHRES       7
      RCHRES       9
      COPY         4
      RCHRES      43
***   COPY        15
      RCHRES      34
      RCHRES      35
      RCHRES      37
      RCHRES      38
      RCHRES       5
      RCHRES      40
      RCHRES      12
      COPY         5
      RCHRES      13
      RCHRES      14
      RCHRES     177
      RCHRES      46
      RCHRES      47
```

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      RCHRES        17
      COPY          48
      RCHRES        18
      RCHRES       193
      COPY           1
      RCHRES       198
      COPY         100
    END INGRP
END OPN SEQUENCE

COPY
  TIMESERIES
  Copy-opn                                                                          ***
    # -  #  NPT  NMN                                                                ***
    1   54         1
  100  100         4
  END TIMESERIES
END COPY

PERLND
  GEN-INFO
    <PLS >        Name            NBLKS   Unit-systems   Printer                    ***
    # -  #                              User  t-series Engl Metr                    ***
                                              in  out                               ***
   16       TFM- TILL FOR MOD       1     1     1    1   60     0
   26       TGM- TILL GR MOD        1     1     1    1   60     0
   34       OF - OUTWASH FOR        1     1     1    1   60     0
   44       OG - OUTWASH GR         1     1     1    1   60     0
   54       SA - WETLANDS           1     1     1    1   60     0
   65       GW - TILL FOR MOD       1     1     1    1   60     0
   66       GW - TILL GR MOD        1     1     1    1   60     0
   67       GW - OUTWASH FOR        1     1     1    1   60     0
   68       GW - OUTWASH FOR        1     1     1    1   60     0

  END GEN-INFO
  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC             ***
   14   68    0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    <PLS > ********************* Print-flags ************************* PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
   14   68    0    0    6    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  PWAT-PARM1
    <PLS > ***************** Flags ********************
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                            ***
   14   68    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS > ***
    # -  # ***FOREST      LZSN     INFILT      LSUR     SLSUR     KVARY     AGWRC
   16                   4.5000     0.2000    200.00    0.1000    0.5000    0.9960
   26                   4.5000     0.0750    400.00    0.1000    0.5000    0.9960
   34                   5.0000     2.0000    200.00    0.0500    0.3000    0.9960
   44                   5.0000     0.8000    200.00    0.0500    0.3000    0.9960
   54                   4.0000     2.0000    200.00    0.0010    0.5000    0.9960
   65                   4.5000     0.2000    200.00    0.1000    0.5000    0.9960
   66                   4.5000     0.0750    400.00    0.1000    0.5000    0.9960
   67                   5.0000     2.0000    200.00    0.0500    0.3000    0.9960
   68                   5.0000     0.8000    200.00    0.0500    0.3000    0.9960

  END PWAT-PARM2
  PWAT-PARM3
    <PLS >***
    # -  #*** PETMAX    PETMIN     INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16                             2.0000    2.0000      0.55      0.00       0.0
   26                             2.0000    2.0000      0.55      0.00       0.0
   34                             2.0000    2.0000      0.55      0.00       0.0
   44                             2.0000    2.0000      0.55      0.00       0.0
   54                             10.000    2.0000      0.55      0.00       0.7
   65                             2.0000    2.0000      0.55      0.00       0.0
   66                             2.0000    2.0000      0.55      0.00       0.0
   67                             2.0000    2.0000      0.55      0.00       0.0
```

```
    68                          2.0000    2.0000      0.55      0.00        0.0

  END PWAT-PARM3
  PWAT-PARM4
    <PLS >                                                              ***
    # -  #      CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
   16          0.2000    0.5000    0.3500     3.000    0.5000    0.7000
   26          0.1000    0.2500    0.2500     3.000    0.5000    0.2500
   34          0.2000    0.5000    0.3500     0.000    0.7000    0.7000
   44          0.1000    0.5000    0.2500     0.000    0.7000    0.2500
   54          0.2000    3.0000    0.5000     1.000    0.7000    0.8000
   65          0.2000    0.5000    0.3500     3.000    0.5000    0.7000
   66          0.1000    0.2500    0.2500     3.000    0.5000    0.2500
   67          0.2000    0.5000    0.3500     0.000    0.7000    0.7000
   68          0.1000    0.5000    0.2500     0.000    0.7000    0.2500

  END PWAT-PARM4
  PWAT-STATE1
    <PLS >  PWATER state variables***
    # -  #***    CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   16           0.078        0.    0.0010        0.     0.075     0.267     0.026
   26           0.051        0.    0.0350        0.     1.928     0.680     0.049
   34           0.078        0.    0.0010        0.     0.090     0.676     0.038
   44           0.051        0.    0.0040        0.     1.127     0.614     0.152
   54           0.051        0.    0.3330        0.     0.622     0.000     0.000
   65           0.078        0.    0.0010        0.     0.075     0.267     0.026
   66           0.051        0.    0.0350        0.     1.928     0.680     0.049
   67           0.078        0.    0.0010        0.     0.090     0.676     0.038
   68           0.051        0.    0.0040        0.     1.127     0.614     0.152

  END PWAT-STATE1
END PERLND

IMPLND
  GEN-INFO
    <ILS >      Name            Unit-systems   Printer                      ***
    # -  #                    User  t-series Engl Metr                      ***
                                    in  out                                 ***
   13  140 IMPERVIOUS            1     1    1   60    0
  END GEN-INFO
  ACTIVITY
    <ILS > ************* Active Sections ****
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL  ***
   13  140    0    0    1    0    0    0
  END ACTIVITY
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
   13  140    0    0    6    0    0    0    1    9
  END PRINT-INFO
  IWAT-PARM1
    <ILS >          Flags         ***                                       ***
    # -  # CSNO RTOP  VRS  VNN RTLI   ***                                   ***
   13  140    0    0    0    0    0
  END IWAT-PARM1
  IWAT-PARM2
    <ILS >                                                                  ***
    # -  #       LSUR     SLSUR      NSUR     RETSC ***
   14           500.0    0.0100    0.1000    0.100
  140          100.00    0.0500    0.1000    0.0500
  END IWAT-PARM2
  IWAT-PARM3
    <ILS >                                                                  ***
    # -  #     PETMAX    PETMIN                                             ***
   13  140
  END IWAT-PARM3
  IWAT-STATE1
    <ILS >  IWATER state variables                                          ***
    # -  #       RETS      SURS                                             ***
   13  140 1.0000E-3 1.0000E-3
  END IWAT-STATE1
END IMPLND

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
```

```
  # -  #<------------------><---> User T-series  Engl Metr LKFG                ***
                                         in  out                                ***
  4     SDS-3 Outlet Swale       1    1    1    1    0    0    0
  5     E.Branch above TyeeP     1    1    1    1    0    0    0
  7     DM7 & DM8 Conveyance     1    1    1    1    0    0    0
  9     DM9 Conveyance           1    1    1    1    0    0    0
 12     Lower W. Branch          1    1    1    1    0    0    0
 13     Confl. to 200th St.      1    1    1    1    0    0    0
 14     200th to Exec. Trib.     1    1    1    1    0    0    0
 17     Executel Tributary       1    1    1    1    0    0    0
 18     Exec.Confl. to 208th     2    1    1    1    0    0    0
 34     Bow Lake                 2    1    1    1    0    0    1
 35     Pipe A Bow LK Outlet     1    1    1    1    0    0    0
 36     SDE-4 Combined Disch     1    1    1    1    0    0    0
 37     Pipe B 60" Intl Blvd     1    1    1    1    0    0    0
 38     Upper E. Branch          1    1    1    1    0    0    0
 39     SDS-1 Storm Only         1    1    1    1    0    0    0
 40     Tyee Pond                1    1    1    1    0    0    0
 41     SDS-2,5,6 & 7 Disch      1    1    1    1    0    0    0
 43     Northwest Ponds          2    1    1    1    0    0    1
 46     Executel Pond            1    1    1    1    0    0    0
 47     Pipe C Exec.Pond Dis     1    1    1    1    0    0    0
177     North Branch Ravine      1    1    1    1    0    0    0
193     Upper Ravine             1    1    1    1    0    0    0
198     Lower Ravine             1    1    1    1    0    0    0
360     SDE-4 NSPS               2    1    1    1    0    0    0
361     SDE-4 CSMPS              2    1    1    1    0    0    0
364     SDN-2 NCPS               2    1    1    1    0    0    0
365     SDN-2 NSMPS              2    1    1    1    0    0    0
366     OTF   SSMPS              2    1    1    1    0    0    0
390     SDS-1 IWS Overflow       2    1    1    1    0    0    0
400     IWS Lagoons              2    1    1    1    0    0    0
END GEN-INFO

ACTIVITY
  RCHRES *************** Active Sections *****************
  # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG                     ***
  1  400    1    0    0    0    0    0    0    0    0    0
END ACTIVITY
PRINT-INFO
  RCHRES *************** Printout Flags ****************** PIVL  PYR
  # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
  1  400    6    0    0    0    0    0    0    0    0    0    1    9
END PRINT-INFO
HYDR-PARM1
  RCHRES  Flags for each HYDR Section                                          ***
  # -  #   VC A1 A2 A3  ODFVFG for each *** ODGTFG for each      FUNCT  for each
           FG FG FG FG  possible   exit *** possible   exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *          ***
  4   17    0  1  1  0    4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
 18   34    0  1  1  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
 35   41    0  1  1  0    4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
 43         0  1  1  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
 46  198    0  1  1  0    4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
360  400    0  1  1  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
END HYDR-PARM1

HYDR-PARM2
  RCHRES                                                                       ***
  # -  #     FTABNO        LEN     DELTH      STCOR         KS       DB50      ***
<------><--------><--------><--------><--------><--------><-------->          ***
  4              4   0.530                                 0.3
  5              5   0.380                                 0.3
  7              7   0.341                                 0.3
  9              9   0.189                                 0.3
 12             12   0.273                                 0.3
 13             13   0.218                                 0.3
 14             14   0.218                                 0.3
 17             17   0.246                                 0.3
 18             18   0.303                                 0.3
 34             34   0.208                                 0.3
 35             35   0.123                                 0.3
 36             36   0.100                                 0.3
 37             37   0.381                                 0.3
 38             38   0.142                                 0.3
 39             39   0.100                                 0.3
```

```
  40              40   0.189                                     0.3
  41              41   0.530                                     0.3
  43              43   0.189                                     0.3
  46              46   0.047                                     0.3
  47              47   0.417                                     0.3
 177             177   0.407                                     0.3
 193             193   0.795                                     0.3
 198             198   0.631                                     0.3
 360             360   0.010                                     0.0
 361             361   0.010                                     0.0
 364             364   0.010                                     0.0
 365             365   0.010                                     0.0
 366             366   0.010                                     0.0
 390             390   0.010                                     0.0
 400             400   0.010                                     0.3
 END HYDR-PARM2

 HYDR-INIT
   RCHRES  Initial conditions for each HYDR section                         ***
   # -  # ***   VOL      Initial  value  of COLIND      Initial  value  of OUTDGT
        *** ac-ft      for each possible exit          for each possible exit
 <------><-------->    <---><---><---><---><---> ***  <---><---><---><---><--->
    4    0.1             4.0
    5    0.1             4.0
    7    0.1             4.0
    9    0.1             4.0
   12    0.1             4.0
   13    0.1             4.0
   14    0.1             4.0
   17    0.1             4.0
   18    0.1             4.0  5.0
   34    35.             4.0  5.0
   35    0.0             4.0
   36    0.0             4.0
   37    0.0             4.0
   38    0.0             4.0
   39    0.0             4.0
   40    0.0             4.0
   41    0.0             4.0
   43    0.7             4.0  5.0
   46    0.0             4.0
   47    0.0             4.0
  177    0.0             4.0
  193    0.0             4.0
  198    0.0             4.0
  360    0.0             4.0  5.0
  361    0.0             4.0  5.0
  364    0.0             4.0  5.0
  365    0.0             4.0  5.0
  366    0.0             4.0  5.0
  390    0.0             4.0  5.0
  400    0.0             4.0  5.0
 END HYDR-INIT
END RCHRES

FTABLES

  FTABLE      4
*** SDS-3 OUTLET SWALE
 ROWS COLS ***
    7    4
***  DEPTH      AREA    VOLUME    OUTFLOW  OUTFLOW2
      (FT)   (ACRES) (ACRE-FT)     (CFS)     (CFS)                       ***
      .000      .000       0.0       0.0
      .500      .198       0.1       9.0
     1.000      .236       0.5      30.9
     2.000      .306       1.0     115.8
     3.000      .376       1.5     265.5
     4.000      .446       5.0     491.8
     5.000      .517      20.0     806.3
  END FTABLE  4

  FTABLE      5
*** (REACH 5:  THIS TABLE LOOKS OK)
*** EAST BRANCH ABOVE TYEE POND
 ROWS COLS ***
```

```
   13     4
***   DEPTH       AREA     VOLUME     OUTFLOW  OUTFLOW2                          ***
       (FT)    (ACRES)  (ACRE-FT)      (CFS)     (CFS)
       .000       .000       .000       .000
       .550       .290       .100      4.900
      1.100       .543       .200     20.800
      1.650       .609       .300     46.500
      2.200       .671       .400     80.000
      2.750       .732      0.500    118.700
      3.300       .778      0.600    159.500
      3.850       .819      0.700    198.400
      4.400       .849      0.801    231.900
      4.950       .866      1.000    252.900
      5.500       .865      1.200    253.000
      8.200       .973      1.500    400.000
     10.200      1.043      2.000    520.000
  END FTABLE  5

  FTABLE      7
*** DM7 & DM8 CONVEYANCE
 ROWS COLS ***
    8     4
***   DEPTH       AREA     VOLUME     OUTFLOW  OUTFLOW2                          ***
       (FT)    (ACRES)  (ACRE-FT)      (CFS)     (CFS)
       .000       .000       .000       .000
       .500       .360       .120      6.200
      1.000       .416       .276     20.800
      2.000       .520       .694     75.400
      3.000       .626      1.252    168.700
      4.000       .732      1.950    306.900
      5.000       .836      2.790    496.100
      6.000       .942      3.768    742.300
  END FTABLE  7

  FTABLE      9
*** DM9 CONVEYANCE
 ROWS COLS ***
    8     4
***   DEPTH       AREA     VOLUME     OUTFLOW  OUTFLOW2                          ***
       (FT)    (ACRES)  (ACRE-FT)      (CFS)     (CFS)
       .000        .00        0.0         .0
       .500        .20        0.7        9.7
      1.000        .23        3.1       32.6
      2.000        .29       14.9        118
      3.000        .35       38.4        265
      4.000        .41         77        482
      5.000        .47        135        778
      6.000        .52        214       1165
  END FTABLE  9

  FTABLE     12
*** LOWER WEST BRANCH
*** REVISED BASED ON HEC-RAS MODEL
 ROWS COLS ***
   13     4
***   DEPTH       AREA     VOLUME     OUTFLOW  OUTFLOW2                          ***
       (FT)    (ACRES)  (ACRE-FT)      (CFS)     (CFS)
       .000       .000      0.000       .000
       .500       .291      0.030      0.150
      1.000       .346      0.260      6.600
      2.000       .450      0.430     14.100
      3.000       .554      0.650     25.000
      4.000       .656      1.180     50.000
      5.000       .753      2.170     75.000
      6.000       .796      3.820    100.000
      7.000       .837      8.820    150.000
      8.000       .837     16.200    200.000
      9.000       .837     27.920    250.000
     10.000       .837     33.530    350.000
     11.000       .837     35.380    450.000
  END FTABLE 12

  FTABLE     13
*** CONFLUENCE TO 200TH STREET
 ROWS COLS ***
    9     4
```

```
***  DEPTH       AREA    VOLUME     OUTFLOW   OUTFLOW2                        ***
      (FT)     (ACRES) (ACRE-FT)     (CFS)      (CFS)
      .000       .000      .000       .000
      .500       .153      .051      4.300
     1.000       .272      .132     14.400
     2.000       .317      .312     50.400
     3.000       .360      .544    109.600
     4.000       .404      .826    195.000
     5.000       .450     1.163    309.500
     6.000       .497     1.548    456.300
     7.000       .542     1.984    638.000
  END FTABLE 13

  FTABLE     14
*** 200TH STREET TO EXECUTEL TRIBUTARY
*** REACH 190 FROM TR-20/KING COUNTY BASIN PLAN MODEL:
 ROWS COLS ***
    5    4
***  DEPTH       AREA    VOLUME     OUTFLOW   OUTFLOW2                        ***
      (FT)     (ACRES) (ACRE-FT)     (CFS)      (CFS)
     0.000      0.000     0.000      0.000
     0.900      0.70     0.4000      30.00
     1.800      0.80     1.1000     115.60
     2.700      1.10     2.1000     269.80
     4.200      1.30     4.3000     707.10
  END FTABLE 14

  FTABLE     17
*** EXECUTEL TRIBUTARY
 ROWS COLS ***
   10    4
***  DEPTH       AREA    VOLUME     OUTFLOW   OUTFLOW2                        ***
      (FT)     (ACRES) (ACRE-FT)     (CFS)      (CFS)
      .000       .000      .000       .000
      .300       .169      .034      2.900
      .600       .192      .076      9.800
      .900       .215      .128     20.400
     1.200       .238      .189     35.100
     1.500       .259      .258     54.100
     1.800       .282      .336     77.700
     2.100       .303      .423    106.200
     3.100       .376      .779    245.000
     3.600       .412      .988    335.000
  END FTABLE 17

  FTABLE     18
*** CONFLUENCE WITH EXECUTEL TRIBUTARY TO 208TH STREET
*** REPRESENTS GW LOSS IN WETLAND BELOW 200TH
 ROWS COLS ***
   14    5
***  DEPTH       AREA    VOLUME     OUTFLOW   OUTFLOW2                        ***
      (FT)     (ACRES) (ACRE-FT)     (CFS)      (CFS)
      .000       .000      .000       .000       0.00
      .500       .572      .191      7.300       0.00
     1.000       .799      .438     10.000       0.00
     2.000       .968     1.001     20.700       0.00
     3.000      1.155     1.727    100.000       0.00
     4.000      1.317     2.542    262.700       0.00
     5.000      1.478     3.475    400.300       0.00
     6.000      1.643     4.545    570.200       0.00
     7.000      1.791     5.688    774.400       0.00
     8.000      1.932     6.822   1015.100       0.00
     9.000      1.945     7.025   1294.500       0.00
    10.000      1.958     7.244   1614.500       0.00
    11.000      1.970     7.481   1977.000       0.00
    12.000      1.983     7.734   2384.700       0.00
  END FTABLE 18

  FTABLE     34
*** BOW LAKE
*** BASED ON ENTRANCE CONTROL FOR 36 INCH OUTLET PIPE
 ROWS COLS ***
    8    5
***  DEPTH       AREA    VOLUME     OUTFLOW   OUTFLOW2                        ***
      (FT)     (ACRES) (ACRE-FT)     (CFS)      (CFS)
     0.000     14.000     0.000      0.000       0.00
```

```
     1.000    14.000    14.000     7.000       0.00
     1.500    14.000    21.000    13.000       0.00
     2.000    14.000    28.000    17.000       0.00
     3.000    14.000    42.000    35.000       0.00
     4.000    14.000    56.000    49.000       0.00
     5.000    14.000    70.000    60.000       0.00
     6.000    14.000    84.000    70.000       0.00
  END FTABLE 34

  FTABLE     35
*** 36" BOW LAKE DISCHARGE PIPELINE (A)
*** STORAGE ELIMINATED FROM MONTGOMERY MODEL (DMH 1/4/96)
 ROWS COLS ***
   13    4
***  DEPTH      AREA    VOLUME   OUTFLOW  OUTFLOW2                              ***
      (FT)   (ACRES) (ACRE-FT)     (CFS)     (CFS)
      .000      .000      .000      .000
      .300      .020     .0006     1.000
      .600      .026     .0026     4.200
      .900      .032     .0068     9.400
     1.200      .034     .0134    16.200
     1.500      .037     .0226    24.000
     1.800      .039     .0346    32.300
     2.100      .040     .0492    40.100
     2.400      .040     .0667    46.900
     2.700      .039     .0857    51.200
     3.000      .037     .1000    55.300
*** SURCHARGING- NEXT LINES ARE FICTITIOUS
     3.300      .038     .2500    60.300
     4.000      .038     .4000    80.000
  END FTABLE 35

*** REACH 36 HUGELY OVER-ATTENUATED FLOWS PROVIDING
*** 25.+ AC-FT OF STORAGE.  1/4/96 DISCUSSION WITH K. RITLAND
*** OF MONTGOMERY GROUP SUGGESTS TR-20 MODEL WAS MISINTERPRETED
*** IN DEVELOPMENT OF ORIGNINAL F-TABLE.  FOLLOWING TABLE IS CON-
*** SISTENT WITH TR-20 MODEL AND 5700 FOOT LENGTH.
*** NOTE: LENGTH SHORTENED TO 0.1 MILE (HSPF UNITS).  MORE CONSISTENT
*** WITH SDE-4 CONVEYANCE
  FTABLE     36
*** SDE-4 COMBINED DISCHARGE
 ROWS COLS ***
   11    4
***  DEPTH      AREA    VOLUME   OUTFLOW  OUTFLOW2                              ***
      (FT)   (ACRES) (ACRE-FT)     (CFS)     (CFS)
      .000      .000      .000      .000
      .400      .343     0.090     2.200
      .800      .442     0.150     9.500
     1.200      .523     0.200    21.100
     1.600      .577     0.250    36.300
     2.000      .618     0.300    54.000
     2.400      .646     0.350    72.500
     2.800      .659     0.400    90.200
     3.200      .662     0.450   105.500
     3.600      .649     0.550   115.000
     4.000      .618     0.650   115.100
  END FTABLE 36

  FTABLE     37
*** 60" INTERNATIONAL BLVD PIPELINE (B)
*** (THIS ONE LOOKS OK, DMH 1/4/96)
 ROWS COLS ***
   13    4
***  DEPTH      AREA    VOLUME   OUTFLOW  OUTFLOW2                              ***
      (FT)   (ACRES) (ACRE-FT)     (CFS)     (CFS)
      .000      .000      .000      .000
      .450      .134      .045     4.800
      .900      .190      .100    20.300
     1.350      .225      .150    45.400
     1.800      .249      .200    78.000
     2.250      .266      .250   115.900
     2.700      .271      .300   155.800
     3.150      .264      .350   193.800
     3.600      .251      .400   226.500
     4.050      .238      .450   247.000
     4.500      .234      .500   247.100
```

```
     6.500       .185       .600   340.000
     8.500       .166       .700   415.000
  END FTABLE 37

  FTABLE      38
*** UPPER EAST BRANCH
*** VOLUMES CORRECTED 1/4/96 (PREVIOUSLY HUGE VOLUMES IN MONTGOMERY TABLE)
 ROWS COLS ***
    9    4
***  DEPTH       AREA    VOLUME    OUTFLOW  OUTFLOW2
      (FT)    (ACRES) (ACRE-FT)      (CFS)     (CFS)                     ***
      .000       .000       .000      .000
      .500       .176       .100     9.200
     1.000       .194      0.150    30.400
     2.000       .232      0.200   105.800
     3.000       .271      0.250   228.900
     4.000       .310      0.350   405.800
     5.000       .349      0.450   642.700
     6.000       .387      0.600   945.700
     7.000       .426      0.800  1320.700
  END FTABLE 38

*** AGAIN, IS THE STORAGE REALISTIC IN THIS TABLE, REACH 39
*** VOLUMES ARE WAY TOO HIGH TO BE CONSISTENT WITH TR-20
*** STORAGE IN MONTGOMERY MODEL HAS BEEN ELIMINATED (DMH  1/4/96)
  FTABLE      39
*** SDS-1 DISCHARGE
 ROWS COLS ***
   11    4
***  DEPTH       AREA    VOLUME    OUTFLOW  OUTFLOW2
      (FT)    (ACRES) (ACRE-FT)      (CFS)     (CFS)                     ***
      .000       .000       .000      .000
      .250       .020       .030     2.200
      .500       .027       .035     9.400
      .750       .031       .042    21.000
     1.000       .035       .049    36.000
     1.250       .039      0.056    53.600
     1.500       .039      0.064    72.000
     1.750       .041      0.074    89.500
     2.000       .041      0.084   104.700
     2.250       .041      0.094   114.200
     2.500       .038      0.100   114.300
  END FTABLE 39

  FTABLE      40
*** TYEE POND
*** BASED ON TYEE POND AS-BUILTS AND AUTOMATED GATE OPERATION MANUAL
*** K RITLAND 2/4/98
 ROWS COLS ***
   20    4
***  DEPTH       AREA    VOLUME    OUTFLOW  OUTFLOW2
      (FT)    (ACRES) (ACRE-FT)      (CFS)     (CFS)                     ***
      0.00       0.00       0.00      0.00
      0.90       0.01       0.01     10.00
      1.65       0.02       0.02     20.00
      3.11       0.07       0.07     30.00
      4.56       0.22       0.29     40.00
      6.02       0.63       0.89     50.00
      7.48       0.88       2.02     60.00
      8.62       1.06       3.18     70.00
      9.79       1.18       4.29     80.00
     10.88       1.34       5.83     90.00
     11.99       1.48       7.20    100.00
     13.12       1.69       9.17    110.00
     15.13       2.04      12.90    120.00
     16.10       2.20      14.92    124.10
     16.30       2.24      15.40    129.65
     16.57       2.28      15.88    150.36
     16.64       2.32      16.36    155.00
     16.80       2.36      16.84    208.74
     17.03       2.40      17.32    293.59
     17.26       2.43      17.79    428.11
  END FTABLE 40

  FTABLE      41
*** SDS-2,5,6 & 7 DISCHARGE
```

```
 ROWS COLS ***
    7    4
***  DEPTH      AREA   VOLUME   OUTFLOW  OUTFLOW2                                ***
      (FT)   (ACRES) (ACRE-FT)    (CFS)     (CFS)
      .000      .000       0.0      0.0
      .500      .198       0.1      9.0
     1.000      .236       0.5     30.9
     2.000      .306       1.0    115.8
     3.000      .376       1.5    265.5
     4.000      .446       5.0    491.8
     5.000      .517      20.0    806.3
  END FTABLE 41

  FTABLE      43
*** NORTHWEST PONDS
*** BASED ON KING COUNTY BASIN PLANNING MODEL (DAVID HARTLEY, 12/16/98)
 ROWS COLS ***
   17    5
***  DEPTH      AREA   VOLUME   OUTFLOW  OUTFLOW2                                ***
      (FT)   (ACRES) (ACRE-FT)    (CFS)     (CFS)
     0.000    12.000     0.000    0.000      0.00
     0.100    12.000    18.800    0.000      0.00
     1.000    12.000    24.000    0.200      0.00
     2.000    12.000    30.000    0.500      0.00
     3.000    12.000    37.000    1.000      0.00
     3.500    13.000    41.000    5.000      0.00
     4.000    13.000    45.700   15.000      0.00
     4.500    13.000    51.000   35.000      0.00
     5.000    14.000    56.500  150.000      0.00
     5.500    14.000    62.800  200.000      0.00
     6.000    14.000    69.000  300.000      0.00
     6.500    14.000    83.500  350.000      0.00
     7.000    15.000    99.900  400.000      0.00
     8.000    17.000    119.00  500.000      0.00
     9.000    20.000    141.50  550.000      0.00
    10.000    23.000    180.00  600.000      0.00
    11.000    27.000    200.00  650.000      0.00
  END FTABLE 43

  FTABLE      46
*** EXECUTEL POND
 ROWS COLS ***
   20    4
***  DEPTH      AREA   VOLUME   OUTFLOW  OUTFLOW2                                ***
      (FT)   (ACRES) (ACRE-FT)    (CFS)     (CFS)
      .000      .000      .000     .000
     1.000      .080      .080   24.420
     2.000      .230      .310   34.540
     3.000      .393      .703   42.300
     3.500      .494      .950   45.690
     4.000      .508     1.204   48.850
     4.500      .532     1.470   51.810
     5.000      .540     1.740   54.610
     5.500      .540     2.010   57.280
     6.000      .580     2.300   59.820
     6.500      .600     2.600   62.270
     7.000      .600     2.900   64.620
     7.500      .600     3.200   66.900
     8.000      .620     3.510   69.100
     8.500      .640     3.830   71.200
     9.000      .740     4.200   82.220
    10.000      .650     4.850  119.830
    11.000      .720     5.570  169.000
    12.000      .750     6.320  250.900
    13.000     1.000     7.320  500.900
  END FTABLE 46

  FTABLE      47
*** EXECUTEL POND DISCHARGE PIPELINE (C)
 ROWS COLS ***
   11    4
***  DEPTH      AREA   VOLUME   OUTFLOW  OUTFLOW2                                ***
      (FT)   (ACRES) (ACRE-FT)    (CFS)     (CFS)
      .000      .000      .000     .000
      .350      .069      .020    4.600
      .700      .096      .056   19.200
```

```
     1.050       .112       .099    42.800
     1.400       .124       .150    73.400
     1.750       .125       .203   109.000
     2.100       .121       .240   146.600
     2.450       .110       .264   182.400
     2.800       .096       .284   213.200
     3.150       .090       .290   232.400
     3.500       .088       .293   232.600
  END FTABLE 47

  FTABLE    177
*** NORTH BRANCH RAVINE
 ROWS COLS ***
   14    4
***  DEPTH      AREA    VOLUME    OUTFLOW  OUTFLOW2                       ***
      (FT)    (ACRES) (ACRE-FT)     (CFS)     (CFS)
      .000       .000      .000        .0
      .500       .572      .191       7.3
     1.000       .799      .438      23.2
     2.000       .968     1.001      75.7
     3.000      1.155     1.727     155.1
     4.000      1.317     2.542     262.7
     5.000      1.478     3.475     400.3
     6.000      1.643     4.545     570.2
     7.000      1.791     5.688     774.4
     8.000      1.932     6.822    1015.1
     9.000      1.945     7.025    1294.5
    10.000      1.958     7.244    1614.5
    11.000      1.970     7.481    1977.0
    12.000      1.983     7.734    2384.7
  END FTABLE177

  FTABLE    193
*** UPPER RAVINE
 ROWS COLS ***
   14    4
***  DEPTH      AREA    VOLUME    OUTFLOW  OUTFLOW2                       ***
      (FT)    (ACRES) (ACRE-FT)     (CFS)     (CFS)
      0.00       0.00      0.00       0.0
      0.35       0.72      0.75       7.8
      0.70       0.72      1.51      23.5
      1.05       0.72      2.28      44.3
      1.40       0.72      3.03      68.2
      1.75       0.72      3.81      95.8
      2.10       0.72      4.56     125.2
      2.45       0.75      5.36     169.0
      2.80       0.89      6.30     171.5
      3.15       1.00      7.35     247.6
      3.50       1.08      8.49     332.7
      3.85       1.21      9.75     396.5
      4.20       1.32     11.13     521.2
      4.55       1.41     12.60     655.5
  END FTABLE193

  FTABLE    198
 ROWS COLS ***
*** LOWER RAVINE
*** ROUGH ESTIMATE BASED ON FIELD VISIT OF 12/20/95
*** NEED A 2 FT CONTOUR SURVEY TO IMPROVE DEPTH STORAGE INFO
*** FLOW WAS 6 TO 7 CFS WITH DEPTH OF 8"
*** NEAR OUTLET.
*** DRIVE WHICH REPRESENTS A RESTRICTION ACCORDING TO OBSERVATION
*** CULVERT HYDRAULICS SHOULD BE ANALYSED ALSO.
    8    4
***  DEPTH      AREA    VOLUME    OUTFLOW  OUTFLOW2                       ***
      (FT)    (ACRES) (ACRE-FT)     (CFS)     (CFS)
      0.00       0.00      0.00       0.0
      1.00       0.50      0.80      10.0
      2.00       0.55      1.30      25.0
      3.00       0.60      1.80      50.0
      5.00       0.70      2.50     100.0
*** SUBMERGENCE OF CULVERT
     10.00       2.50     12.00     245.0
*** OVERBANK STORAGE
*** FLOWS BASED ON 243', .03 D-W FACTOR, PLUS LOSS OF 1. VELOCITY HEAD
     15.00      10.00     40.00     325.0
```

```
   20.00      11.00      90.00      390.0
 END FTABLE198

 FTABLE     360
*** NORTH SATELLITE PUMP STATION (SDE-4) (INSTALLED IN 1995)
 ROWS COLS                                                              ***
    5    5
     DEPTH       AREA     VOLUME       (IWS)      (SDS)                 ***
      (FT)    (ACRES)  (ACRE-FT)       (CFS)      (CFS)                 ***
        .0        1.0        .00        0.00       0.00
      1.00        1.0        .01        4.79       0.00
      2.00        1.0        .02        4.79       0.00
      3.00        1.0        .03        4.79      25.00
      4.00        1.0        .04        4.79      50.00
 END FTABLE360

 FTABLE     361
*** CENTRAL SNOWMELT PUMP STATION (SDE-4) (INSTALLED IN 1998)
 ROWS COLS                                                              ***
    5    5
     DEPTH       AREA     VOLUME       (IWS)      (SDS)                 ***
      (FT)    (ACRES)  (ACRE-FT)    ( FT3/S)   ( FT3/S)                 ***
        .0        1.0        .00        0.00       0.00
      1.00        1.0        .01        1.67       0.00
      2.00        1.0        .02        1.67       0.00
      3.00        1.0        .03        1.67      25.00
      4.00        1.0        .04        1.67      50.00
 END FTABLE361

 FTABLE     364
*** NORTH CARGO PUMP STATION (SDN-2) (INSTALLED IN OCTOBER 1997)
 ROWS COLS                                                              ***
    5    5
     DEPTH       AREA     VOLUME       (IWS)      (SDN)                 ***
      (FT)    (ACRES)  (ACRE-FT)       (CFS)      (CFS)                 ***
        .0       1.00        .00        0.00       0.00
      1.00       1.00        .01        6.13       0.00
      2.00       1.00        .02        6.13       0.00
      3.00       1.00        .03        6.13      25.00
      4.00       1.00        .04        6.13      50.00
 END FTABLE364

 FTABLE     365
*** NORTH SNOWMELT PUMP STATION (SDN-2) (INSTALLED IN LATE 1997/1998)
 ROWS COLS                                                              ***
    5    5
     DEPTH       AREA     VOLUME       (IWS)      (SDN)                 ***
      (FT)    (ACRES)  (ACRE-FT)       (CFS)      (CFS)                 ***
        .0       1.00        .00        0.00       0.00
      1.00       1.00        .01        1.67       0.00
      2.00       1.00        .02        1.67       0.00
      3.00       1.00        .03        1.67      25.00
      4.00       1.00        .04        1.67      50.00
 END FTABLE365

 FTABLE     366
*** SOUTH SNOWMELT (OLYMPIC TANK FARM) PUMP STATION (INSTALLED IN LATE 1997/1998)
 ROWS COLS                                                              ***
    5    5
     DEPTH       AREA     VOLUME       (IWS)      (SDS)                 ***
      (FT)    (ACRES)  (ACRE-FT)       (CFS)      (CFS)                 ***
        .0       1.00        .00        0.00       0.00
      1.00       1.00        .01        1.67       0.00
      2.00       1.00        .02        1.67       0.00
      3.00       1.00        .03        1.67      25.00
      4.00       1.00        .04        1.67      50.00
 END FTABLE366

 FTABLE     390
*** IWS OVERFLOW TO SDS-1
*** BASED ON SYMONDS MEMO 1/6/98, FROM WATERWORKS MODELING
 ROWS COLS                                                              ***
    7    5
     DEPTH       AREA     VOLUME       (IWS)      (SDS)                 ***
      (FT)    (ACRES)  (ACRE-FT)       (CFS)      (CFS)                 ***
        .0        .00       .000         .00        .00
```

```
     1.00       .20       .001      4.70      0.00
     1.50       .20       .002      4.90      0.50
     2.00       .20       .003      5.60      3.00
     2.50       .23       .004      5.65      4.40
     3.00       .23       .005      5.70      6.30
     4.00       .23       .006      6.00     12.00
  END FTABLE390

  FTABLE    400
 ROWS COLS           IWS LAGOONS                                         ***
*** OUTFLOW1 =  2/4 MGD OUTPUT OF TREATED EFFLUENT TO SOUND
*** OUTFLOW2 =  OVERFLOW TO NORTHWEST PONDS
   9    5
    DEPTH      AREA    VOLUME  IWS - PS  OVERFLOW                        ***
     (FT)   (ACRES) (ACRE-FT)     (CFS)     (CFS)                        ***
       .0       0.0       .00      0.00       .00
      2.0       7.0      20.0      3.09      0.00
      4.0       7.0      34.0      3.09      0.00
      6.0       7.5      48.0      3.09      0.00
      8.0       8.0      63.0      6.19      0.00
     10.0       8.0      79.0      6.19      0.00
*** THREAT OF OVERFLOW, THEN PLANT INCREASES TREATMENT RATE, BUT
*** LOSES TREATMENT EFFICIENCY IN ORDER TO AVOID DISCHARGE TO
*** DES MOINES CREEK SYSTEM
     11.5       8.0      90.5     11.00      0.00
     11.6       8.0      91.0     11.00    100.00
     11.7       8.0      91.5     11.00    300.00
  END FTABLE400
END FTABLES


EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGLZERO               PERLND  14  68 EXTNL  PREC
WDM      2 PREC     ENGLZERO               IMPLND  14     EXTNL  PREC
WDM      2 PREC     ENGLZERO               RCHRES  34     EXTNL  PREC
WDM      2 PREC     ENGLZERO               RCHRES  40     EXTNL  PREC
WDM      2 PREC     ENGLZERO               RCHRES  43     EXTNL  PREC
WDM      1 EVAP     ENGLZERO    0.8        PERLND  14 440 EXTNL  PETINP
WDM      1 EVAP     ENGLZERO    0.8        IMPLND  14 140 EXTNL  PETINP
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  34     EXTNL  POTEV
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  43     EXTNL  POTEV
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  40     EXTNL  POTEV
END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
********************************************************************************
*** TO WDM ONLY FOR WATER BALANCE CALIBRATION
COPY     50 OUTPUT MEAN   1     12.1       WDM     50 TAET      ENGL      REPL
COPY     51 OUTPUT MEAN   1     12.1       WDM     51 IMPE      ENGL      REPL
COPY     52 OUTPUT MEAN   1                WDM     52 UZS       ENGL      REPL
COPY     53 OUTPUT MEAN   1                WDM     53 LZS       ENGL      REPL
COPY     54 OUTPUT MEAN   1                WDM     54 AGWS      ENGL      REPL
********************************************************************************

*** SDS
********************************************************************************
*** SDE-4 (TOTAL)
RCHRES  36 HYDR   RO                       WDM     21 FLOW      ENGL      REPL
********************************************************************************
*** SDS-1 (TOTAL)
RCHRES  39 HYDR   RO                       WDM     22 FLOW      ENGL      REPL
********************************************************************************
*** SDS-3 RUNWAY (NO DETENTION)
COPY     42 OUTPUT MEAN   1     12.1       WDM     23 FLOW      ENGL      REPL
********************************************************************************
*** SDS-3A TAXIWAY VAULT
COPY     20 OUTPUT MEAN   1     12.1 ***   WDM     24 FLOW      ENGL      REPL
********************************************************************************
*** SDS-7 3RD RUNWAY VAULT
COPY      3 OUTPUT MEAN   1     12.1 ***   WDM     26 FLOW      ENGL      REPL
********************************************************************************
*** SDS-4
```

```
COPY     10 OUTPUT MEAN   1     12.1          WDM     28 FLOW     ENGL       REPL
*******************************************************************************

*** IWS
*******************************************************************************
*** IWS TREATMENT INFLOW TOTAL
COPY      8 OUTPUT MEAN   1     12.1          WDM     32 FLOW     ENGL       REPL
*******************************************************************************
*** IWS LAGOON OUTFLOW TO PUGET SOUND
RCHRES 400 HYDR   O       1                   WDM     33 FLOW     ENGL       REPL
*******************************************************************************
*** IWS LAGOON OVERFLOW TO NORTHWEST PONDS
RCHRES 400 HYDR   O       2                   WDM     34 FLOW     ENGL       REPL
*******************************************************************************

*** WEST BRANCH
*******************************************************************************
*** NORTHWEST PONDS
RCHRES  43 HYDR   RO                          WDM     31 FLOW     ENGL       REPL
*******************************************************************************
*** LOWER WEST BRANCH
RCHRES  12 HYDR   RO                          WDM     35 FLOW     ENGL       REPL
*******************************************************************************

*** EAST BRANCH
*******************************************************************************
*** BOW LAKE OUTFLOW
RCHRES  35 HYDR   RO                          WDM     36 FLOW     ENGL       REPL
*******************************************************************************
*** EXISTING UPPER EAST BRANCH (FUTURE SASA DETENTION SITE)
RCHRES  38 HYDR   RO                          WDM     37 FLOW     ENGL       REPL
*******************************************************************************
*** TYEE INFLOW (GAUGE 11C)
RCHRES   5 HYDR   RO                          WDM     38 FLOW     ENGL       REPL
*******************************************************************************
*** TYEE OUTFLOW
RCHRES  40 HYDR   RO                          WDM     39 FLOW     ENGL       REPL
*******************************************************************************

*** MAIN STEM
*******************************************************************************
*** BELOW CONFLUENCE AT TYEE GOLF COURSE WEIR (GAUGE 11F)
COPY      5 OUTPUT MEAN   1     12.1          WDM     40 FLOW     ENGL       REPL
*******************************************************************************
*** BELOW CONFLUENCE AT SOUTH 200TH STREET
RCHRES  13 HYDR   RO                          WDM     41 FLOW     ENGL       REPL
*******************************************************************************
*** LOWER DES MOINES CREEK NEAR MOUTH (GAUGE 11D)
RCHRES 198 HYDR   RO                          WDM     42 FLOW     ENGL       REPL
*******************************************************************************
*** S200TH ST
COPY    100 OUTPUT MEAN   1   0.000343        WDM     73 AGWO     ENGL AGGR REPL
COPY    100 OUTPUT MEAN   2   0.000417        WDM     74 PETM     ENGL AGGR REPL
COPY    100 OUTPUT MEAN   3   0.000417        WDM     75 SAET     ENGL AGGR REPL
COPY    100 OUTPUT MEAN   4                   WDM     76 IMPE     ENGL AGGR REPL

END EXT TARGETS
                                                                            ***
NETWORK
***          <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>       <-MEMBER->
<NAME>    # <NAME>    TEM STRG<-FACTOR->STRG <NAME>    #    # <-GRP> <NAME> # # ***
*******************************************************************************
*******************************************************************************
*** TO WDM ONLY FOR WATER BALANCE CALIBRATION
PERLND  16 PWATER TAET         21.898        COPY     50       INPUT  MEAN    1
PERLND  26 PWATER TAET         82.595        COPY     50       INPUT  MEAN    1
PERLND  34 PWATER TAET         21.522        COPY     50       INPUT  MEAN    1
PERLND  44 PWATER TAET         53.793        COPY     50       INPUT  MEAN    1
PERLND  54 PWATER TAET          5.520        COPY     50       INPUT  MEAN    1
*******************************************************************************
IMPLND  14 IWATER IMPEV        97.745        COPY     51       INPUT  MEAN    1
*******************************************************************************
PERLND  16 PWATER UZS          21.898        COPY     52       INPUT  MEAN    1
PERLND  26 PWATER UZS          82.595        COPY     52       INPUT  MEAN    1
PERLND  34 PWATER UZS          21.522        COPY     52       INPUT  MEAN    1
PERLND  44 PWATER UZS          53.793        COPY     52       INPUT  MEAN    1
```

```
PERLND  54 PWATER UZS            5.520      COPY    52      INPUT  MEAN    1
*******************************************************************************
PERLND  16 PWATER LZS           21.898      COPY    53      INPUT  MEAN    1
PERLND  26 PWATER LZS           82.595      COPY    53      INPUT  MEAN    1
PERLND  34 PWATER LZS           21.522      COPY    53      INPUT  MEAN    1
PERLND  44 PWATER LZS           53.793      COPY    53      INPUT  MEAN    1
PERLND  54 PWATER LZS            5.520      COPY    53      INPUT  MEAN    1
*******************************************************************************
PERLND  16 PWATER AGWS          21.898      COPY    54      INPUT  MEAN    1
PERLND  26 PWATER AGWS          82.595      COPY    54      INPUT  MEAN    1
PERLND  34 PWATER AGWS          21.522      COPY    54      INPUT  MEAN    1
PERLND  44 PWATER AGWS          53.793      COPY    54      INPUT  MEAN    1
PERLND  54 PWATER AGWS           5.520      COPY    54      INPUT  MEAN    1
*******************************************************************************
*******************************************************************************
*** AIRPORT SUBBASINS
*******************************************************************************
*** (DM23) SDE-4
PERLND  26 PWATER SURO           4.631      RCHRES  36      EXTNL  IVOL
PERLND  26 PWATER IFWO           4.631      RCHRES  34      EXTNL  IVOL
IMPLND  14 IWATER SURO          10.205      RCHRES  36      EXTNL  IVOL
*******************************************************************************
*** (DM24) SDS-1
PERLND  26 PWATER SURO           0.123      RCHRES  39      EXTNL  IVOL
PERLND  26 PWATER IFWO           0.123      RCHRES  38      EXTNL  IVOL
IMPLND  14 IWATER SURO           0.915      RCHRES  39      EXTNL  IVOL
*******************************************************************************
*** (DM25) SDS-3A  TAXIWAY VAULT (to wdm only)
*** 1994 TARGET FLOW FOR FUTURE DETENTION FACILITY
PERLND  26 PWATER SURO           *****      COPY    20      INPUT  MEAN    1
PERLND  26 PWATER IFWO           *****      COPY     4      INPUT  MEAN    1
IMPLND  14 IWATER SURO           *****      COPY    20      INPUT  MEAN    1
*******************************************************************************
*** (DM25) SDS-7   3RD RUNWAY (to wdm only)
*** 1994 TARGET FLOW FOR FUTURE DETENTION FACILITY
PERLND  26 PWATER SURO           *****      COPY     3      INPUT  MEAN    1
PERLND  26 PWATER IFWO           *****      COPY     4      INPUT  MEAN    1
IMPLND  14 IWATER SURO           *****      COPY     3      INPUT  MEAN    1
*******************************************************************************
*** (DM25) SDS-3
***  Areas OF 26 AND 14 revised to incorporate King County comments
*** 1994 LAND USE ADJUSTED TO INCLUDE 23.2 ACRES OF RECENTLY CONSTRUCTED IMPERVIOUS
PERLND  26 PWATER SURO          21.496      COPY    42      INPUT  MEAN    1
PERLND  26 PWATER IFWO          21.496      RCHRES   4      EXTNL  IVOL
PERLND  54 PWATER SURO           0.039      COPY    42      INPUT  MEAN    1
PERLND  54 PWATER IFWO           0.039      RCHRES   4      EXTNL  IVOL
IMPLND  14 IWATER SURO          15.512      COPY    42      INPUT  MEAN    1
*******************************************************************************
*** (DM26) SDS-2,5,6,7
*** AGWO for PERLN 26 inserted to answer King County comment
PERLND  16 PWATER SURO           0.228      RCHRES  41      EXTNL  IVOL
PERLND  16 PWATER IFWO           0.228      RCHRES  43      EXTNL  IVOL
PERLND  16 PWATER AGWO           0.228      RCHRES  43      EXTNL  IVOL
PERLND  26 PWATER SURO           8.002      RCHRES  41      EXTNL  IVOL
PERLND  26 PWATER IFWO           8.002      RCHRES  43      EXTNL  IVOL
PERLND  26 PWATER AGWO           8.002      RCHRES  43      EXTNL  IVOL
PERLND  34 PWATER SURO           0.676      RCHRES  41      EXTNL  IVOL
PERLND  34 PWATER IFWO           0.676      RCHRES  43      EXTNL  IVOL
PERLND  34 PWATER AGWO           0.676      RCHRES  43      EXTNL  IVOL
PERLND  44 PWATER SURO           0.042      RCHRES  41      EXTNL  IVOL
PERLND  44 PWATER IFWO           0.042      RCHRES  43      EXTNL  IVOL
PERLND  44 PWATER AGWO           0.042      RCHRES  43      EXTNL  IVOL
PERLND  54 PWATER SURO           0.043      RCHRES  41      EXTNL  IVOL
PERLND  54 PWATER IFWO           0.043      RCHRES  43      EXTNL  IVOL
PERLND  54 PWATER AGWO           0.043      RCHRES  43      EXTNL  IVOL
IMPLND  14 IWATER SURO           1.096      RCHRES  41      EXTNL  IVOL
*******************************************************************************
*** (DM27) SDS-4
PERLND  26 PWATER SURO           0.755      COPY    10      INPUT  MEAN    1
PERLND  26 PWATER IFWO           0.755      COPY     5      INPUT  MEAN    1
PERLND  26 PWATER AGWO           0.755      COPY     5      INPUT  MEAN    1
PERLND  34 PWATER SURO           0.018      COPY    10      INPUT  MEAN    1
PERLND  34 PWATER IFWO           0.018      COPY     5      INPUT  MEAN    1
PERLND  34 PWATER AGWO           0.018      COPY     5      INPUT  MEAN    1
PERLND  44 PWATER SURO           2.406      COPY    10      INPUT  MEAN    1
PERLND  44 PWATER IFWO           2.406      COPY     5      INPUT  MEAN    1
```

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PERLND  44 PWATER AGWO          2.406      COPY     5      INPUT  MEAN    1
IMPLND ·14 IWATER SURO          1.614      COPY    10      INPUT  MEAN    1
********************************************************************************
*** SASA ROOFTOP (FUTURE)
IMPLND  14 IWATER SURO          *****      COPY    15      INPUT  MEAN    1
********************************************************************************


*** IWS SYSTEM PRIMARY SYSTEM AND PUMP STATIONS
*** (INCLUDING AREAS DIVERTED FROM MILLER CREEK BASIN)
********************************************************************************
*** I-1: NORTH CARGO PUMP STATION TO IWS (SDN-2)
*** OVERFLOW TO MILLER BASIN
*** INSTALLED IN OCTOBER 1997
PERLND  26 PWATER SURO          *****      RCHRES 364      EXTNL  IVOL
PERLND  26 PWATER IFWO          *****      RCHRES 364      EXTNL  IVOL
IMPLND  14 IWATER SURO          *****      RCHRES 364      EXTNL  IVOL
********************************************************************************
*** I-2: NORTH SNOWMELT PUMP STATION TO IWS (SDN-2)
*** INSTALLED IN LATE 1997/1998
PERLND  26 PWATER SURO          *****      RCHRES 365      EXTNL  IVOL
PERLND  26 PWATER IFWO          *****      RCHRES 365      EXTNL  IVOL
IMPLND  14 IWATER SURO          *****      RCHRES 365      EXTNL  IVOL
********************************************************************************
*** I-3: NORTH SATELLITE PUMP STATION TO IWS
*** OVERFLOW TO SDE-4
*** INSTALLED IN 1995
IMPLND  14 IWATER SURO          *****      RCHRES 360      EXTNL  IVOL
********************************************************************************
*** I-4: CENTRAL SNOWMELT PUMP STATION TO IWS
*** OVERFLOW TO SDE-4
*** INSTALLED IN 1998
IMPLND  14 IWATER SURO          *****      RCHRES 361      EXTNL  IVOL
********************************************************************************
*** I-5: SOUTH SNOWMELT (OLYMPIC TANK FARM) PUMP STATION TO IWS
*** OVERFLOW TO DES MOINES EAST BRANCH
*** INSTALLED IN LATE 1997/1998
IMPLND  14 IWATER SURO          *****      RCHRES 366      EXTNL  IVOL
********************************************************************************
*** I-6: IWS-510 DIVERSION TO IWS
*** OVERFLOW TO SDS-1
PERLND  26 PWATER SURO          0.036      RCHRES 390      EXTNL  IVOL
PERLND  26 PWATER IFWO          0.036      RCHRES  34      EXTNL  IVOL
IMPLND  14 IWATER SURO          2.738      RCHRES 390      EXTNL  IVOL
********************************************************************************
*** I-7: IWS - PRIMARY DIRECT PIPED
*** NO OVERFLOW TO SDS
PERLND  16 PWATER SURO          0.222      COPY    18      INPUT  MEAN    1
PERLND  16 PWATER IFWO          0.222      RCHRES  34      EXTNL  IVOL
PERLND  26 PWATER SURO          0.598      COPY    18      INPUT  MEAN    1
PERLND  26 PWATER IFWO          0.598      RCHRES  34      EXTNL  IVOL
PERLND  34 PWATER SURO          0.158      COPY    18      INPUT  MEAN    1
PERLND  34 PWATER IFWO          0.158      RCHRES  34      EXTNL  IVOL
PERLND  44 PWATER SURO          0.009      COPY    18      INPUT  MEAN    1
PERLND  44 PWATER IFWO          0.009      RCHRES  34      EXTNL  IVOL
IMPLND  14 IWATER SURO         19.966      COPY    18      INPUT  MEAN    1
********************************************************************************


*** EAST BRANCH OF CREEK
********************************************************************************
*** DM1
PERLND  16 PWATER SURO          0.860      RCHRES  34      EXTNL  IVOL
PERLND  16 PWATER IFWO          0.860      RCHRES  34      EXTNL  IVOL
PERLND  16 PWATER AGWO          0.238      RCHRES  34      EXTNL  IVOL
PERLND  26 PWATER SURO         11.078      RCHRES  34      EXTNL  IVOL
PERLND  26 PWATER IFWO         11.078      RCHRES  34      EXTNL  IVOL
PERLND  26 PWATER AGWO          3.069      RCHRES  34      EXTNL  IVOL
PERLND  34 PWATER SURO          0.599      RCHRES  34      EXTNL  IVOL
PERLND  34 PWATER IFWO          0.599      RCHRES  34      EXTNL  IVOL
PERLND  34 PWATER AGWO          0.166      RCHRES  34      EXTNL  IVOL
PERLND  44 PWATER SURO          7.697      RCHRES  34      EXTNL  IVOL
PERLND  44 PWATER IFWO          7.697      RCHRES  34      EXTNL  IVOL
PERLND  44 PWATER AGWO          2.132      RCHRES  34      EXTNL  IVOL
PERLND  54 PWATER SURO          1.176      RCHRES  34      EXTNL  IVOL
PERLND  54 PWATER IFWO          1.176      RCHRES  34      EXTNL  IVOL
PERLND  54 PWATER AGWO          0.326      RCHRES  34      EXTNL  IVOL
IMPLND  14 IWATER SURO         14.274      RCHRES  34      EXTNL  IVOL
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*****************************************************************************
*** DM2
PERLND  26 PWATER SURO          1.232       RCHRES  37      EXTNL  IVOL
PERLND  26 PWATER IFWO          1.232       RCHRES  37      EXTNL  IVOL
IMPLND  14 IWATER SURO          0.821       RCHRES  37      EXTNL  IVOL
*****************************************************************************
*** DM3
PERLND  26 PWATER PERO          4.077       RCHRES  38      EXTNL  IVOL
PERLND  54 PWATER PERO          0.028       RCHRES  38      EXTNL  IVOL
IMPLND  14 IWATER SURO          6.205       RCHRES  38      EXTNL  IVOL
*****************************************************************************
*** DM4
PERLND  16 PWATER PERO          0.574       RCHRES  38      EXTNL  IVOL
PERLND  26 PWATER PERO          0.571       RCHRES  38      EXTNL  IVOL
PERLND  54 PWATER PERO          0.037       RCHRES  38      EXTNL  IVOL
IMPLND  14 IWATER SURO          3.234       RCHRES  38      EXTNL  IVOL
*****************************************************************************
*** DM5
PERLND  16 PWATER PERO          1.310       RCHRES   5      EXTNL  IVOL
PERLND  26 PWATER PERO          0.558       RCHRES   5      EXTNL  IVOL
PERLND  34 PWATER PERO          0.114       RCHRES   5      EXTNL  IVOL
PERLND  44 PWATER PERO          0.384       RCHRES   5      EXTNL  IVOL
PERLND  54 PWATER PERO          0.171       RCHRES   5      EXTNL  IVOL
IMPLND  14 IWATER SURO          1.156       RCHRES   5      EXTNL  IVOL
*****************************************************************************
*** DM6
PERLND  16 PWATER PERO          1.814       RCHRES  40      EXTNL  IVOL
PERLND  26 PWATER PERO          1.153       RCHRES  40      EXTNL  IVOL
PERLND  44 PWATER PERO          0.917       RCHRES  40      EXTNL  IVOL
PERLND  54 PWATER PERO          0.337       RCHRES  40      EXTNL  IVOL
IMPLND  14 IWATER SURO          0.354       RCHRES  40      EXTNL  IVOL
*****************************************************************************

*** WEST BRANCH OF CREEK
*****************************************************************************
*** DM7
PERLND  16 PWATER SURO          2.189       RCHRES   7      EXTNL  IVOL
PERLND  16 PWATER IFWO          2.189       RCHRES   7      EXTNL  IVOL
PERLND  16 PWATER AGWO          0.792       RCHRES   7      EXTNL  IVOL
PERLND  26 PWATER SURO          2.944       RCHRES   7      EXTNL  IVOL
PERLND  26 PWATER IFWO          2.944       RCHRES   7      EXTNL  IVOL
PERLND  26 PWATER AGWO          1.066       RCHRES   7      EXTNL  IVOL
PERLND  34 PWATER SURO          1.966       RCHRES   7      EXTNL  IVOL
PERLND  34 PWATER IFWO          1.966       RCHRES   7      EXTNL  IVOL
PERLND  34 PWATER AGWO          0.712       RCHRES   7      EXTNL  IVOL
PERLND  44 PWATER SURO          4.138       RCHRES   7      EXTNL  IVOL
PERLND  44 PWATER IFWO          4.138       RCHRES   7      EXTNL  IVOL
PERLND  44 PWATER AGWO          1.498       RCHRES   7      EXTNL  IVOL
PERLND  54 PWATER SURO          0.551       RCHRES   7      EXTNL  IVOL
PERLND  54 PWATER IFWO          0.551       RCHRES   7      EXTNL  IVOL
PERLND  54 PWATER AGWO          0.199       RCHRES   7      EXTNL  IVOL
IMPLND  14 IWATER SURO          2.397       RCHRES   7      EXTNL  IVOL
*****************************************************************************
*** DM8
PERLND  16 PWATER SURO          0.202       RCHRES   7      EXTNL  IVOL
PERLND  16 PWATER IFWO          0.202       RCHRES   7      EXTNL  IVOL
PERLND  16 PWATER AGWO          0.077       RCHRES   7      EXTNL  IVOL
PERLND  26 PWATER SURO          0.718       RCHRES   7      EXTNL  IVOL
PERLND  26 PWATER IFWO          0.718       RCHRES   7      EXTNL  IVOL
PERLND  26 PWATER AGWO          0.273       RCHRES   7      EXTNL  IVOL
PERLND  34 PWATER SURO          0.709       RCHRES   7      EXTNL  IVOL
PERLND  34 PWATER IFWO          0.709       RCHRES   7      EXTNL  IVOL
PERLND  34 PWATER AGWO          0.269       RCHRES   7      EXTNL  IVOL
PERLND  44 PWATER SURO          1.111       RCHRES   7      EXTNL  IVOL
PERLND  44 PWATER IFWO          1.111       RCHRES   7      EXTNL  IVOL
PERLND  44 PWATER AGWO          0.422       RCHRES   7      EXTNL  IVOL
PERLND  54 PWATER SURO          0.162       RCHRES   7      EXTNL  IVOL
PERLND  54 PWATER IFWO          0.162       RCHRES   7      EXTNL  IVOL
PERLND  54 PWATER AGWO          0.062       RCHRES   7      EXTNL  IVOL
IMPLND  14 IWATER SURO          2.332       RCHRES   7      EXTNL  IVOL
*****************************************************************************
*** DM9
PERLND  16 PWATER SURO          0.002       RCHRES   9      EXTNL  IVOL
PERLND  16 PWATER IFWO          0.002       RCHRES   9      EXTNL  IVOL
PERLND  16 PWATER AGWO          0.001       RCHRES   9      EXTNL  IVOL
PERLND  26 PWATER SURO          1.200       RCHRES   9      EXTNL  IVOL
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PERLND  26 PWATER IFWO          1.200      RCHRES   9      EXTNL  IVOL
PERLND  26 PWATER AGWO          0.524      RCHRES   9      EXTNL  IVOL
PERLND  34 PWATER SURO          0.016      RCHRES   9      EXTNL  IVOL
PERLND  34 PWATER IFWO          0.016      RCHRES   9      EXTNL  IVOL
PERLND  34 PWATER AGWO          0.007      RCHRES   9      EXTNL  IVOL
PERLND  44 PWATER SURO          3.039      RCHRES   9      EXTNL  IVOL
PERLND  44 PWATER IFWO          3.039      RCHRES   9      EXTNL  IVOL
PERLND  44 PWATER AGWO          1.328      RCHRES   9      EXTNL  IVOL
PERLND  54 PWATER SURO          0.010      RCHRES   9      EXTNL  IVOL
PERLND  54 PWATER IFWO          0.010      RCHRES   9      EXTNL  IVOL
PERLND  54 PWATER AGWO          0.004      RCHRES   9      EXTNL  IVOL
IMPLND  14 IWATER SURO          0.633      RCHRES   9      EXTNL  IVOL
******************************************************************************
*** DM10
PERLND  16 PWATER PERO          0.943      RCHRES  43      EXTNL  IVOL
PERLND  26 PWATER PERO          0.738      RCHRES  43      EXTNL  IVOL
PERLND  34 PWATER PERO          1.934      RCHRES  43      EXTNL  IVOL
PERLND  44 PWATER PERO          0.510      RCHRES  43      EXTNL  IVOL
PERLND  54 PWATER PERO          0.710      RCHRES  43      EXTNL  IVOL
IMPLND  14 IWATER SURO          0.185      RCHRES  43      EXTNL  IVOL
******************************************************************************
*** DM11
PERLND  16 PWATER PERO          0.321      RCHRES  43      EXTNL  IVOL
PERLND  26 PWATER PERO          0.514      RCHRES  43      EXTNL  IVOL
PERLND  34 PWATER PERO          1.028      RCHRES  43      EXTNL  IVOL
PERLND  44 PWATER PERO          0.466      RCHRES  43      EXTNL  IVOL
PERLND  54 PWATER PERO          1.036      RCHRES  43      EXTNL  IVOL
IMPLND  14 IWATER SURO          2.618      RCHRES  43      EXTNL  IVOL
******************************************************************************
*** DM12
PERLND  16 PWATER PERO          0.511      RCHRES  12      EXTNL  IVOL
PERLND  26 PWATER PERO          0.001      RCHRES  12      EXTNL  IVOL
PERLND  34 PWATER PERO          0.376      RCHRES  12      EXTNL  IVOL
PERLND  44 PWATER PERO          2.114      RCHRES  12      EXTNL  IVOL
PERLND  54 PWATER PERO          0.543      RCHRES  12      EXTNL  IVOL
******************************************************************************
*** DM13
PERLND  16 PWATER PERO          2.684      RCHRES  13      EXTNL  IVOL
PERLND  26 PWATER PERO          1.886      RCHRES  13      EXTNL  IVOL
PERLND  34 PWATER PERO          1.204      RCHRES  13      EXTNL  IVOL
PERLND  44 PWATER PERO          1.845      RCHRES  13      EXTNL  IVOL
PERLND  54 PWATER PERO          0.068      RCHRES  13      EXTNL  IVOL
IMPLND  14 IWATER SURO          1.978      RCHRES  13      EXTNL  IVOL
******************************************************************************

*** LOWER BASIN
******************************************************************************
*** DM14
PERLND  16 PWATER PERO          0.481      RCHRES  14      EXTNL  IVOL
PERLND  26 PWATER PERO          0.295      RCHRES  14      EXTNL  IVOL
PERLND  34 PWATER PERO          1.940      RCHRES  14      EXTNL  IVOL
PERLND  44 PWATER PERO          1.195      RCHRES  14      EXTNL  IVOL
IMPLND  14 IWATER SURO          0.340      RCHRES  14      EXTNL  IVOL
******************************************************************************

*** EXECUTEL TRIBUTARY
******************************************************************************
*** DM16 INFLOW TO EXECUTEL POND
PERLND  16 PWATER SURO          0.647      RCHRES  46      EXTNL  IVOL
PERLND  16 PWATER IFWO          0.647      RCHRES  46      EXTNL  IVOL
PERLND  16 PWATER AGWO          0.446      RCHRES  46      EXTNL  IVOL
PERLND  26 PWATER SURO          5.573      RCHRES  46      EXTNL  IVOL
PERLND  26 PWATER IFWO          5.573      RCHRES  46      EXTNL  IVOL
PERLND  26 PWATER AGWO          3.845      RCHRES  46      EXTNL  IVOL
PERLND  34 PWATER SURO          0.639      RCHRES  46      EXTNL  IVOL
PERLND  34 PWATER IFWO          0.639      RCHRES  46      EXTNL  IVOL
PERLND  34 PWATER AGWO          0.441      RCHRES  46      EXTNL  IVOL
PERLND  44 PWATER SURO          8.023      RCHRES  46      EXTNL  IVOL
PERLND  44 PWATER IFWO          8.023      RCHRES  46      EXTNL  IVOL
PERLND  44 PWATER AGWO          5.536      RCHRES  46      EXTNL  IVOL
PERLND  54 PWATER SURO          0.183      RCHRES  46      EXTNL  IVOL
PERLND  54 PWATER IFWO          0.183      RCHRES  46      EXTNL  IVOL
PERLND  54 PWATER AGWO          0.126      RCHRES  46      EXTNL  IVOL
IMPLND  14 IWATER SURO          4.249      RCHRES  46      EXTNL  IVOL
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*** DM17
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PERLND  16 PWATER PERO           2.078      RCHRES  17       EXTNL  IVOL
PERLND  26 PWATER PERO           2.261      RCHRES  17       EXTNL  IVOL
PERLND  34 PWATER PERO           3.003      RCHRES  17       EXTNL  IVOL
PERLND  44 PWATER PERO           3.280      RCHRES  17       EXTNL  IVOL
IMPLND  14 IWATER SURO           2.655      RCHRES  17       EXTNL  IVOL
*******************************************************************************

*** MAINSTEM RAVINE
*******************************************************************************
*** DM18
PERLND  16 PWATER PERO           0.789      RCHRES  18       EXTNL  IVOL
PERLND  26 PWATER PERO           0.277      RCHRES  18       EXTNL  IVOL
PERLND  34 PWATER PERO           3.151      RCHRES  18       EXTNL  IVOL
PERLND  44 PWATER PERO           1.106      RCHRES  18       EXTNL  IVOL
PERLND  54 PWATER PERO           0.300      RCHRES  18       EXTNL  IVOL
IMPLND  14 IWATER SURO           0.296      RCHRES  18       EXTNL  IVOL
*******************************************************************************

*** NORTH BRANCH RAVINE
*******************************************************************************
*** DM19
PERLND  16 PWATER PERO           0.182      RCHRES 177       EXTNL  IVOL
PERLND  26 PWATER PERO           6.019      RCHRES 177       EXTNL  IVOL
PERLND  34 PWATER PERO           0.167      RCHRES 177       EXTNL  IVOL
PERLND  44 PWATER PERO           5.552      RCHRES 177       EXTNL  IVOL
IMPLND  14 IWATER SURO           2.617      RCHRES 177       EXTNL  IVOL
*******************************************************************************
*** DM20
PERLND  16 PWATER PERO           4.007      RCHRES 193       EXTNL  IVOL
PERLND  26 PWATER PERO           6.624      RCHRES 193       EXTNL  IVOL
PERLND  34 PWATER PERO           2.784      RCHRES 193       EXTNL  IVOL
PERLND  44 PWATER PERO           4.602      RCHRES 193       EXTNL  IVOL
PERLND  54 PWATER PERO           0.116      RCHRES 193       EXTNL  IVOL
IMPLND  14 IWATER SURO           3.714      RCHRES 193       EXTNL  IVOL
*******************************************************************************

*** LOWER MAINSTEM
*******************************************************************************
*** DM21
PERLND  16 PWATER PERO           2.143      RCHRES 198       EXTNL  IVOL
PERLND  26 PWATER PERO           6.306      RCHRES 198       EXTNL  IVOL
PERLND  34 PWATER PERO           1.429      RCHRES 198       EXTNL  IVOL
PERLND  44 PWATER PERO           4.205      RCHRES 198       EXTNL  IVOL
IMPLND  14 IWATER SURO           3.091      RCHRES 198       EXTNL  IVOL
*******************************************************************************
*** DM22
PERLND  16 PWATER PERO           0.381      RCHRES 198       EXTNL  IVOL
PERLND  26 PWATER PERO           4.654      RCHRES 198       EXTNL  IVOL
PERLND  34 PWATER PERO           0.218      RCHRES 198       EXTNL  IVOL
PERLND  44 PWATER PERO           2.620      RCHRES 198       EXTNL  IVOL
PERLND  54 PWATER PERO           0.016      RCHRES 198       EXTNL  IVOL
IMPLND  14 IWATER SURO           1.972      RCHRES 198       EXTNL  IVOL
*******************************************************************************

*** NONCONTIGUOUS GROUNDWATER BASINS
*******************************************************************************
*** G1
PERLND  16 PWATER AGWO           2.833      RCHRES   5       EXTNL  IVOL
PERLND  26 PWATER AGWO           9.917      RCHRES   5       EXTNL  IVOL
*******************************************************************************
*** G2
PERLND  16 PWATER AGWO           0.417      RCHRES 193       EXTNL  IVOL
PERLND  26 PWATER AGWO           1.333      RCHRES 193       EXTNL  IVOL
*******************************************************************************
*** G3
PERLND  16 PWATER AGWO           5.083      RCHRES 193       EXTNL  IVOL
PERLND  26 PWATER AGWO          17.667      RCHRES 193       EXTNL  IVOL
PERLND  34 PWATER AGWO           1.167      RCHRES 193       EXTNL  IVOL
PERLND  44 PWATER AGWO           4.250      RCHRES 193       EXTNL  IVOL
*******************************************************************************
*******************************************************************************

*** CHANNEL NETWORK LINKAGES ***
*******************************************************************************

*** DICHARGE TO IWS LAGOONS
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******************************************************************************
RCHRES 360 HYDR   OVOL   1                   COPY     8      INPUT  MEAN   1
RCHRES 361 HYDR   OVOL   1                   COPY     8      INPUT  MEAN   1
RCHRES 364 HYDR   OVOL   1                   COPY     8      INPUT  MEAN   1
RCHRES 365 HYDR   OVOL   1                   COPY     8      INPUT  MEAN   1
RCHRES 366 HYDR   OVOL   1                   COPY     8      INPUT  MEAN   1
RCHRES 390 HYDR   OVOL   1                   COPY     8      INPUT  MEAN   1
COPY    18 OUTPUT MEAN   1                   COPY     8      INPUT  MEAN   1
COPY     8 OUTPUT MEAN   1                   RCHRES 400      EXTNL  IVOL
******************************************************************************

*** PUMP STATION OVERFLOW TO SDS
******************************************************************************
RCHRES 360 HYDR   OVOL   2                   RCHRES  36      EXTNL  IVOL
RCHRES 361 HYDR   OVOL   2                   RCHRES  36      EXTNL  IVOL
RCHRES 366 HYDR   OVOL   2                   RCHRES   5      EXTNL  IVOL
RCHRES 390 HYDR   OVOL   2                   RCHRES  39      EXTNL  IVOL
******************************************************************************

*** OVERFLOW OF IWS LAGOONS TO SDS
******************************************************************************
RCHRES 400 HYDR   OVOL   2                   COPY     4      INPUT  MEAN   1
******************************************************************************

*** EAST BRANCH OF CREEK
******************************************************************************
RCHRES  34 HYDR   OVOL   1                   RCHRES  35      EXTNL  IVOL
RCHRES  35 HYDR   ROVOL  1                   RCHRES  37      EXTNL  IVOL
RCHRES  36 HYDR   ROVOL  1                   RCHRES  37      EXTNL  IVOL
COPY    15 OUTPUT MEAN   1       ***         RCHRES  38      EXTNL  IVOL
RCHRES  37 HYDR   ROVOL  1                   RCHRES  38      EXTNL  IVOL
RCHRES  38 HYDR   ROVOL  1                   RCHRES   5      EXTNL  IVOL
RCHRES  39 HYDR   ROVOL  1                   RCHRES   5      EXTNL  IVOL
RCHRES   5 HYDR   ROVOL  1                   RCHRES  40      EXTNL  IVOL
RCHRES  40 HYDR   ROVOL  1                   COPY     5      INPUT  MEAN   1
******************************************************************************


*** WEST BRANCH OF CREEK
******************************************************************************
COPY    42 OUTPUT MEAN   1                   COPY     9      INPUT  MEAN   1
COPY     9 OUTPUT MEAN   1                   RCHRES   4      EXTNL  IVOL
RCHRES  41 HYDR   ROVOL  1                   COPY     4      INPUT  MEAN   1
RCHRES   4 HYDR   ROVOL  1                   COPY     4      INPUT  MEAN   1
RCHRES   7 HYDR   ROVOL  1                   COPY     4      INPUT  MEAN   1
RCHRES   9 HYDR   ROVOL  1                   COPY     4      INPUT  MEAN   1
COPY     4 OUTPUT MEAN   1                   RCHRES  43      EXTNL  IVOL
RCHRES  43 HYDR   OVOL   1                   RCHRES  12      EXTNL  IVOL
COPY    10 OUTPUT MEAN   1                   COPY     5      INPUT  MEAN   1
RCHRES  12 HYDR   ROVOL  1                   COPY     5      INPUT  MEAN   1
******************************************************************************

*** MAINSTEM BELOW CONFLUENCE OF E. AND W. BRANCH
******************************************************************************
*** MAINSTEM ABOVE EXECUTEL TRIBUTARY
COPY     5 OUTPUT MEAN   1                   RCHRES  13      EXTNL  IVOL
RCHRES  13 HYDR   ROVOL  1                   RCHRES  14      EXTNL  IVOL
RCHRES  14 HYDR   ROVOL  1                   COPY    48      INPUT  MEAN   1
******************************************************************************
*** EXECUTEL TRIBUTARY
RCHRES  46 HYDR   ROVOL  1                   RCHRES  47      EXTNL  IVOL
RCHRES  47 HYDR   ROVOL  1                   RCHRES  17      EXTNL  IVOL
RCHRES  17 HYDR   ROVOL  1                   COPY    48      INPUT  MEAN   1
******************************************************************************
*** MAINSTEM FROM HEAD OF RAVINE TO NORTH BRANCH CONFLUENCE
COPY    48 OUTPUT MEAN   1                   RCHRES  18      EXTNL  IVOL
RCHRES  18 HYDR   OVOL   1                   RCHRES 193      EXTNL  IVOL
RCHRES 193 HYDR   ROVOL  1                   COPY     1      INPUT  MEAN   1
******************************************************************************
*** NORTH BRANCH RAVINE TO MAINSTEM
RCHRES 177 HYDR   ROVOL  1                   COPY     1      INPUT  MEAN   1
******************************************************************************
*** MAINSTEM FROM NORTH BRANCH CONFLUENCE TO PARK BELOW MVD CULVERT
COPY     1 OUTPUT MEAN   1                   RCHRES 198      EXTNL  IVOL
******************************************************************************
```

```
END NETWORK

SCHEMATIC
<-Source->                  <--Area-->    <-Target->  MBLK    ***
<Name>   #                  <-factor->    <Name>   #  Tbl#    ***
*** PERLND AGWO, AET & PET TO COPY BLOCK
*** areas from HSPFmodel-MillerCreekAreas-DesMoines Landuse June19.xls, 2006basins areas
PERLND  14                       34.17    COPY    100      13
PERLND  16                      184.81    COPY    100      13
PERLND  18                        7.44    COPY    100      13
PERLND  24                      512.17    COPY    100      13
PERLND  26                      597.32    COPY    100      13
PERLND  28                        4.64    COPY    100      13
PERLND  34                      265.34    COPY    100      13
PERLND  44                      667.34    COPY    100      13
PERLND  54                       66.23    COPY    100      13
PERLND  65                      100.00    COPY    100      13
PERLND  66                      347.00    COPY    100      13
PERLND  67                       14.00    COPY    100      13
PERLND  68                       51.00    COPY    100      13

*** IMPLND AET TO COPY BLOCK
*** just one IMPLND, so don't need to weight by area
IMPLND  14                                COPY    100      14
END SCHEMATIC

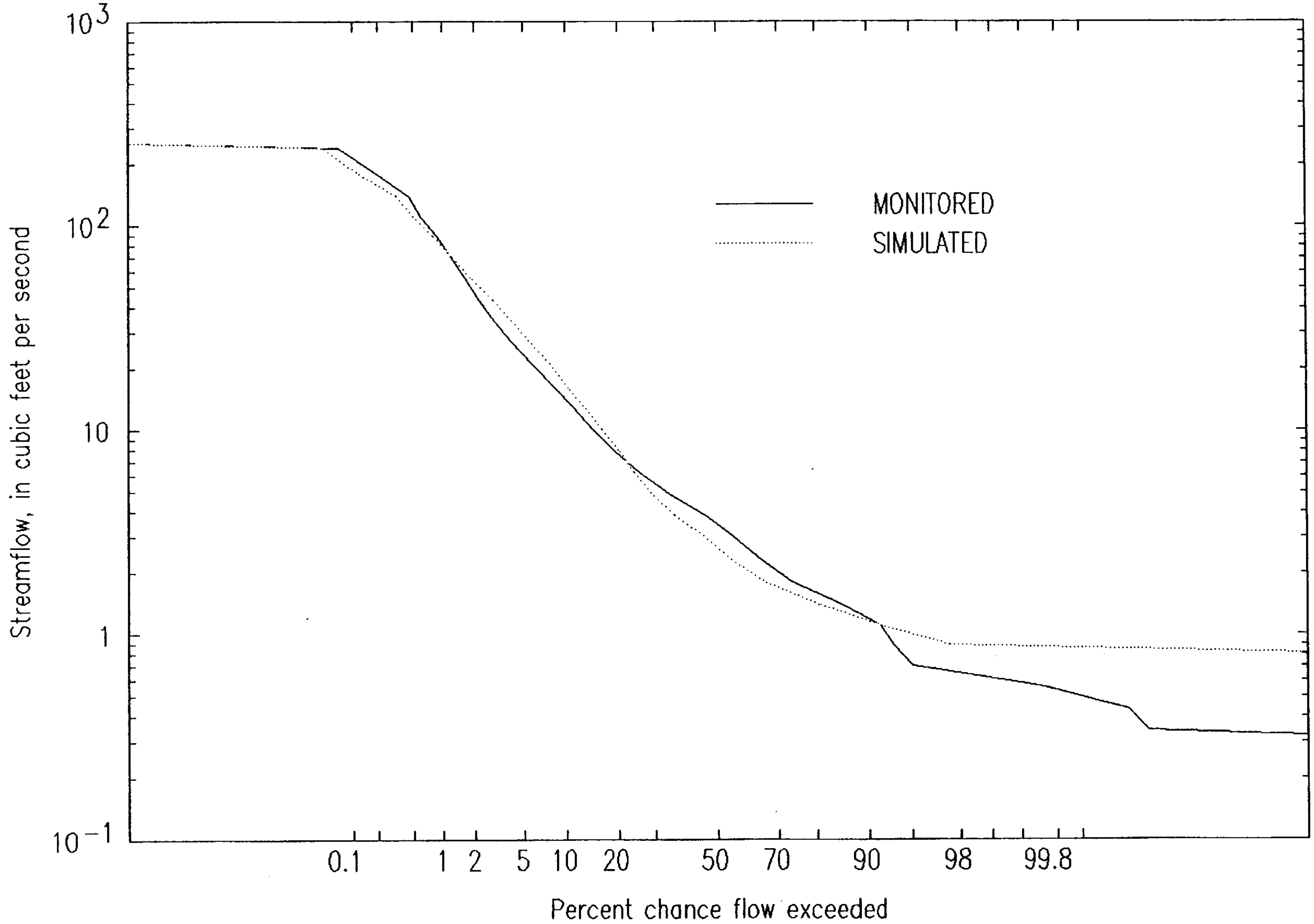
MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->    <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->    <Name>                <Name> # #***
  MASS-LINK       13
PERLND     PWATER AGWO                    COPY           INPUT  MEAN   1
PERLND     PWATER PET                     COPY           INPUT  MEAN   2
PERLND     PWATER TAET                    COPY           INPUT  MEAN   3
  END MASS-LINK   13

  MASS-LINK       14
IMPLND     IWATER IMPEV                   COPY           INPUT  MEAN   4
  END MASS-LINK   14

END MASS-LINK

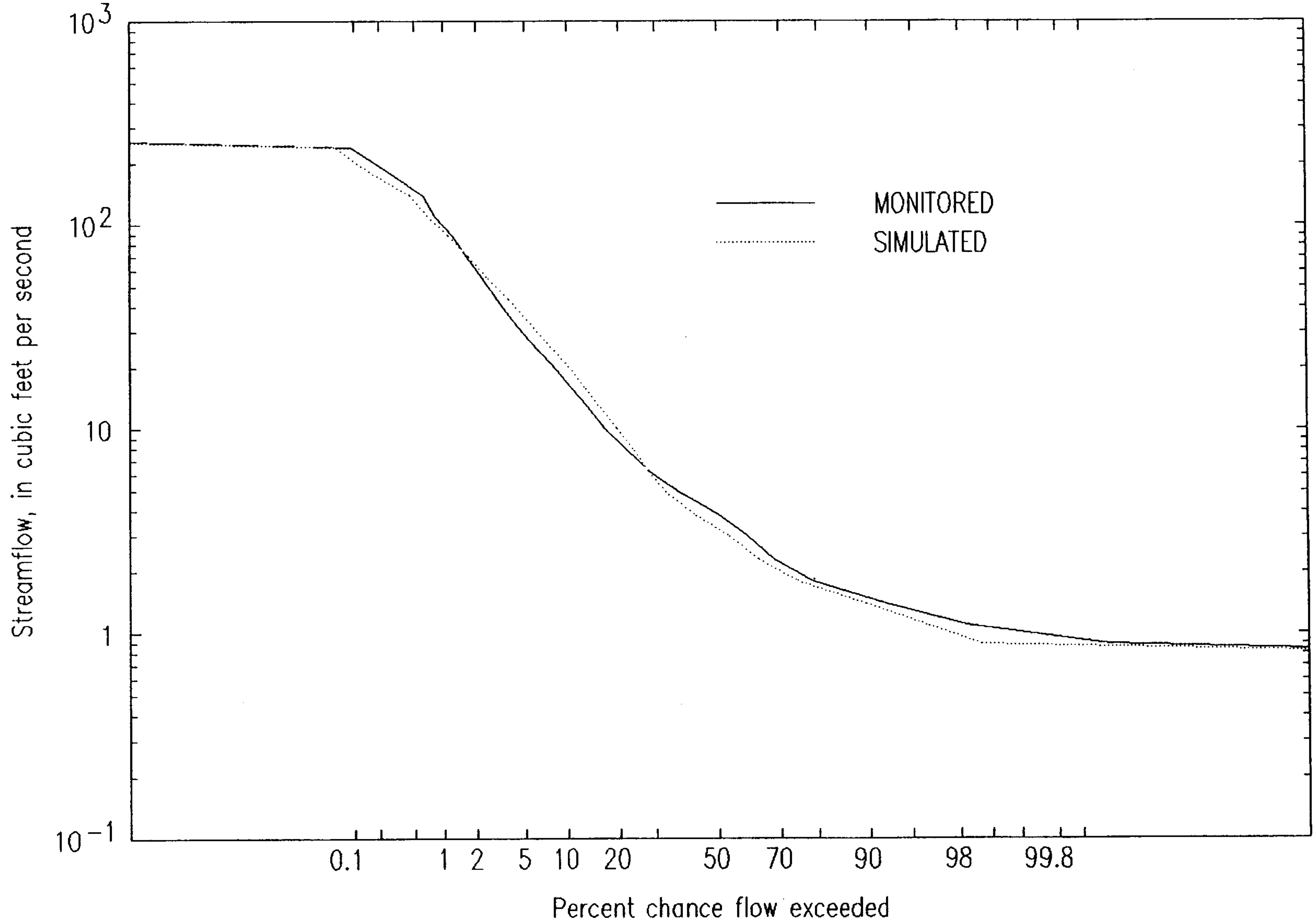
END RUN
```

DES MOINES CREEK
CALIBRATED MODEL HYDROGRAPHS



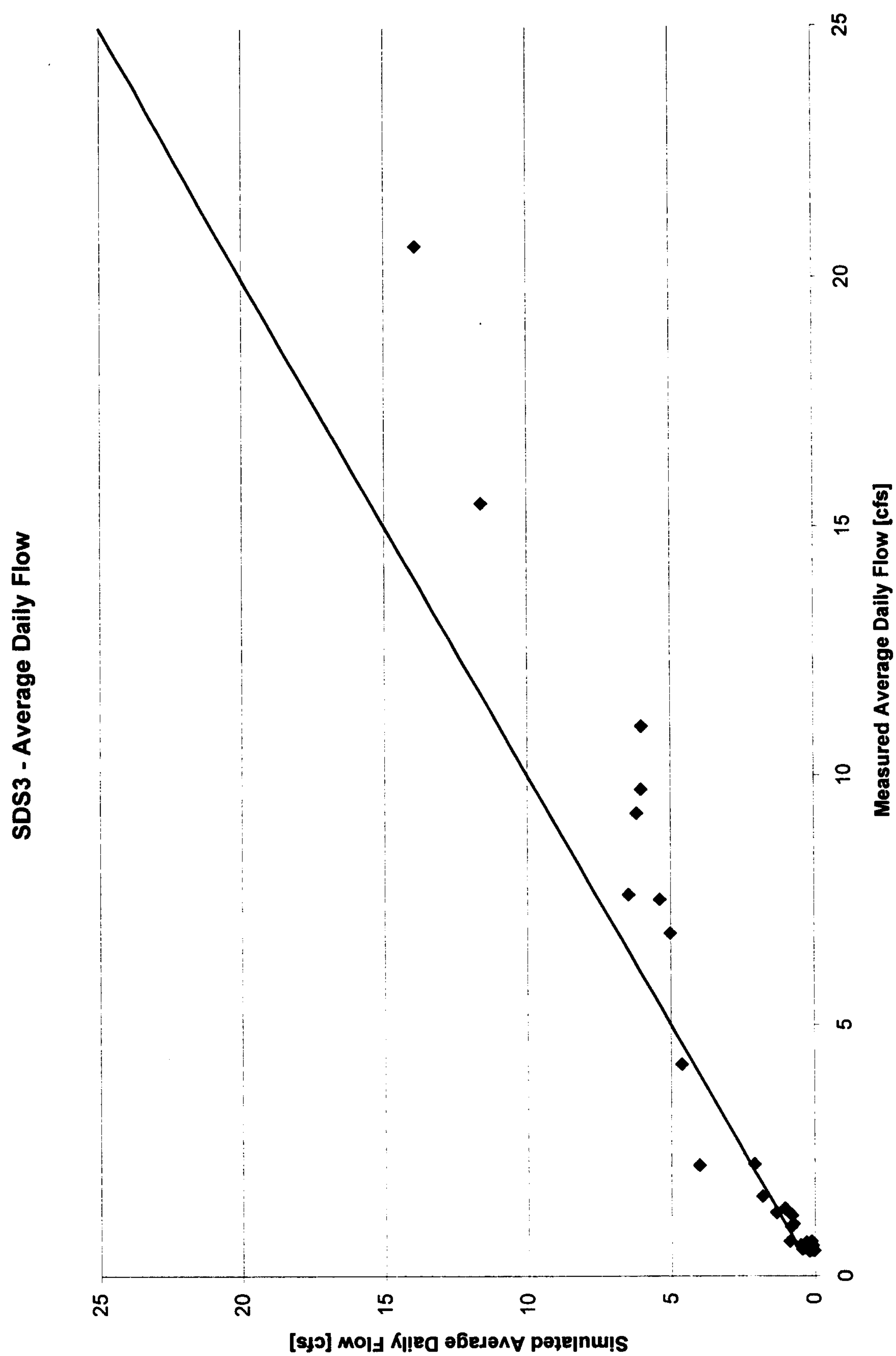
CALIBRATED VS MONITORED VALUES NEAR MOUTH

AR 010869

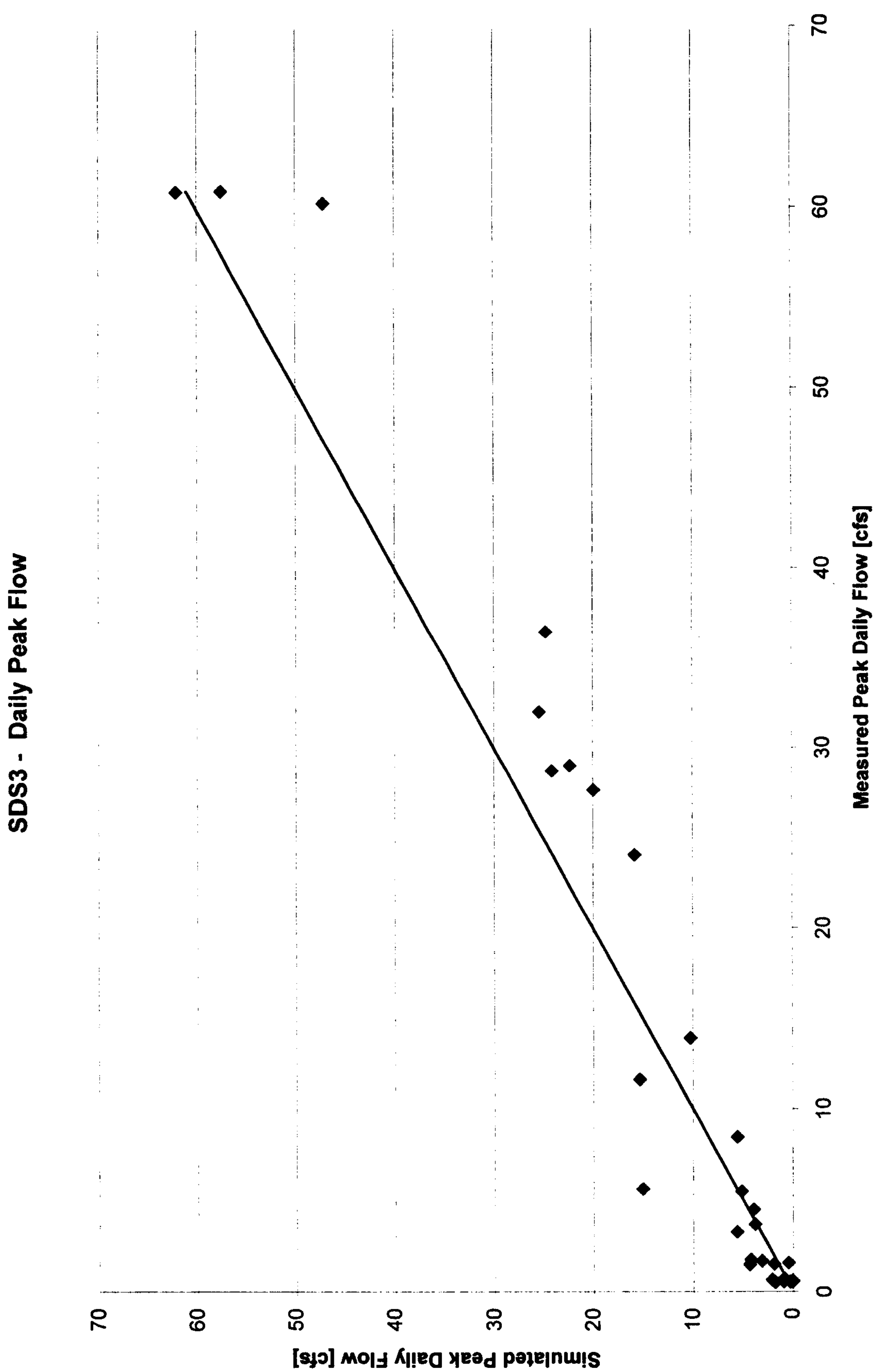


CALIBRATED VS MONITORED VALUES NEAR MOUTH

10-1-94- 9-30-96

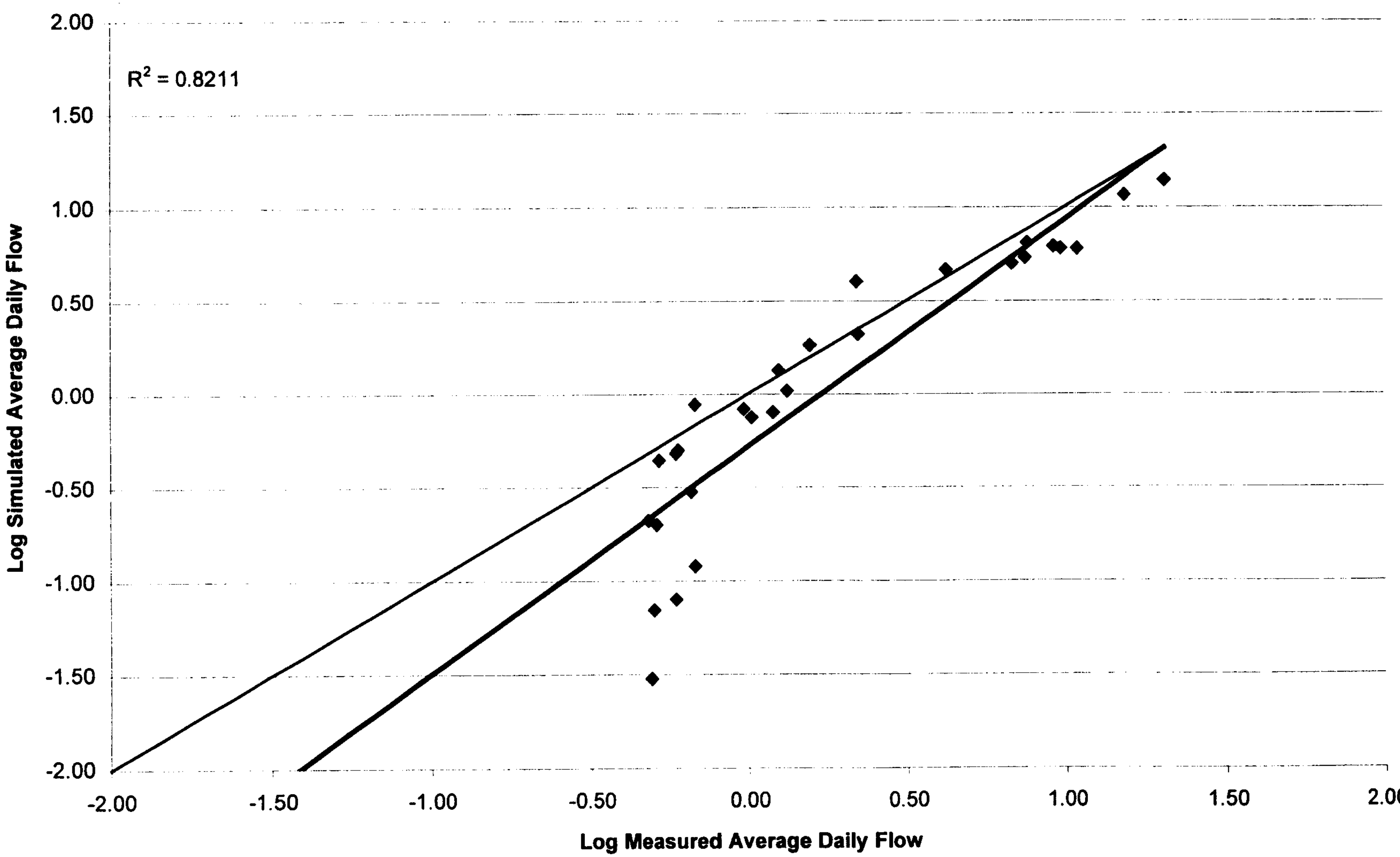


July 2001
556-2912-001 (28)

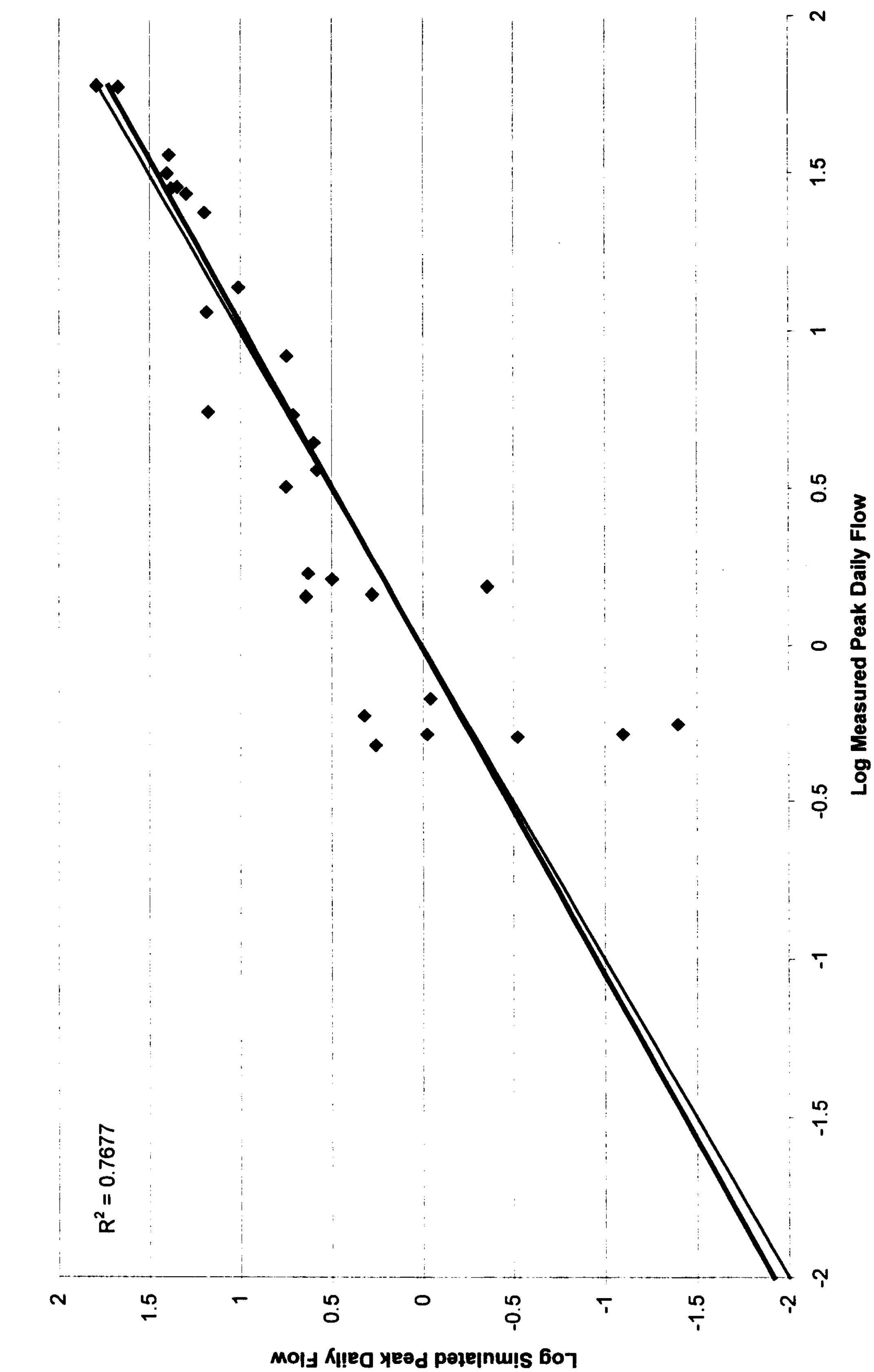


SDS3 - Daily Peak Flow
Simulated Peak Daily Flow [cfs]
Measured Peak Daily Flow [cfs]
0
10
20
30
40
50
60
70
0
10
20
30
40
50
60
70

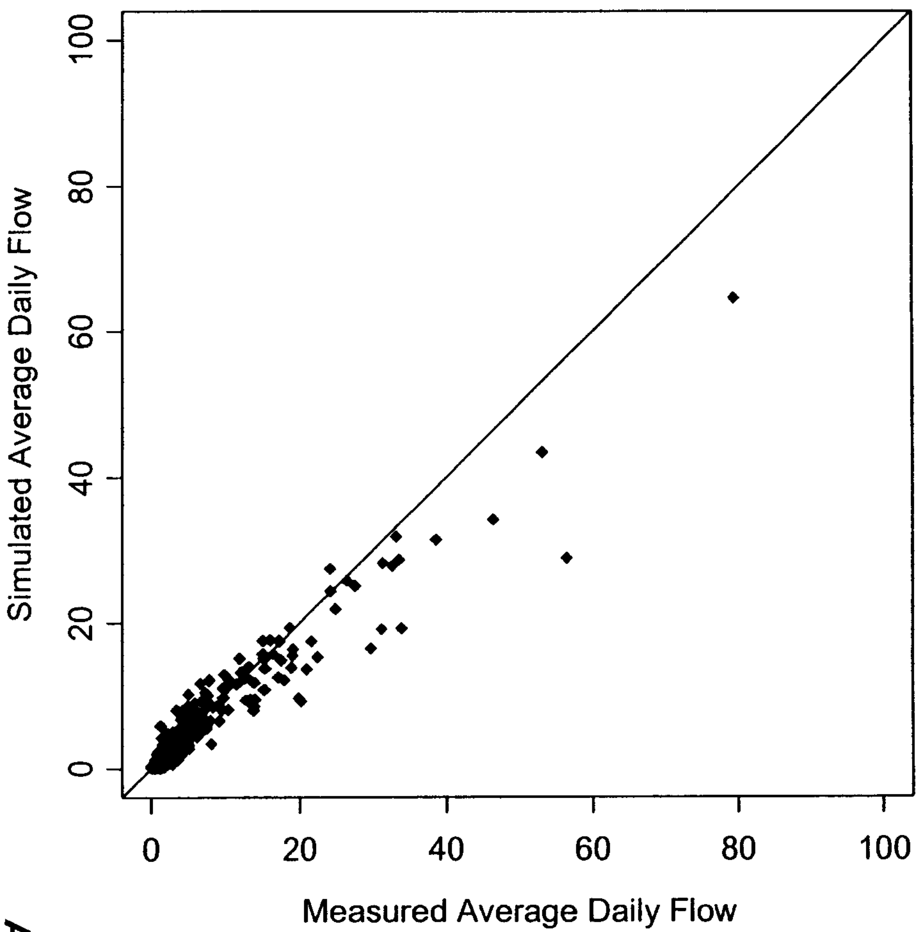
SDS3 - Average Daily Flow



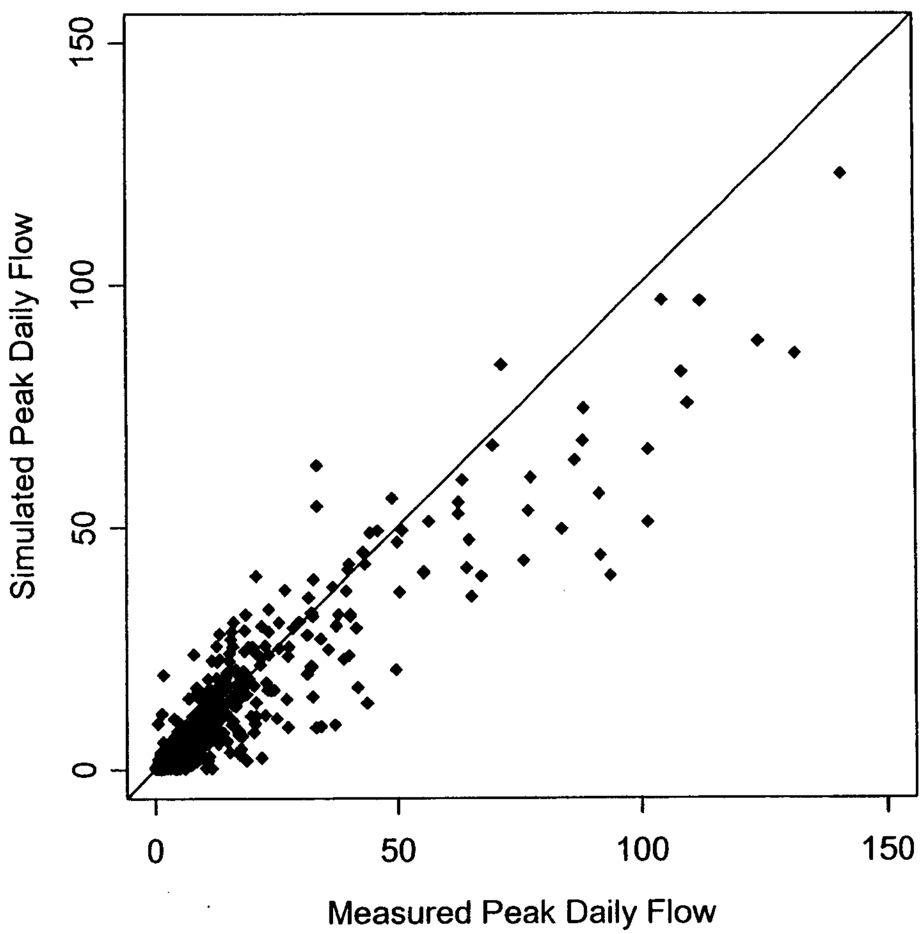
SDS3 - Peak Daily Flow



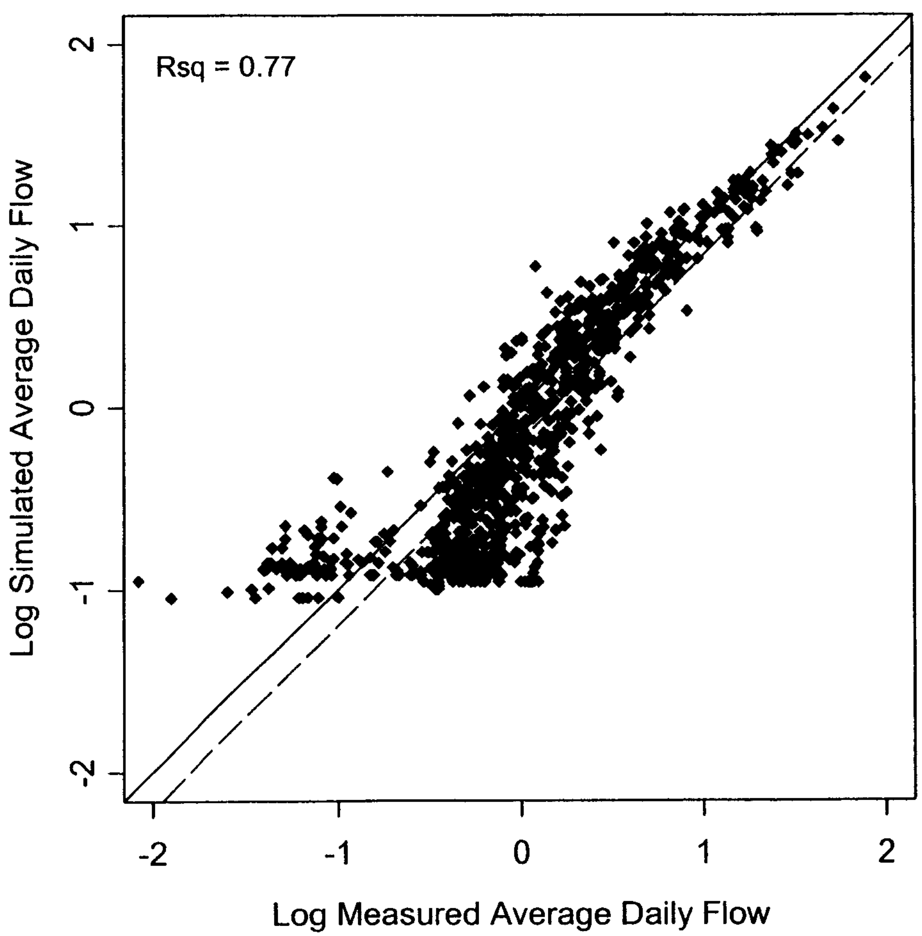
Tyee - Daily Average Flow



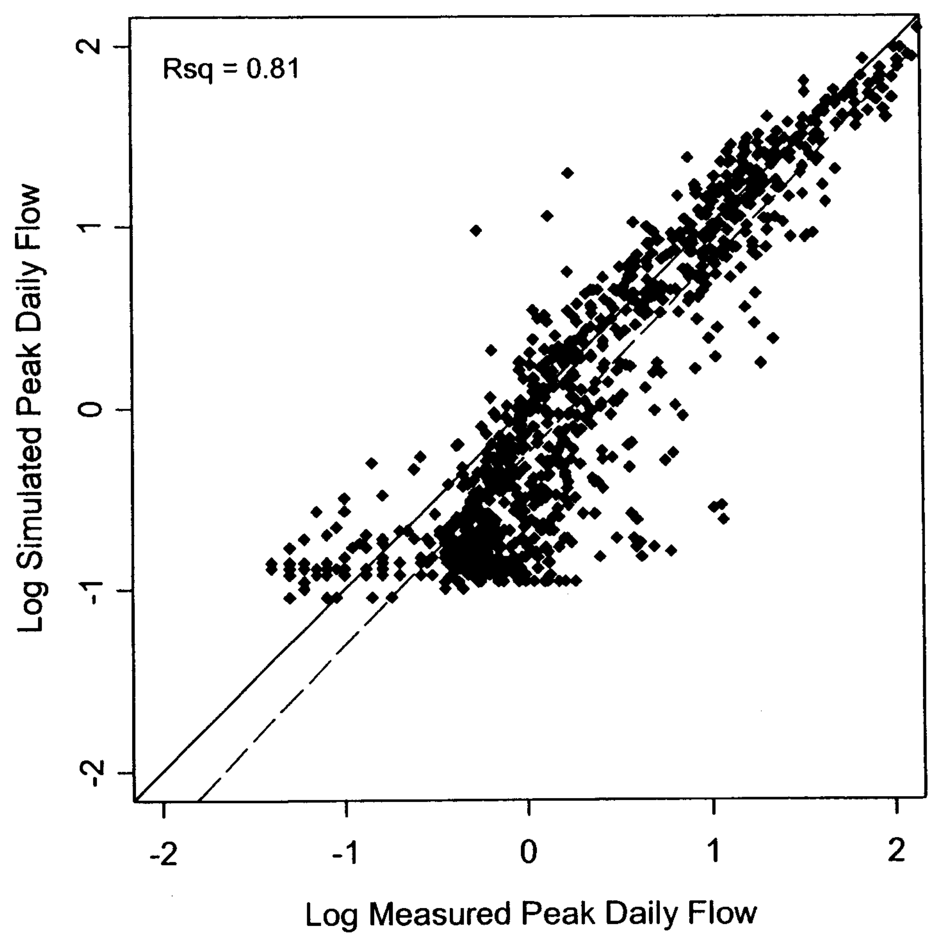
Tyee - Daily Peak Flow

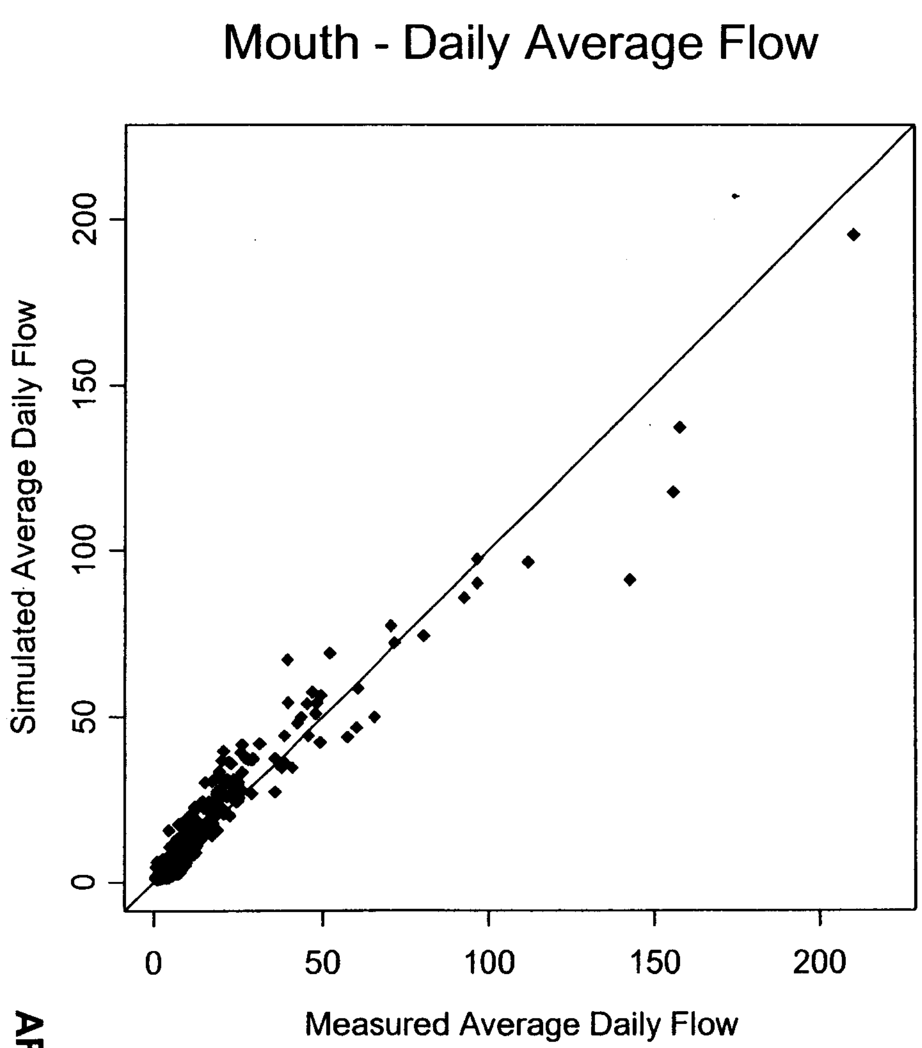


Tyee - Daily Average Flow

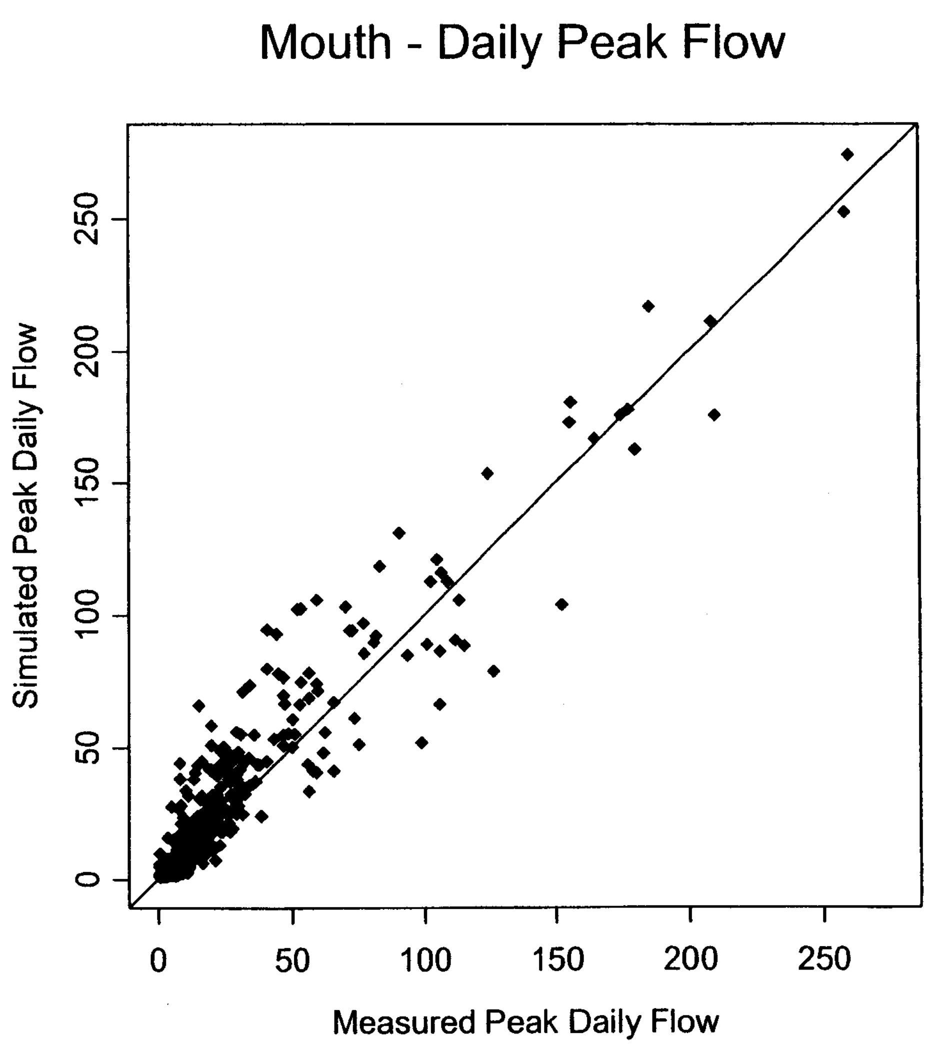


Tyee - Daily Peak Flow

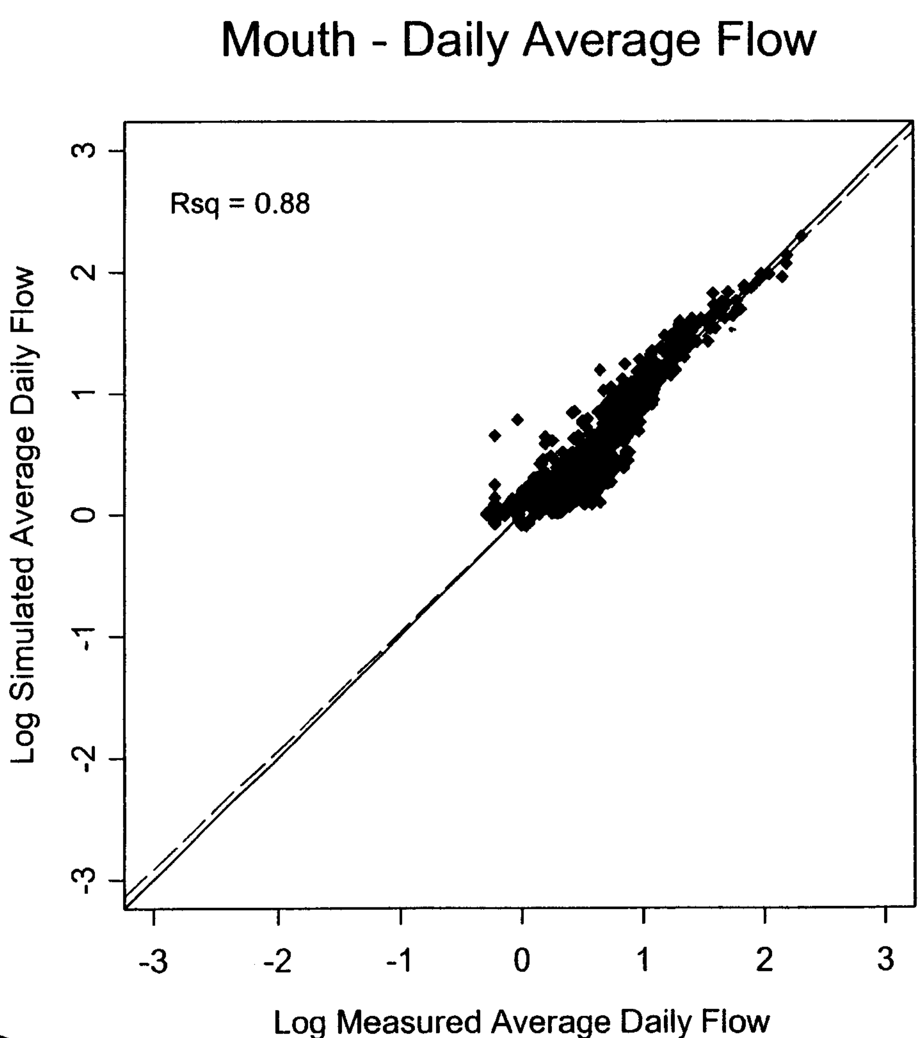


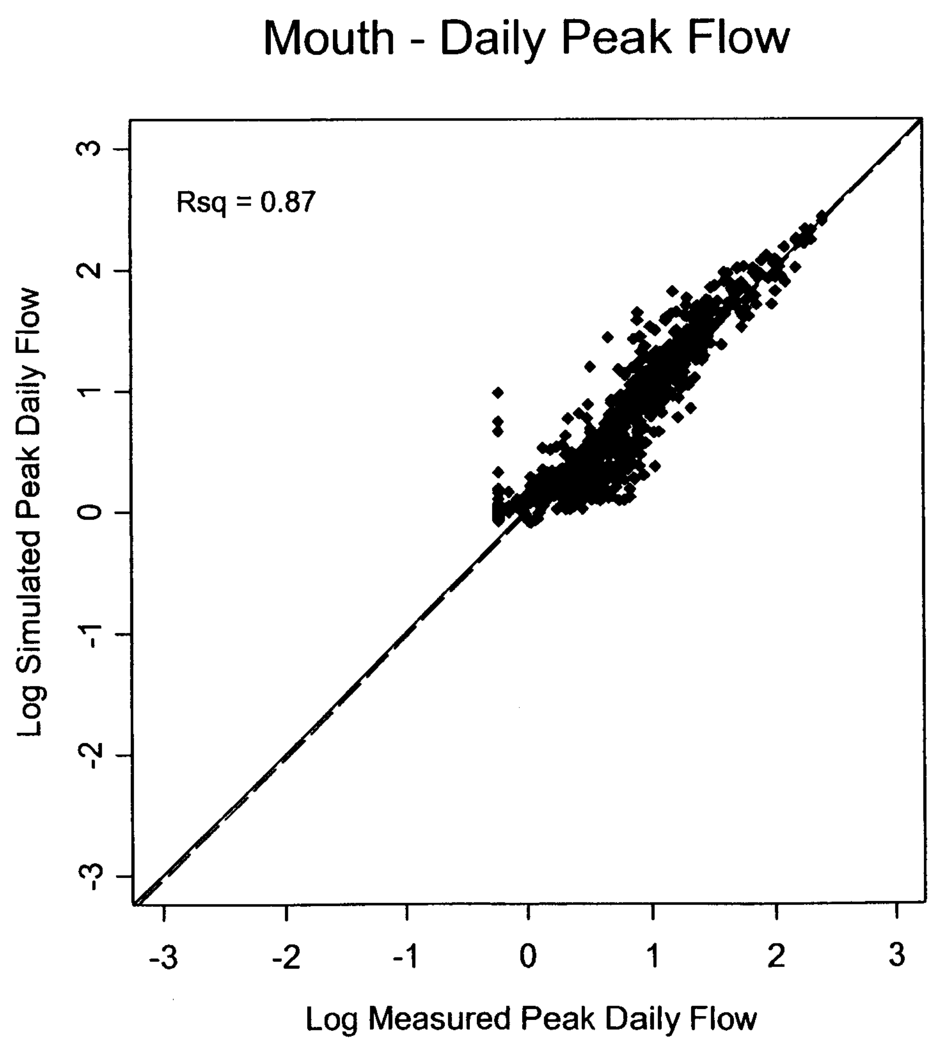


Mouth - Daily Average Flow
Simulated Average Daily Flow
Measured Average Daily Flow
0
50
100
150
200

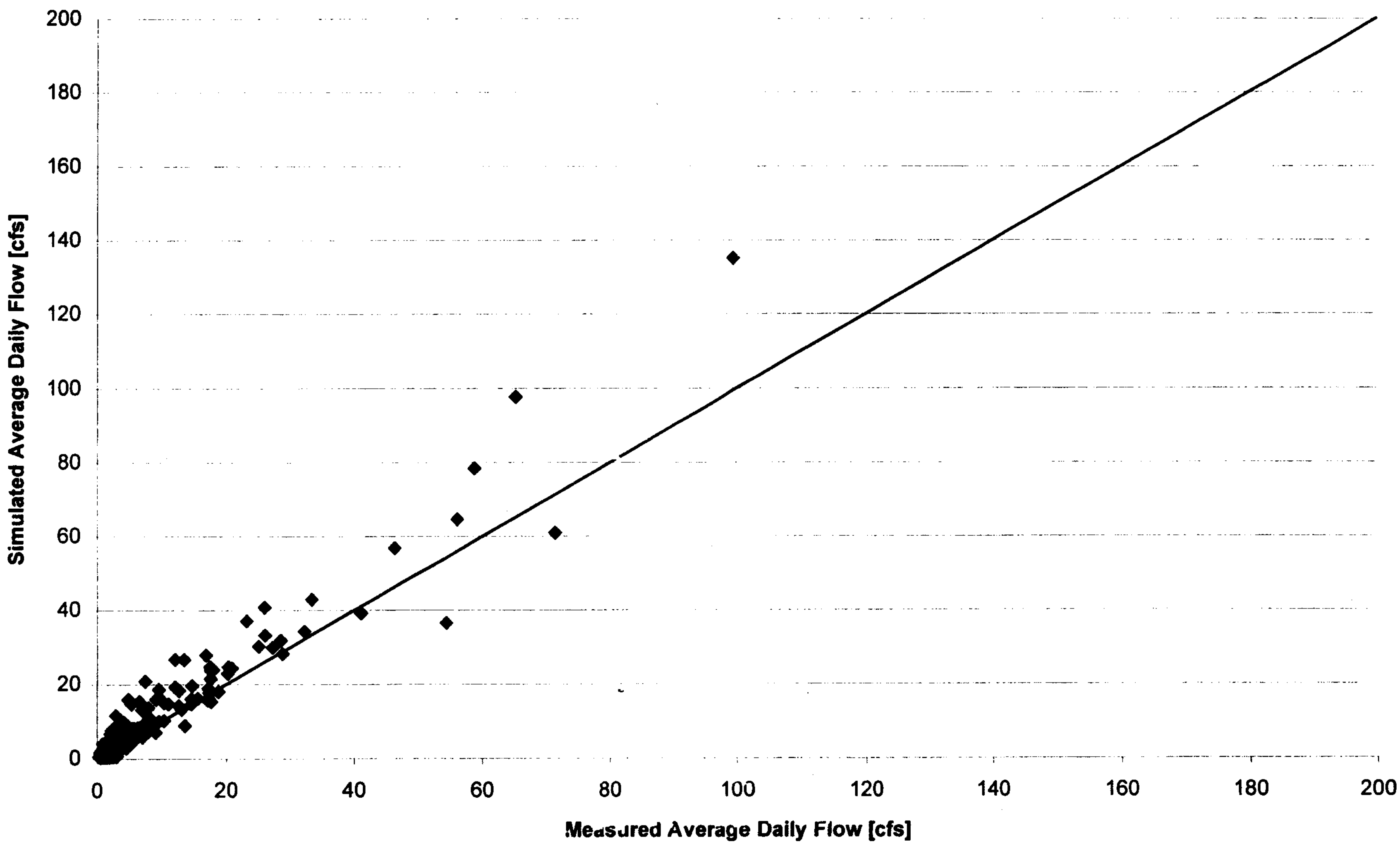


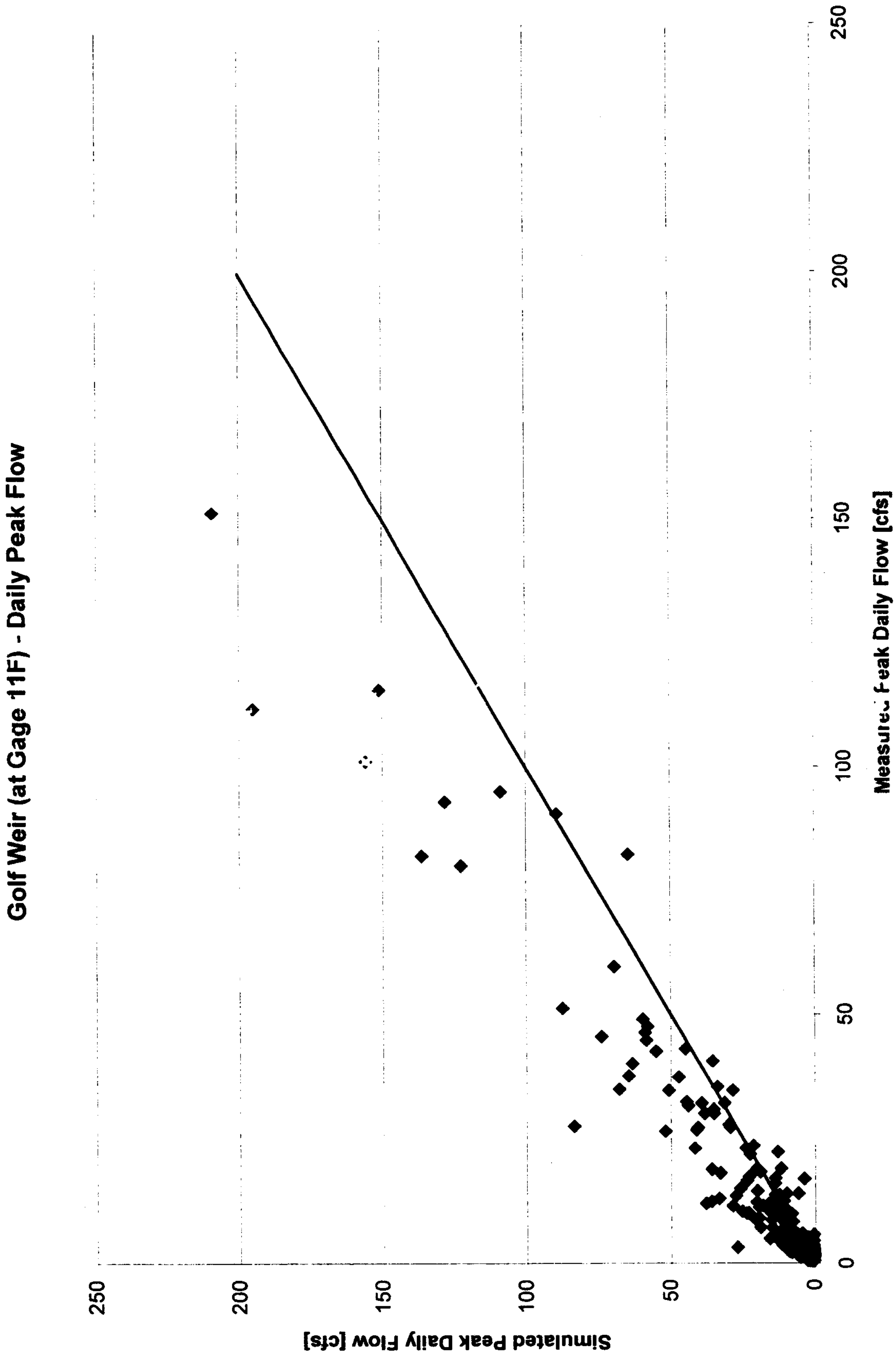
Mouth - Daily Peak Flow
Simulated Peak Daily Flow
Measured Peak Daily Flow
0
50
100
150
200
250

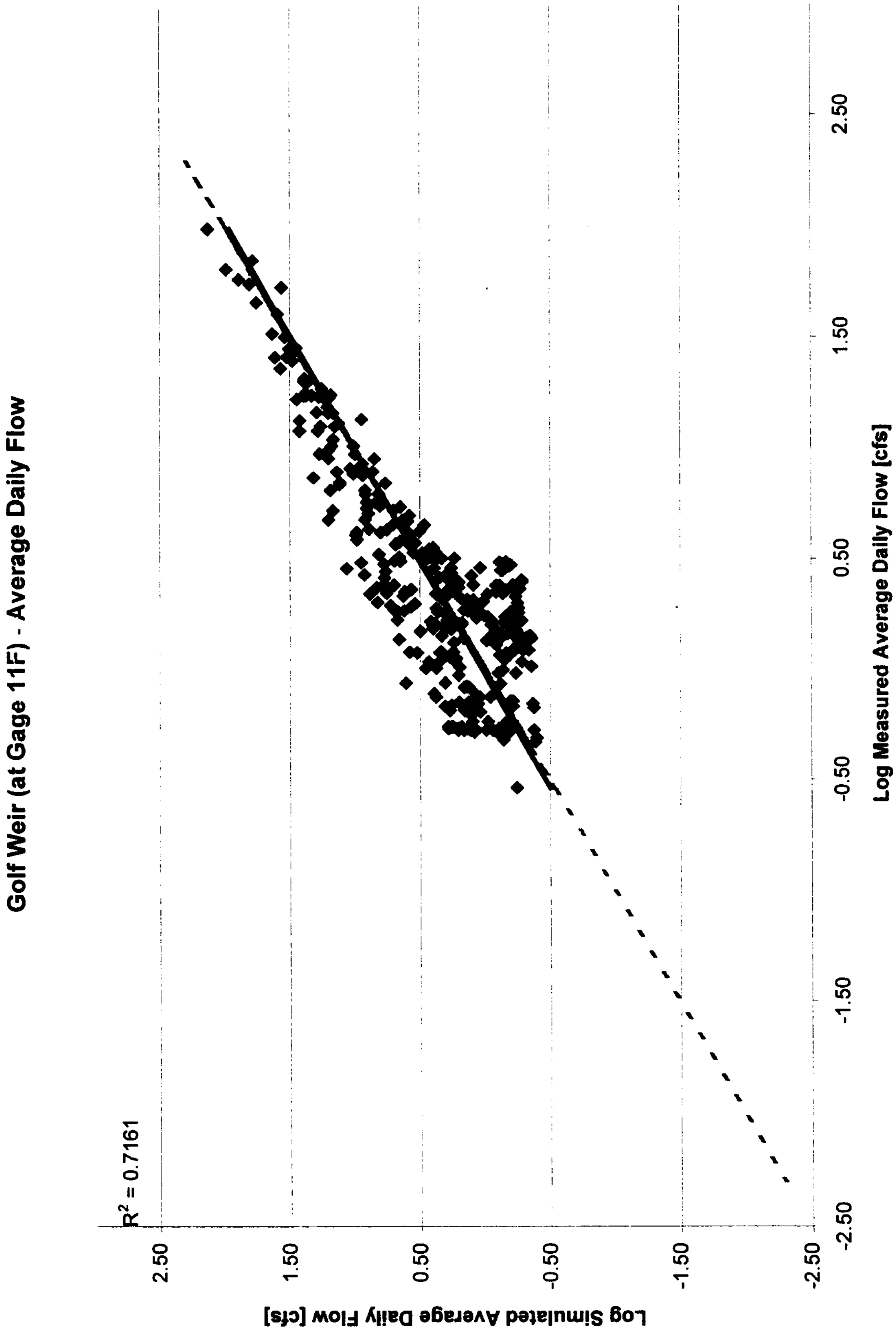

Mouth - Daily Average Flow
Rsq = 0.88
Log Simulated Average Daily Flow
Log Measured Average Daily Flow
-3
-2
-1
0
1
2
3

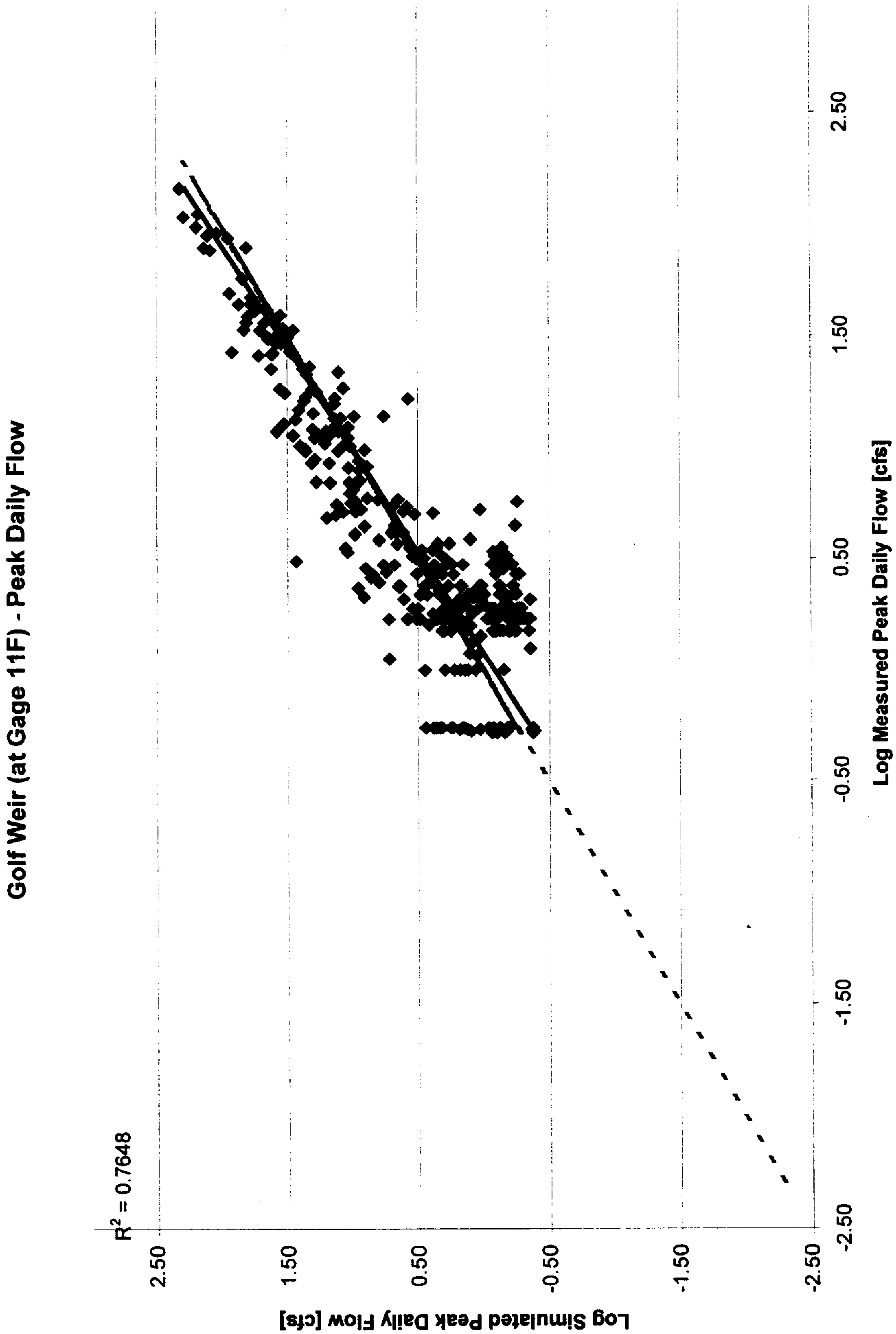

Mouth - Daily Peak Flow
Rsq = 0.87
Log Simulated Peak Daily Flow
Log Measured Peak Daily Flow
-3
-2
-1
0
1
2
3

Golf Weir (at Gage 11F) - Average Daily Flow

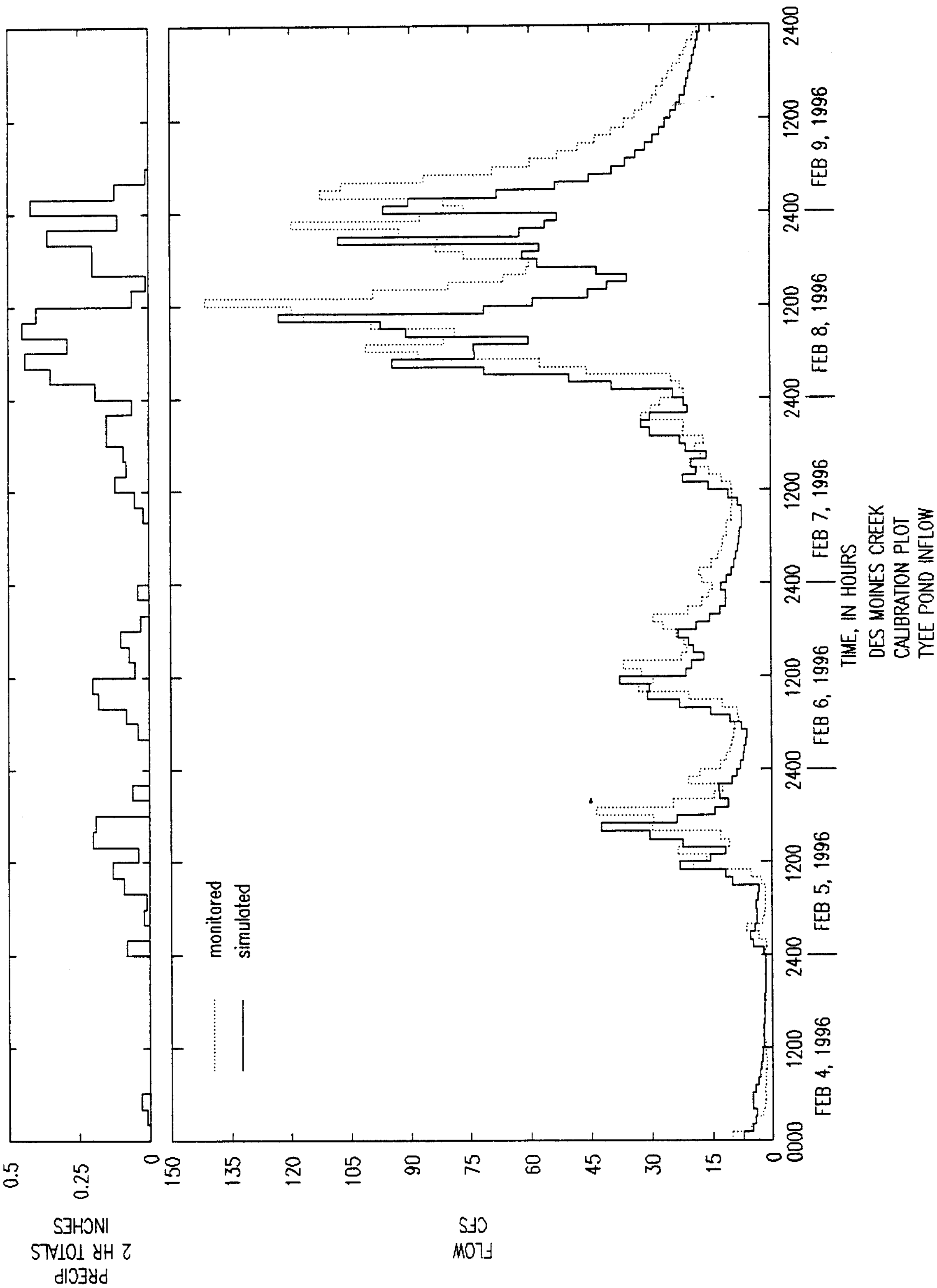


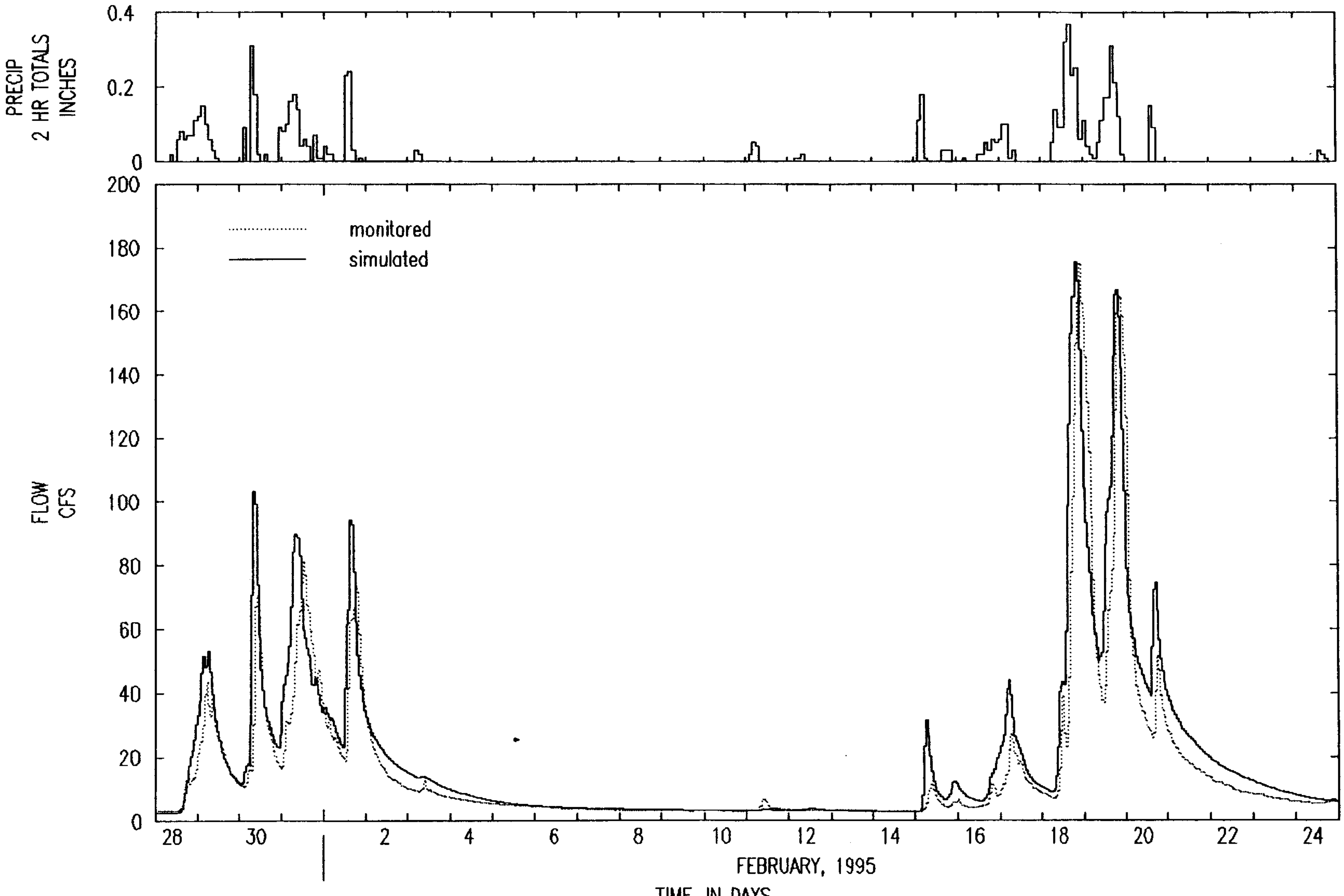

Golf Weir (at Gage 11F) - Daily Peak Flow
Simulated Peak Daily Flow [cfs]
0
50
100
150
200
250
0
50
100
150
200
250


Golf Weir (at Gage 11F) - Average Daily Flow
R^2 = 0.7161
Log Simulated Average Daily Flow [cfs]
2.50
1.50
0.50
-0.50
-1.50
-2.50
Log Measured Average Daily Flow [cfs]
-2.50
-1.50
-0.50
0.50
1.50
2.50

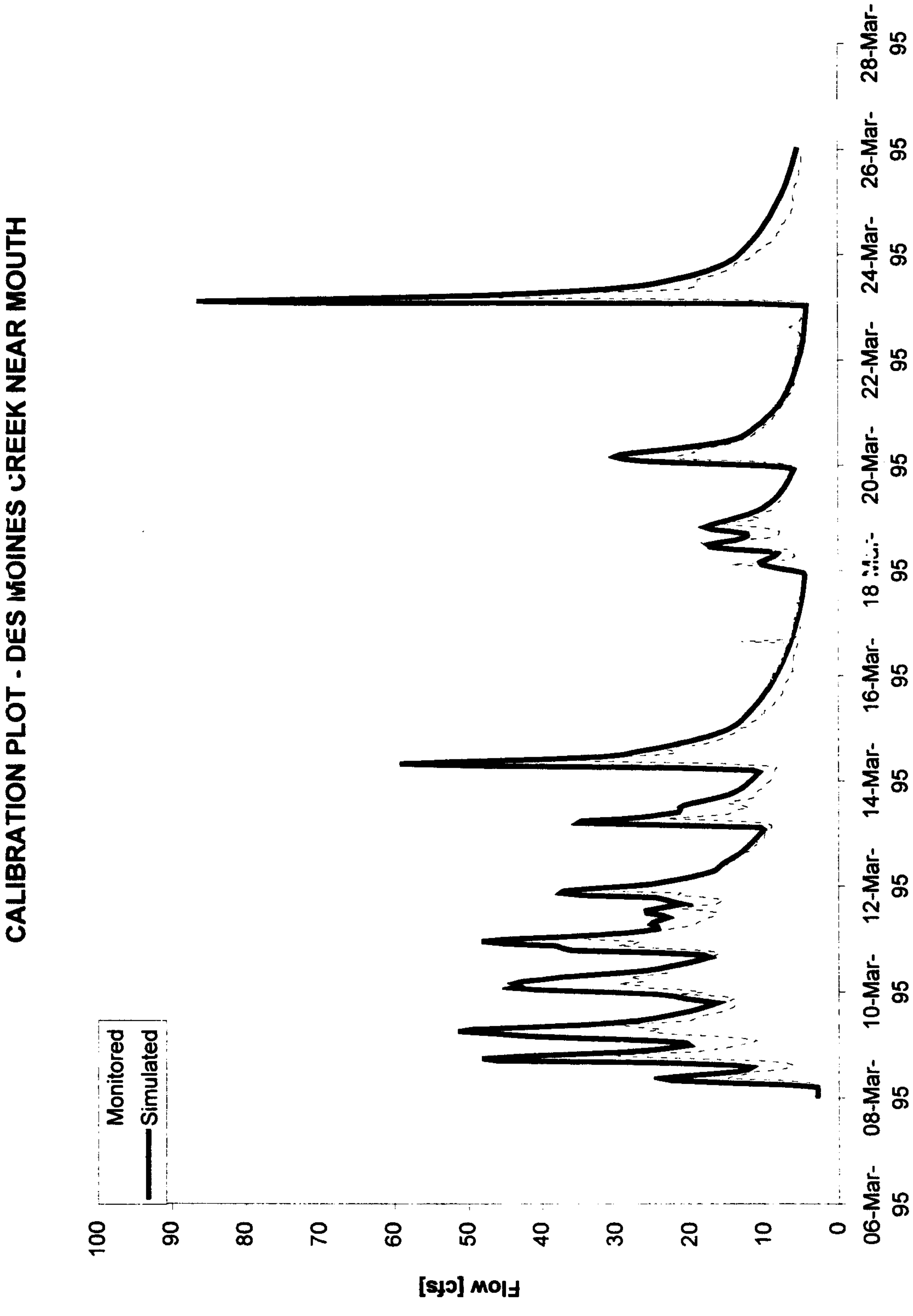


Golf Weir (at Gage 11F) - Peak Daily Flow
R^2 = 0.7648
Log Simulated Peak Daily Flow [cfs]
Log Measured Peak Daily Flow [cfs]
2.50
1.50
0.50
-0.50
-1.50
-2.50

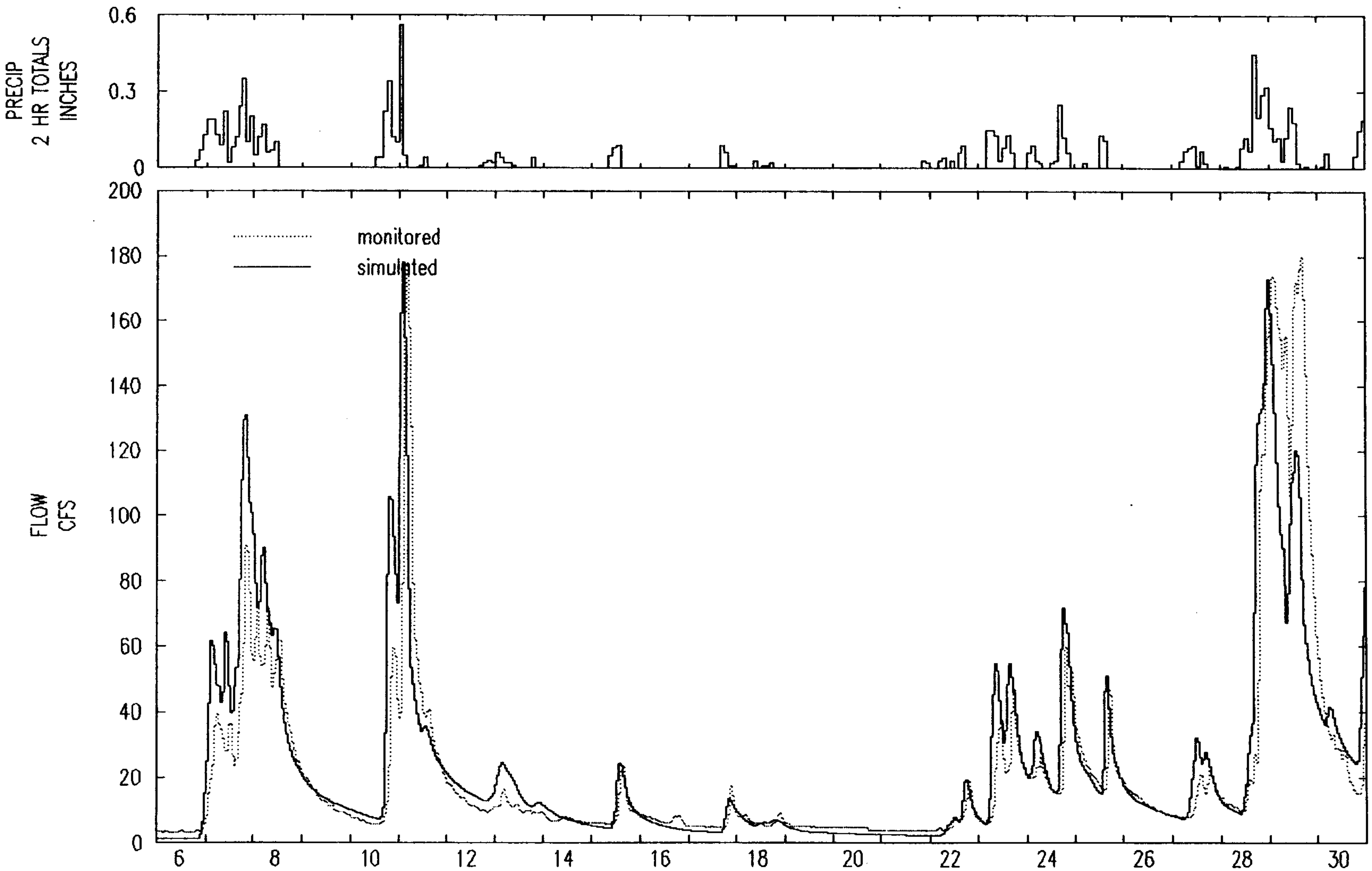

PRECIP
2 HR TOTALS
INCHES
0.5
0.25
0
FLOW
CFS
150
135
120
105
90
75
60
45
30
15
0
monitored
simulated
0000
1200
2400
1200
2400
1200
2400
1200
2400
1200
2400
1200
2400
FEB 4, 1996
FEB 5, 1996
FEB 6, 1996
FEB 7, 1996
FEB 8, 1996
FEB 9, 1996
TIME, IN HOURS
DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW



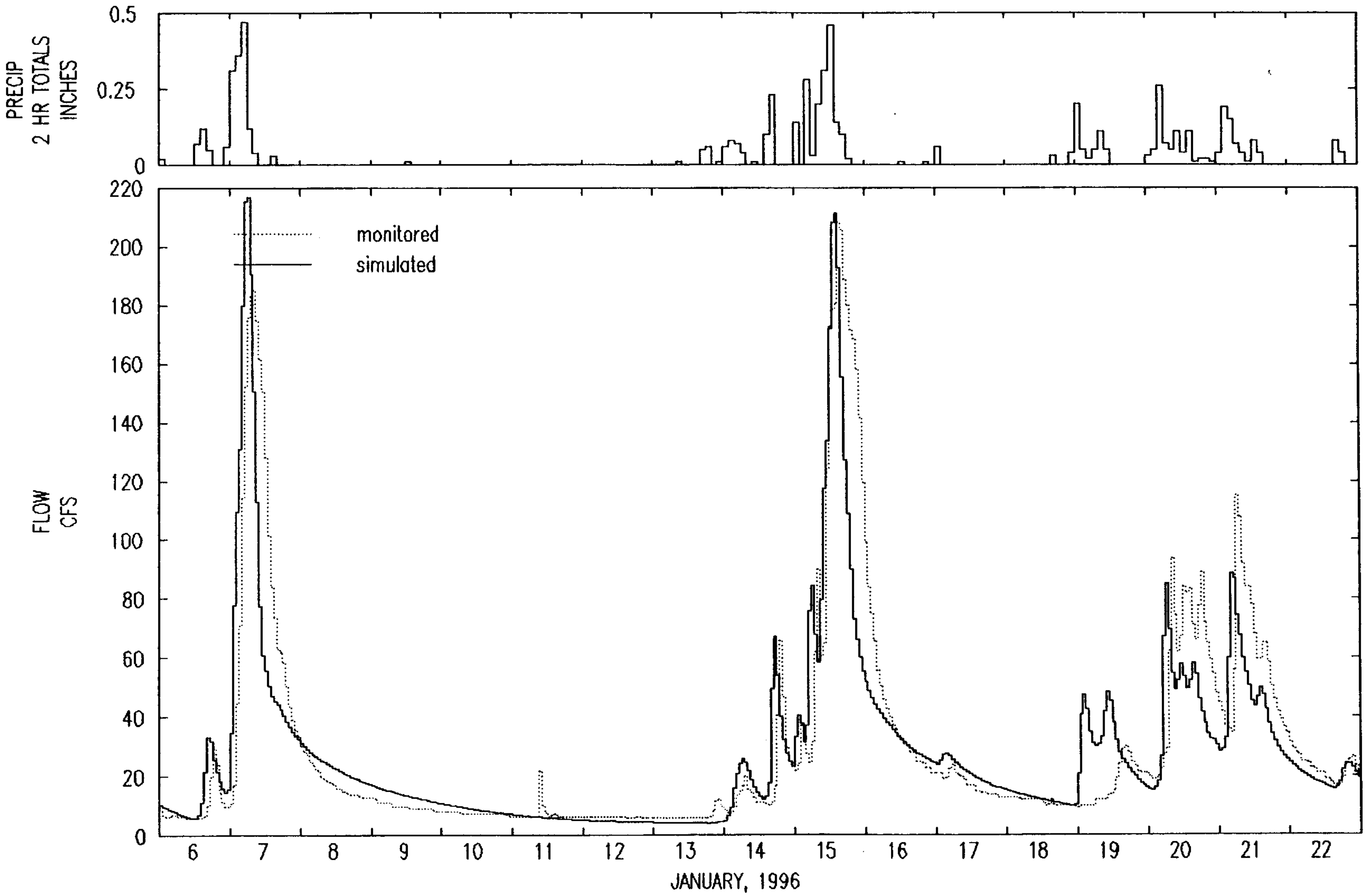
DES MOINES CREEK
CALIBRATION PLOT
NEAR MOUTH



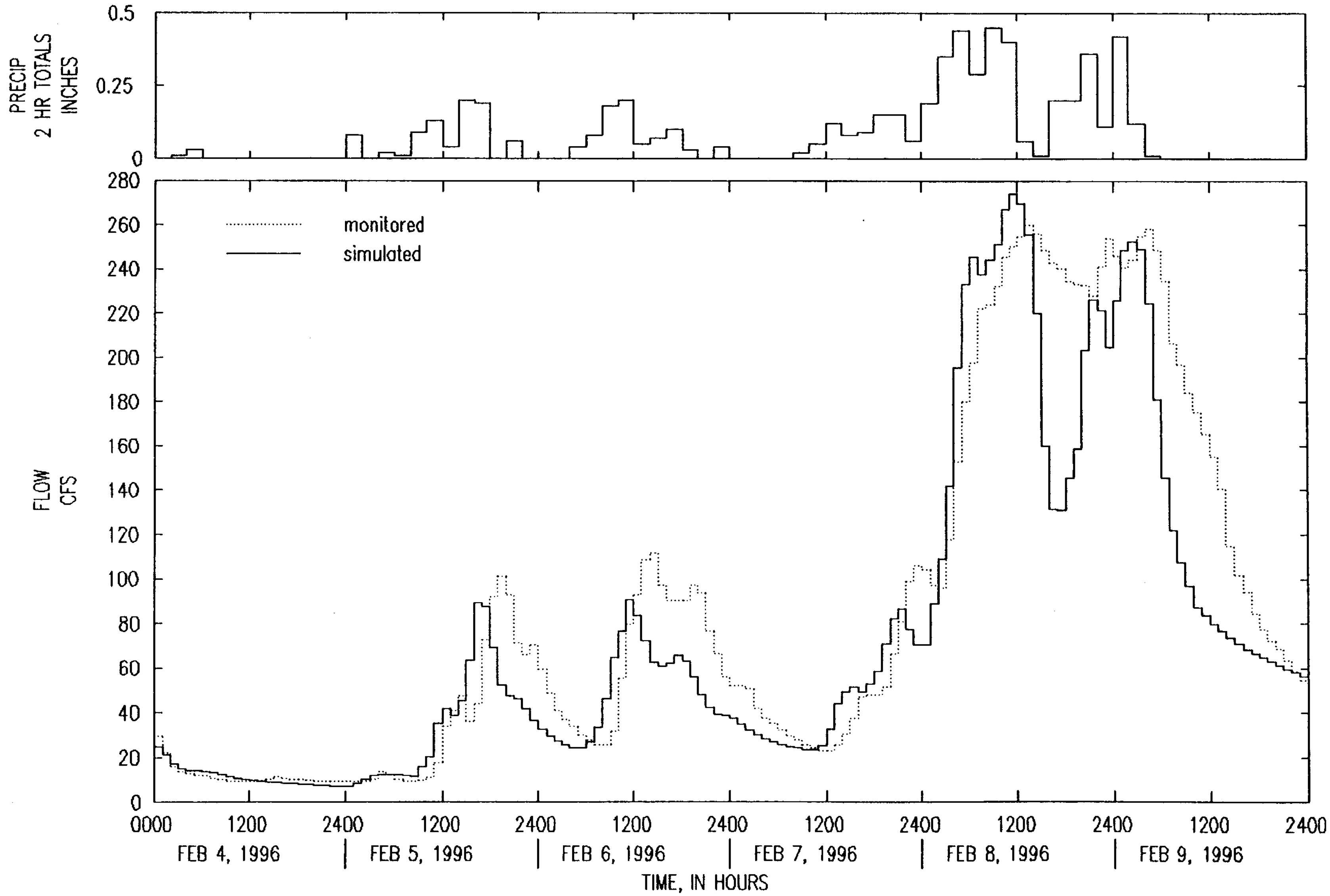
CALIBRATION PLOT - DES MOINES CREEK NEAR MOUTH
Monitored
Simulated
Flow [cfs]
100
90
80
70
60
50
40
30
20
10
0
06-Mar-95
08-Mar-95
10-Mar-95
12-Mar-95
14-Mar-95
16-Mar-95
18-Mar-95
20-Mar-95
22-Mar-95
24-Mar-95
26-Mar-95
28-Mar-95
Time [days]



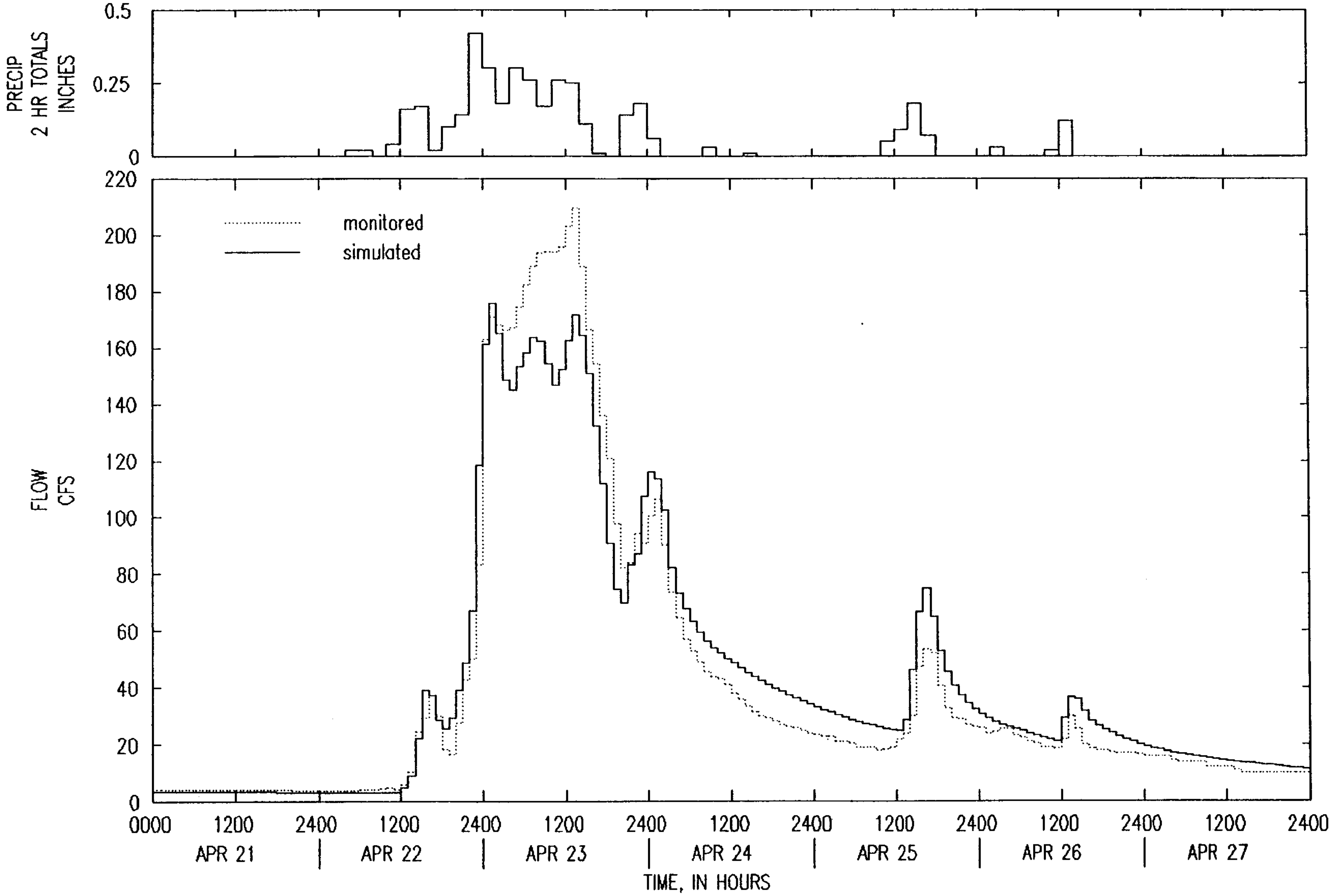
NOVEMBER, 1995
TIME, IN DAYS
DES MOINES CREEK
CALIBRATION PLOT
NEAR MOUTH



DES MOINES CREEK
CALIBRATION PLOT
NEAR MOUTH

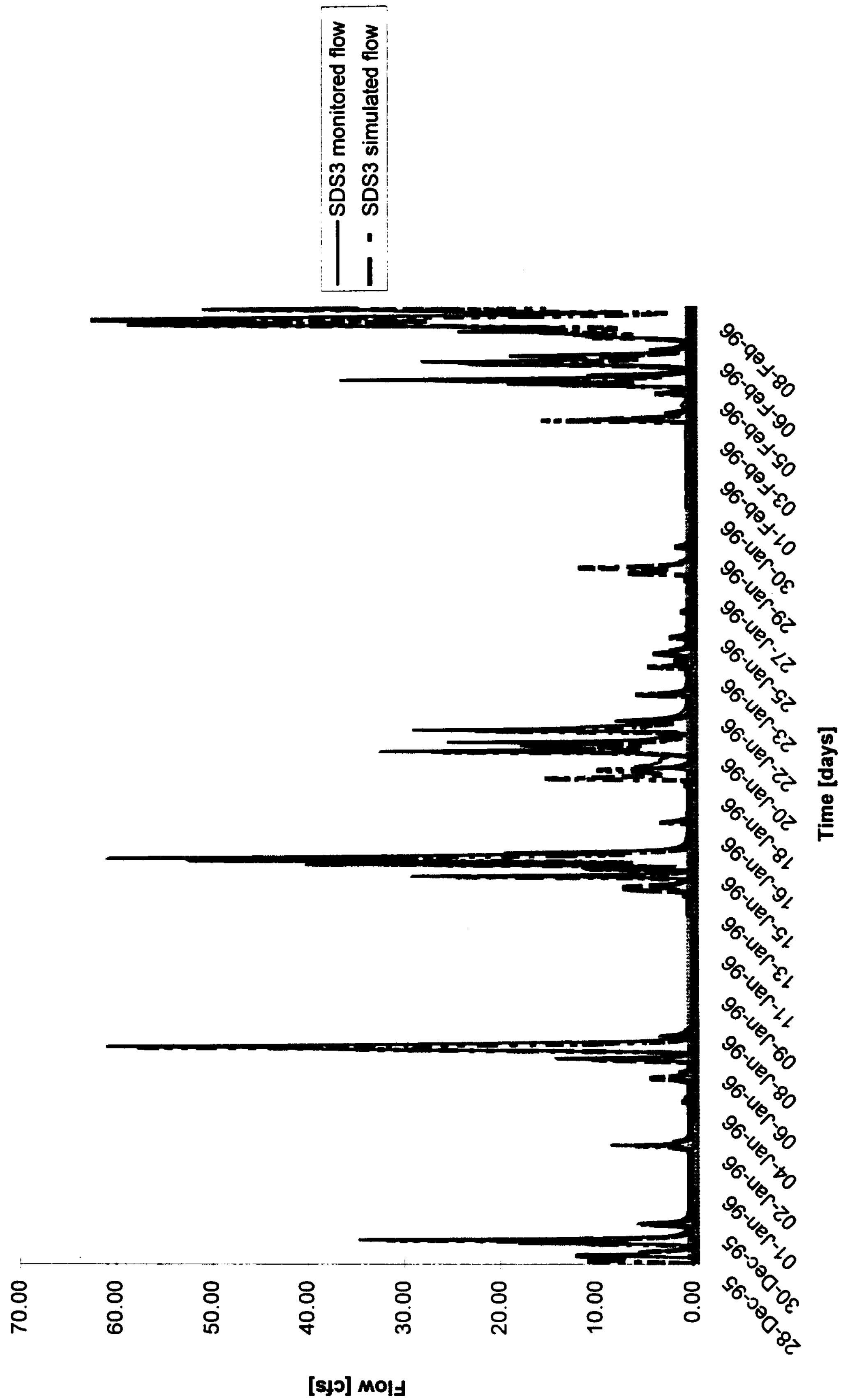


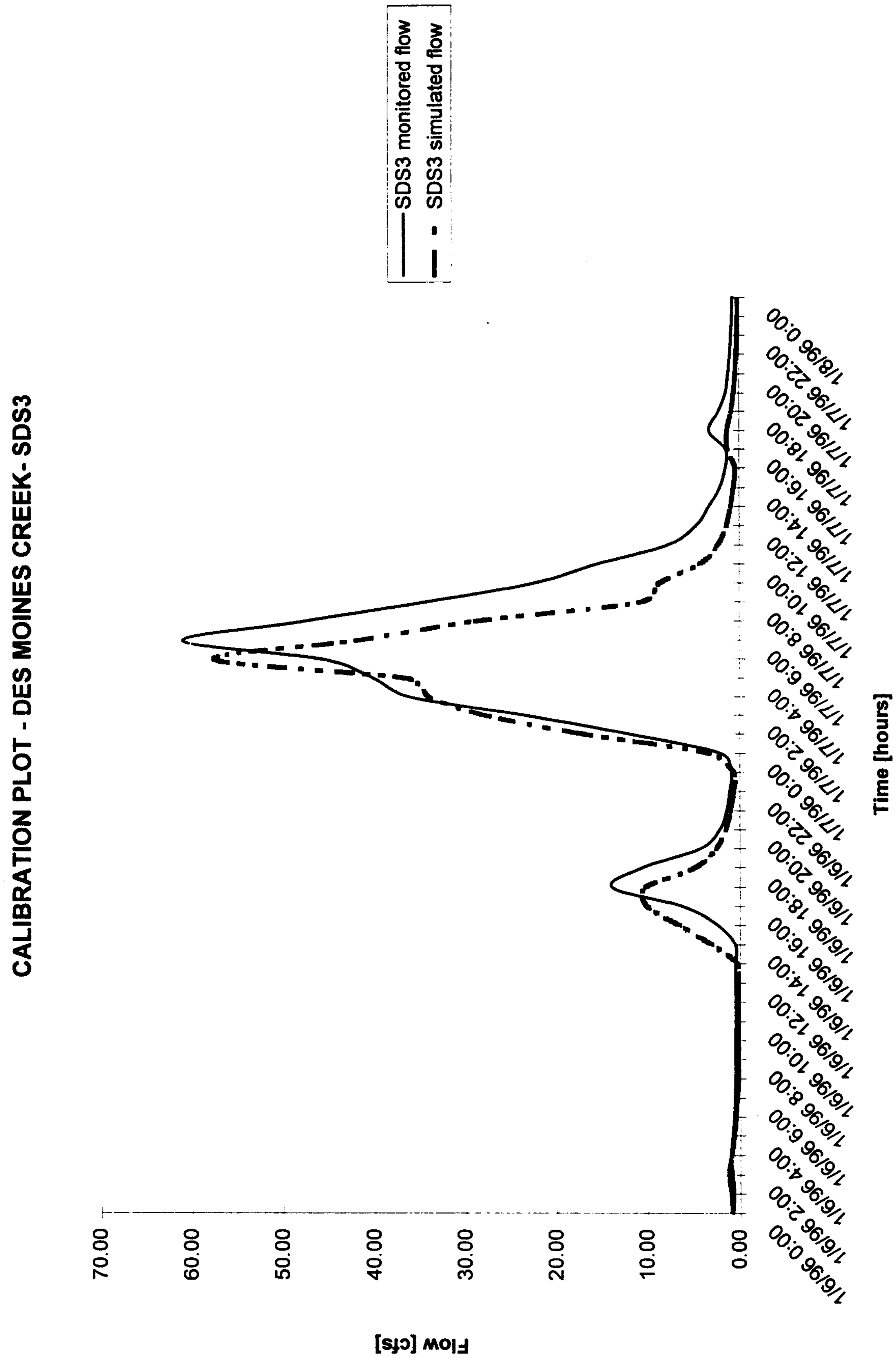
DES MOINES CREEK
CALIBRATION PLOT
NEAR MOUTH



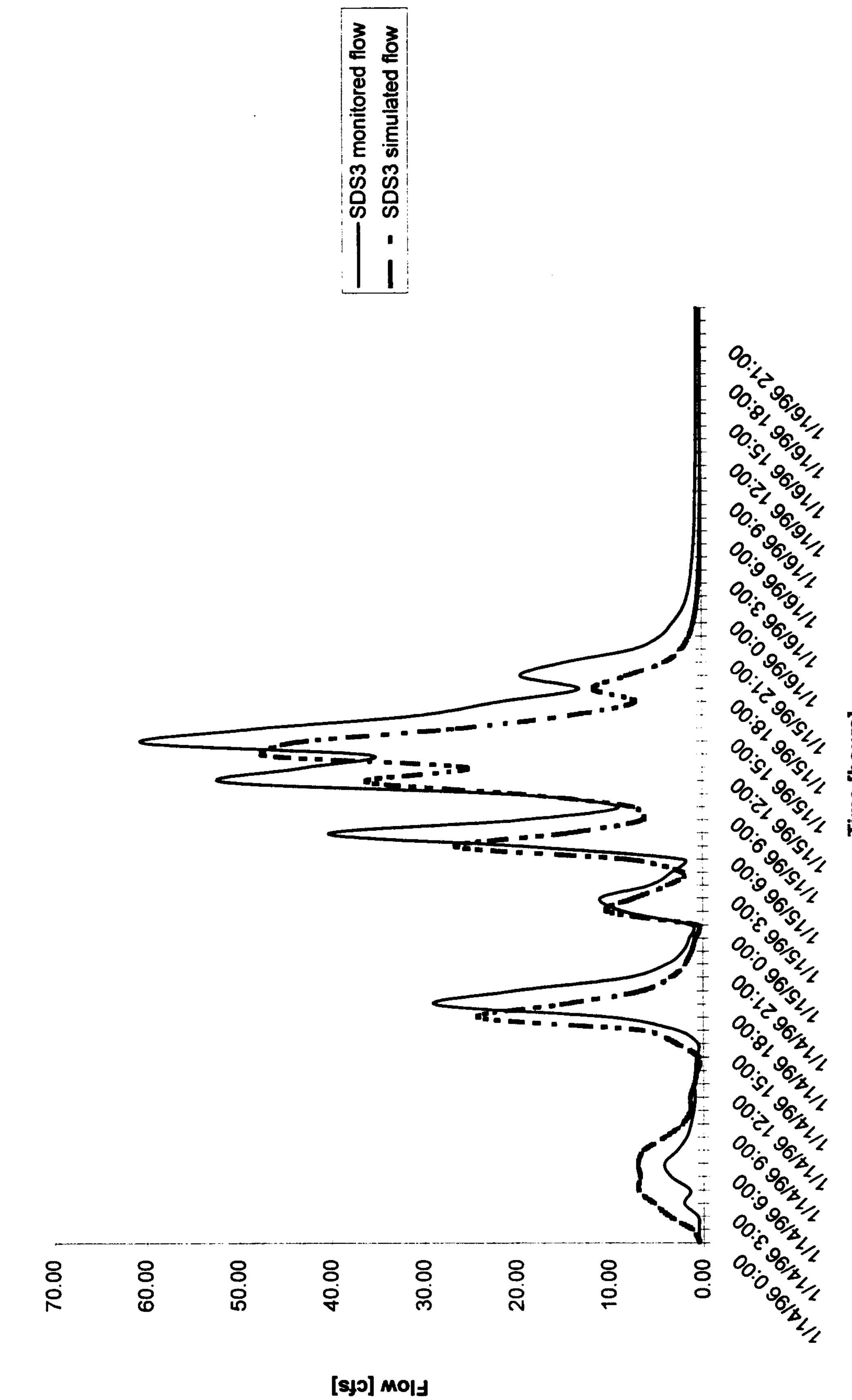
DES MOINES CREEK
CALIBRATION PLOT
NEAR MOUTH

CALIBRATION PLOT - DES MOINES CREEK- SDS3

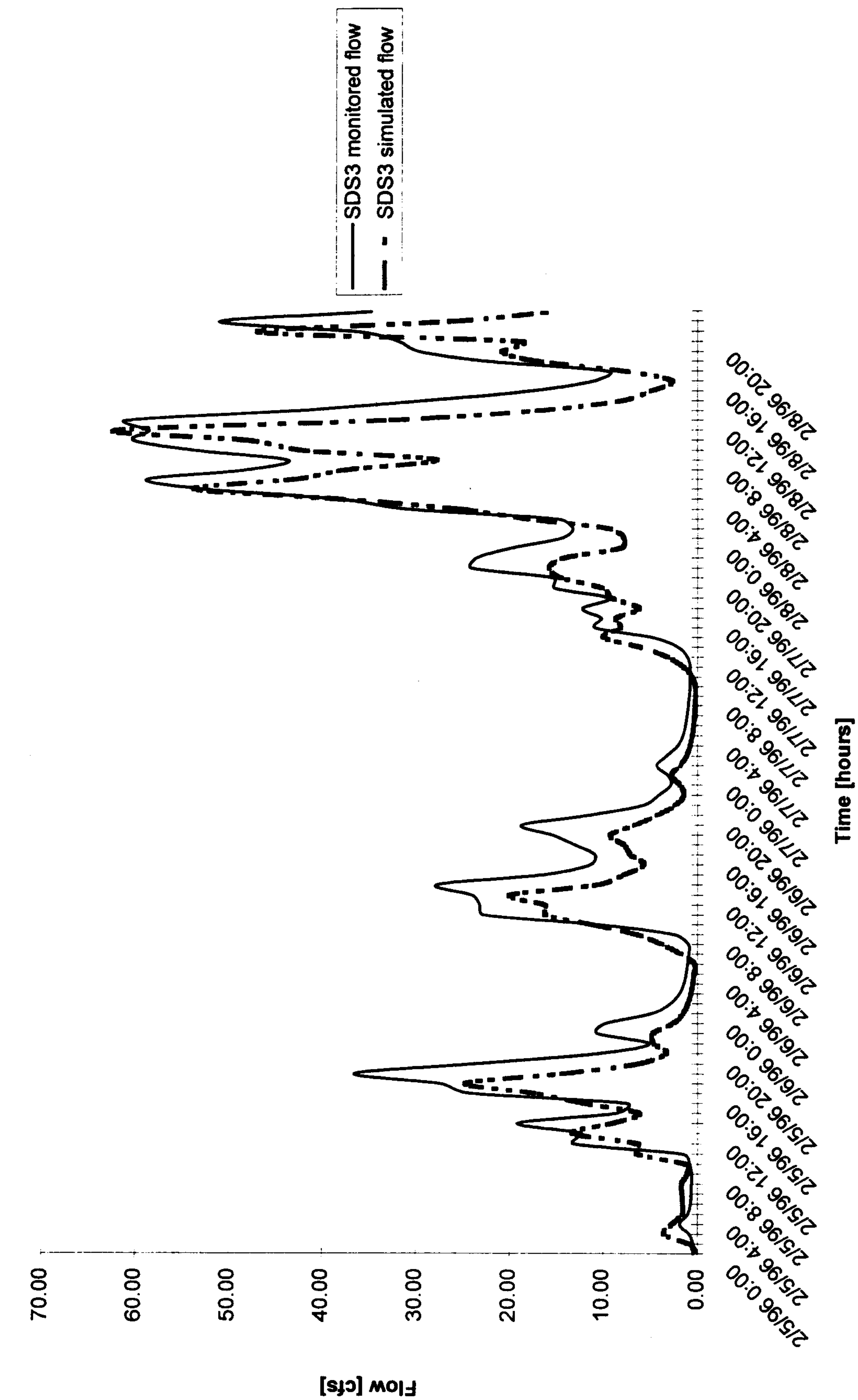


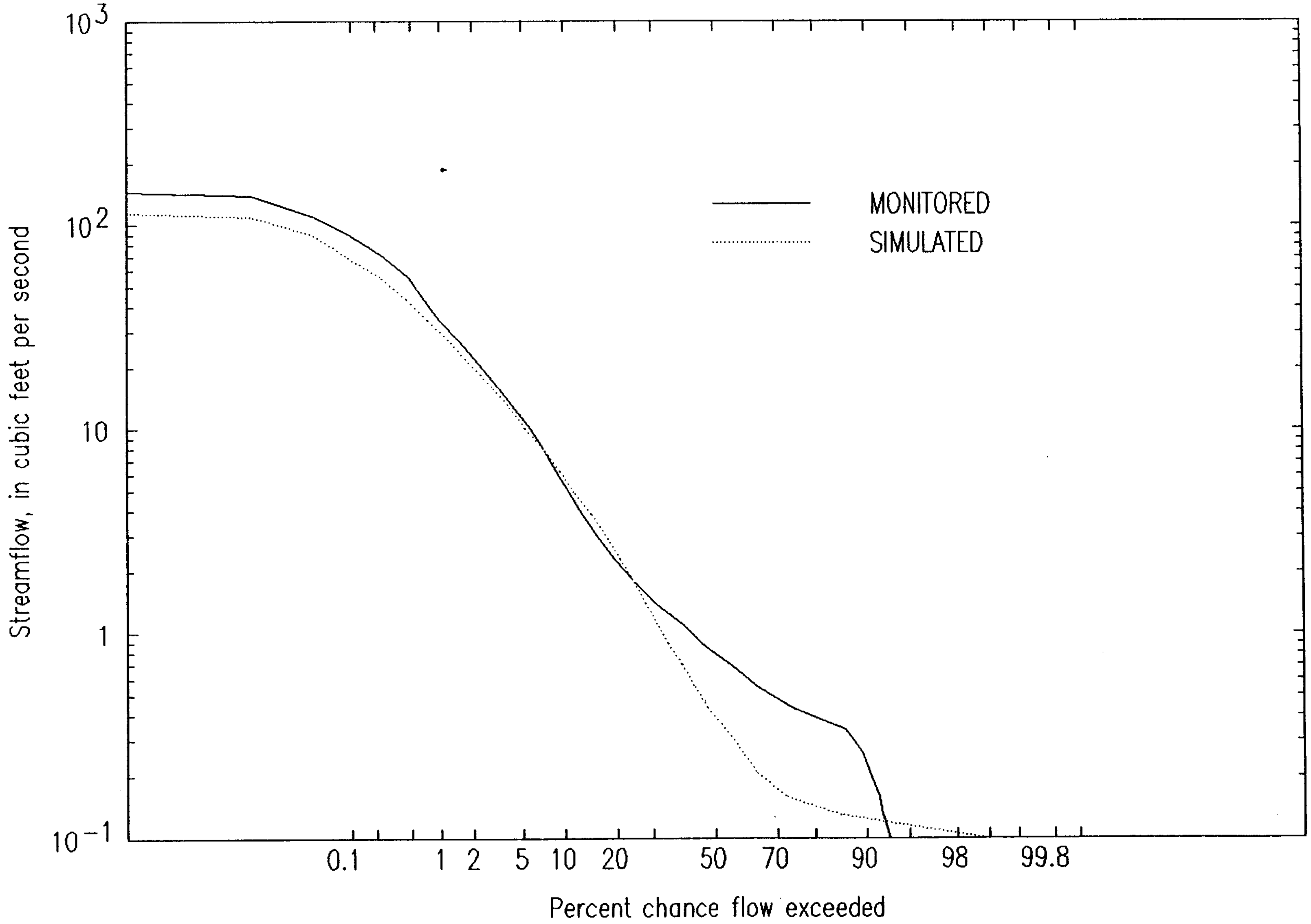

CALIBRATION PLOT - DES MOINES CREEK - SDS3
SDS3 monitored flow
SDS3 simulated flow
Flow [cfs]
Time [hours]
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1/6/96 0:00
1/6/96 2:00
1/6/96 4:00
1/6/96 6:00
1/6/96 8:00
1/6/96 10:00
1/6/96 12:00
1/6/96 14:00
1/6/96 16:00
1/6/96 18:00
1/6/96 20:00
1/6/96 22:00
1/7/96 0:00
1/7/96 2:00
1/7/96 4:00
1/7/96 6:00
1/7/96 8:00
1/7/96 10:00
1/7/96 12:00
1/7/96 14:00
1/7/96 16:00
1/7/96 18:00
1/7/96 20:00
1/7/96 22:00
1/8/96 0:00

CALIBRATION PLOT - DES MOINES CREEK- SDS3

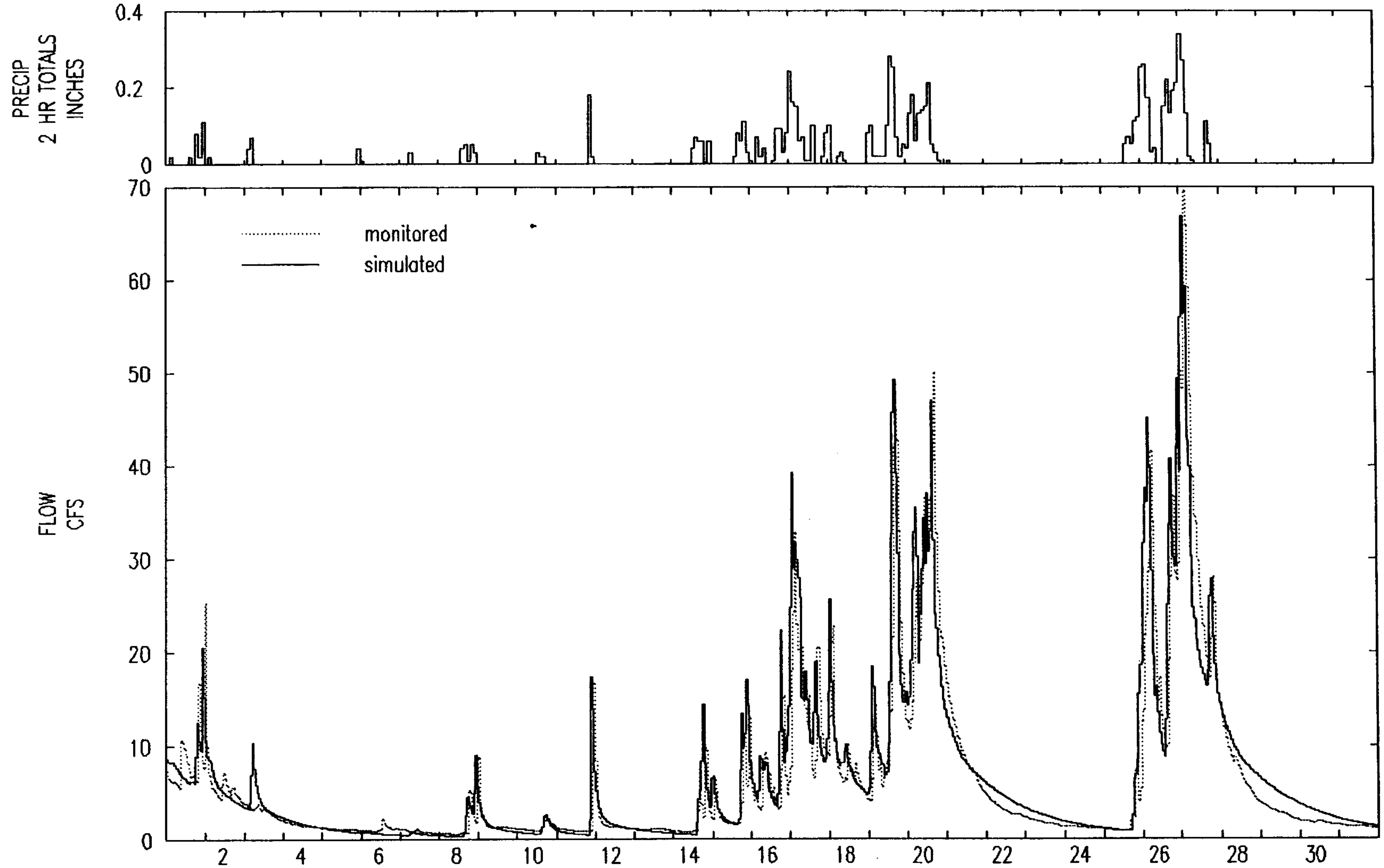


CALIBRATION PLOT - DES MOINES CREEK- SDS3

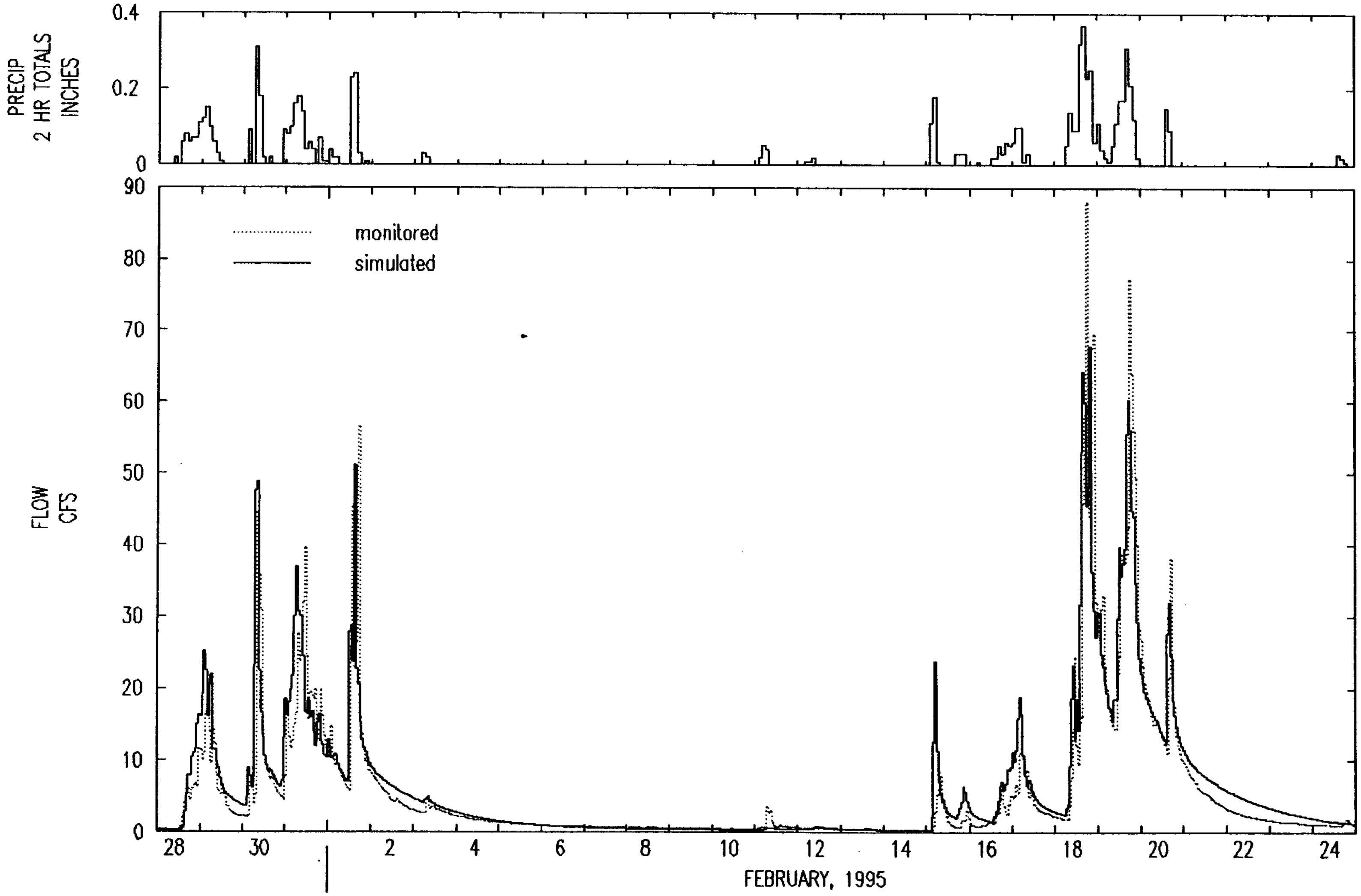




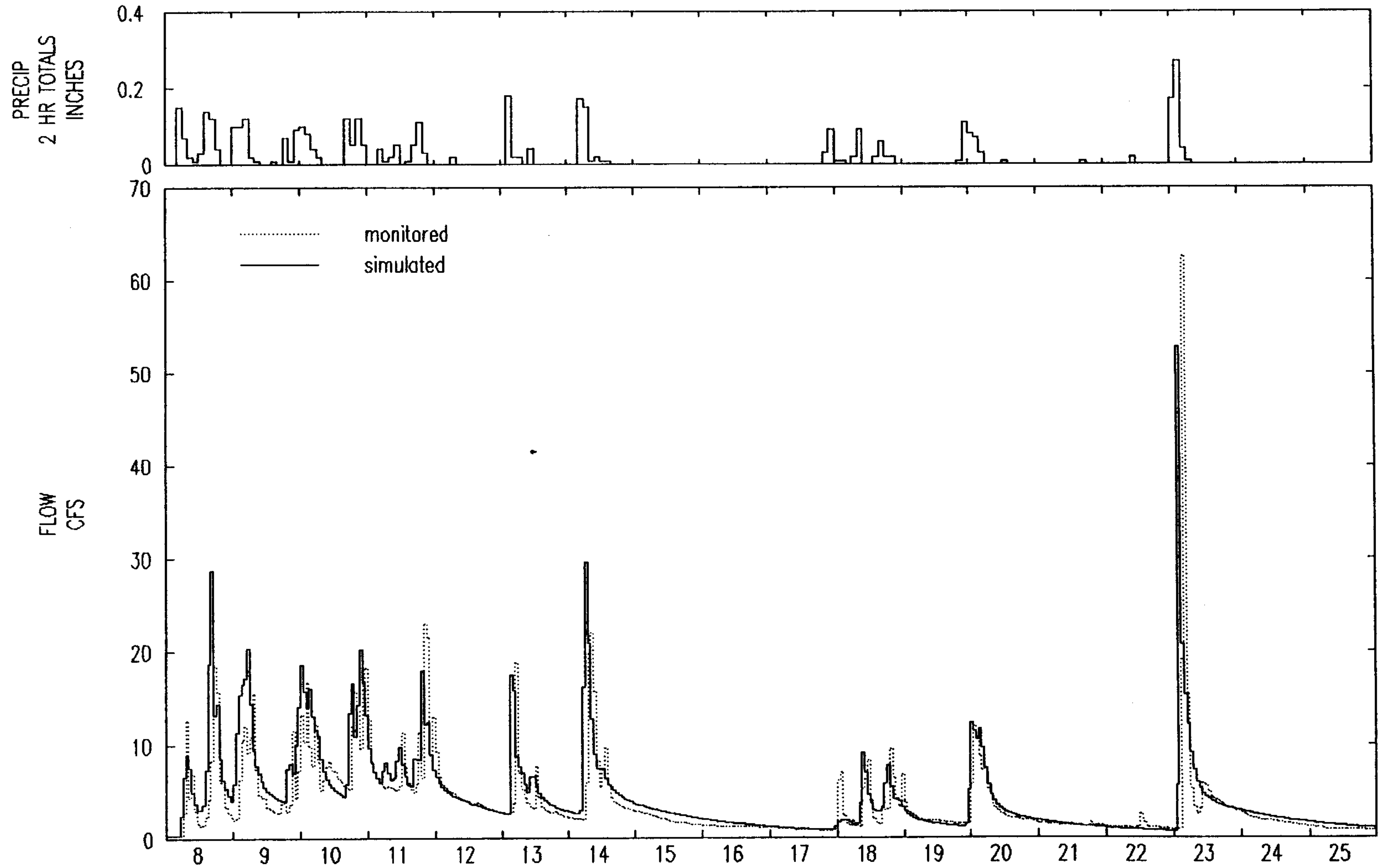
CALIBRATED VS MONITORED VALUES AT TYEE POND INFLOW



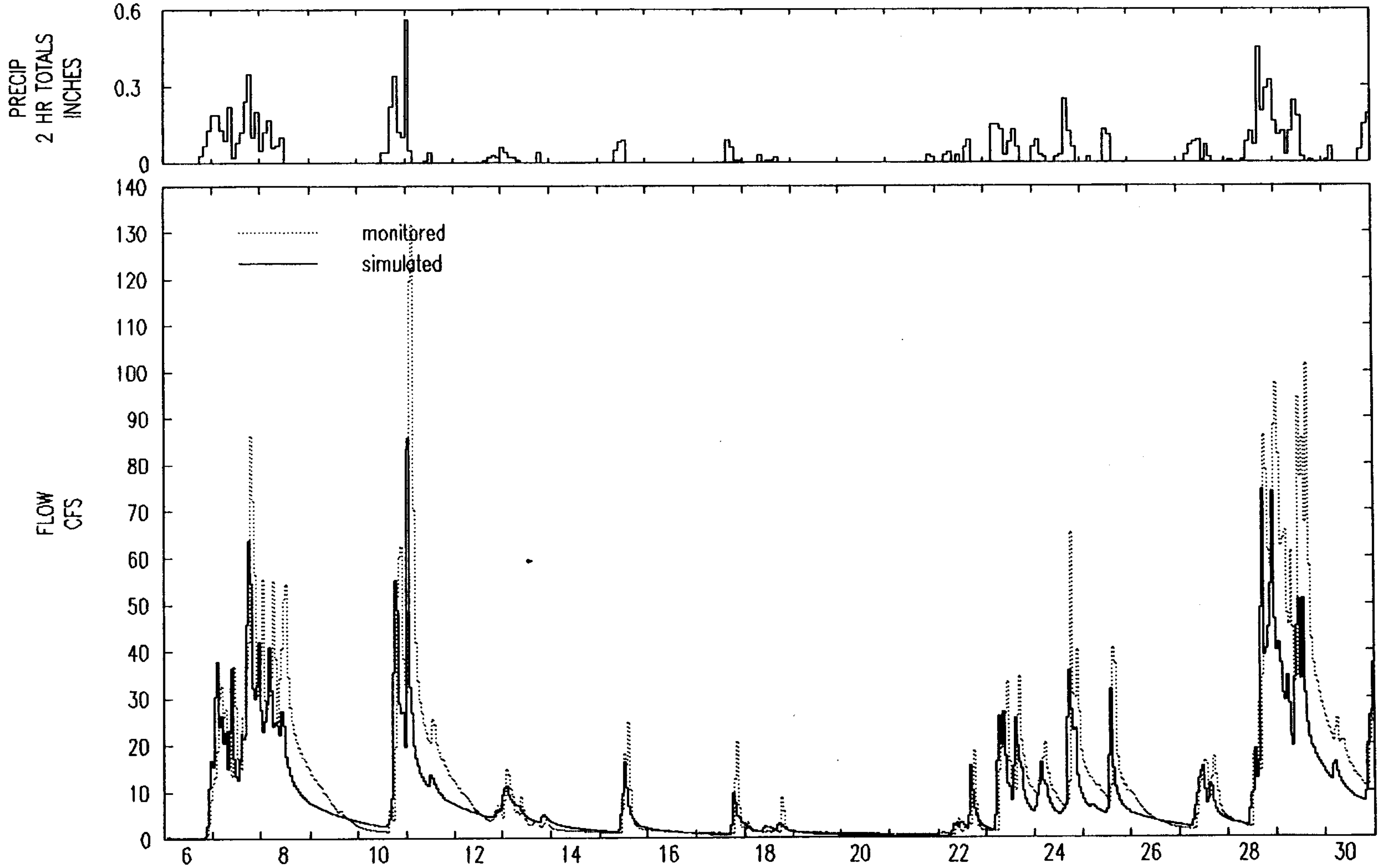
DECEMBER, 1994
TIME, IN DAYS
DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW



DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW

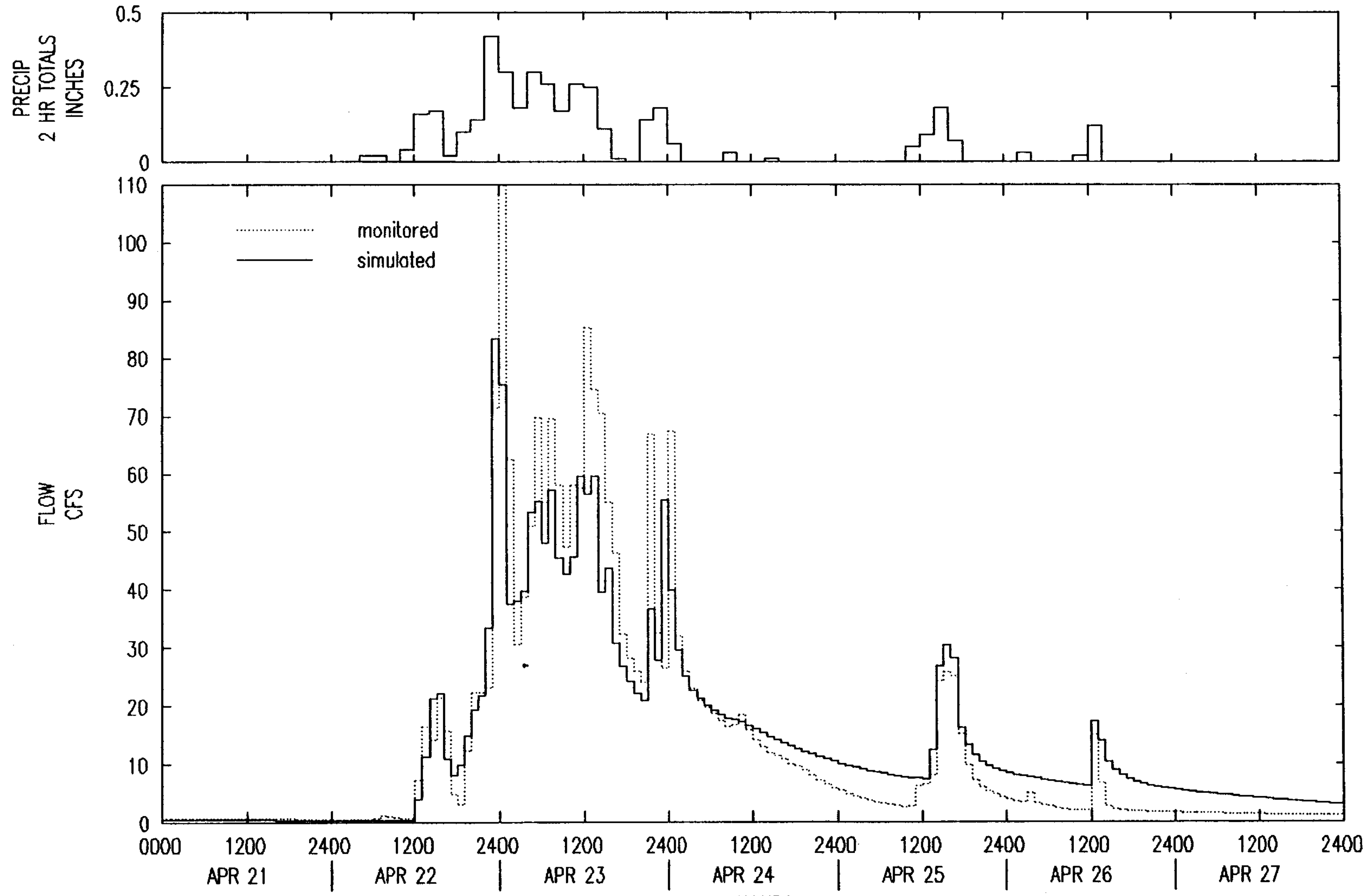


MARCH, 1995
TIME, IN DAYS
DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW

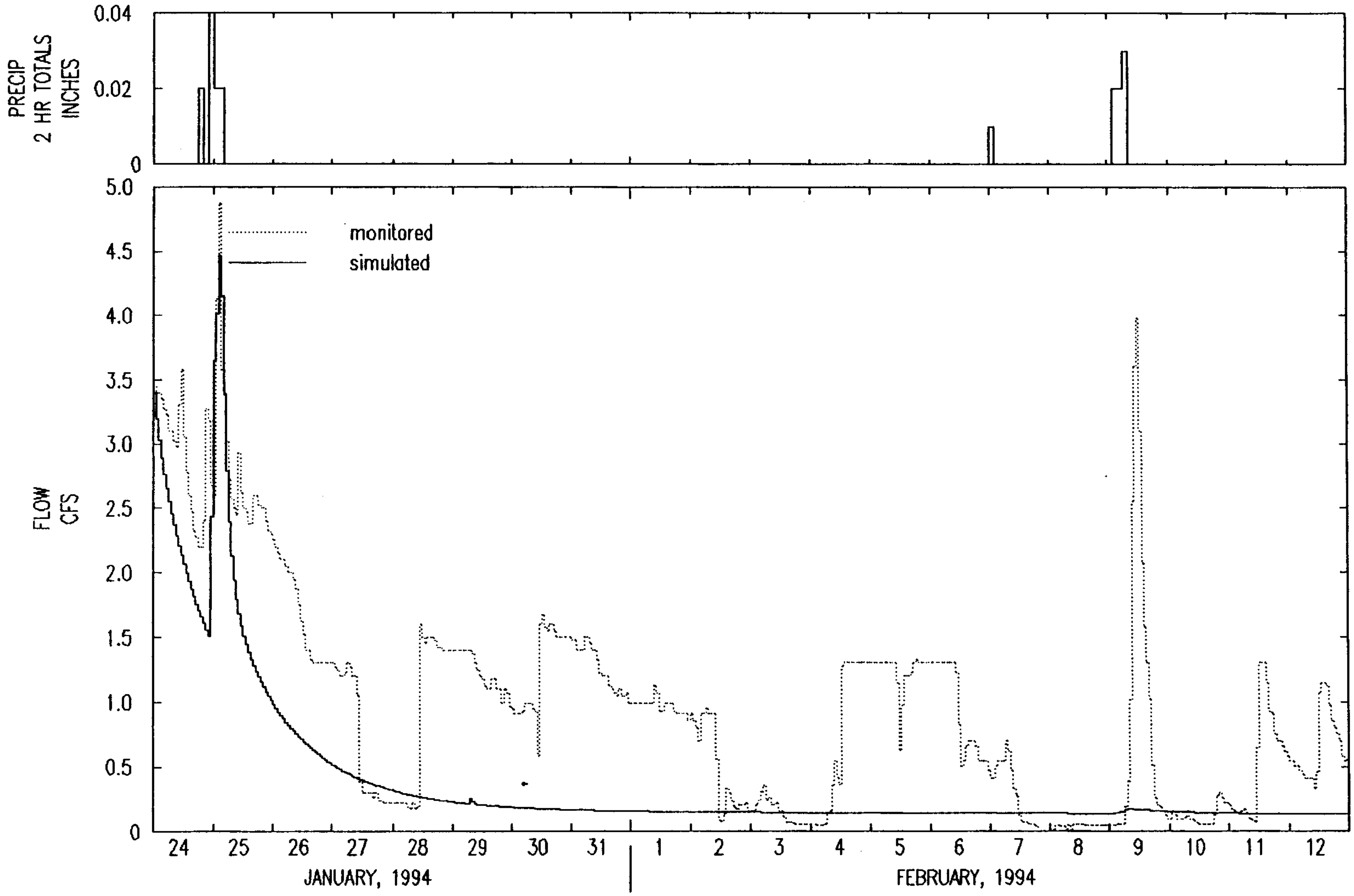


NOVEMBER, 1995
TIME, IN DAYS

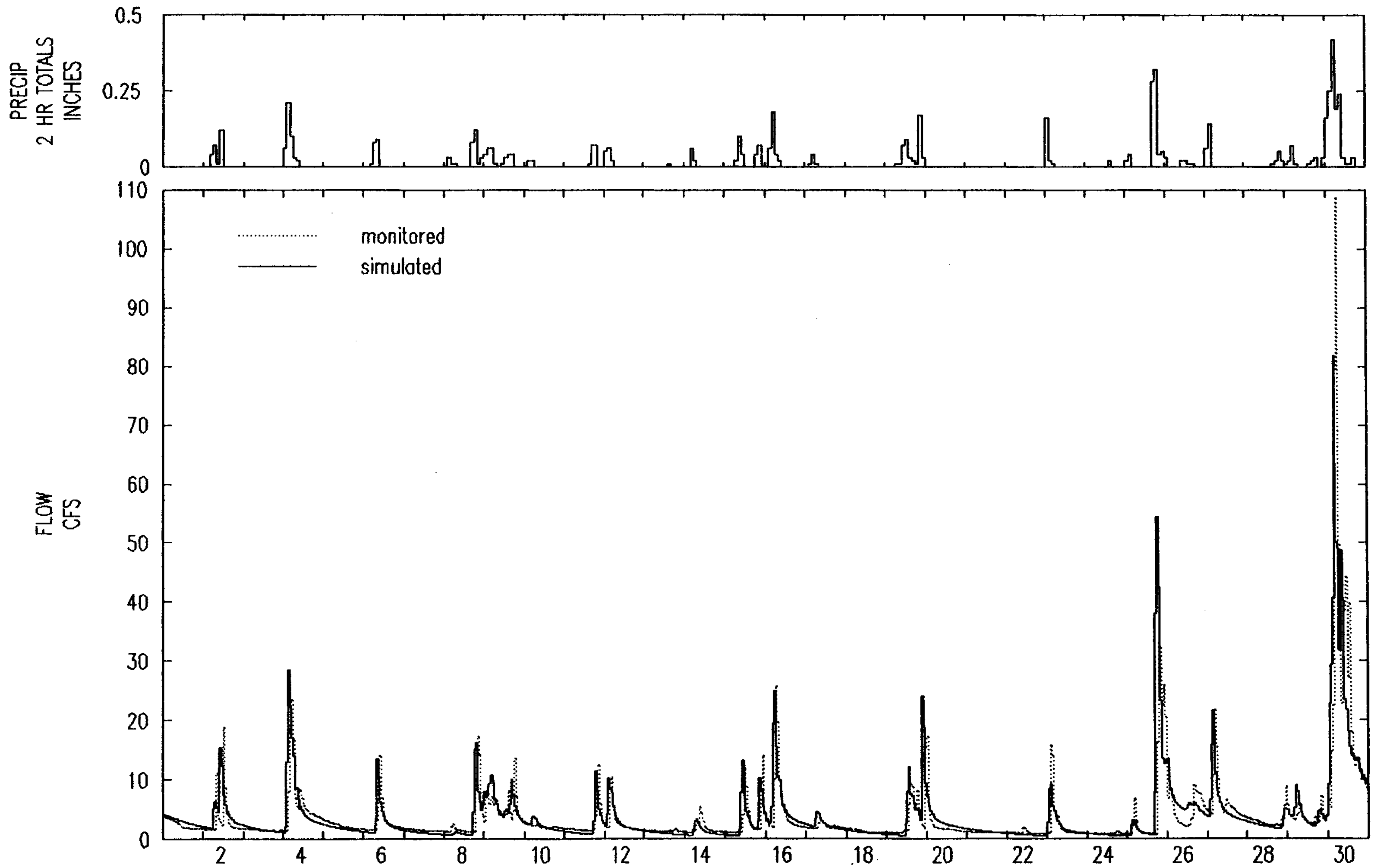
DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW



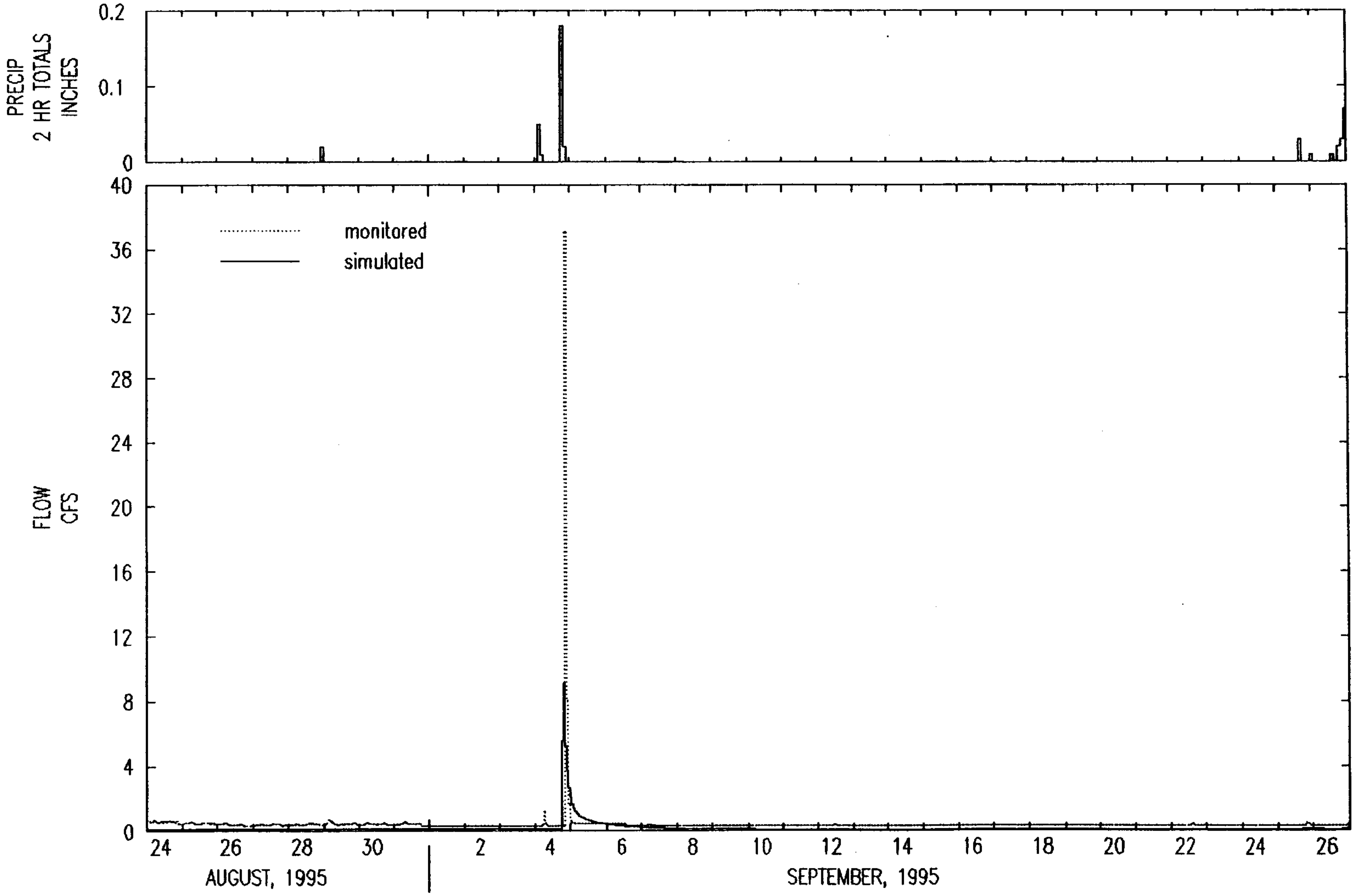
DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW



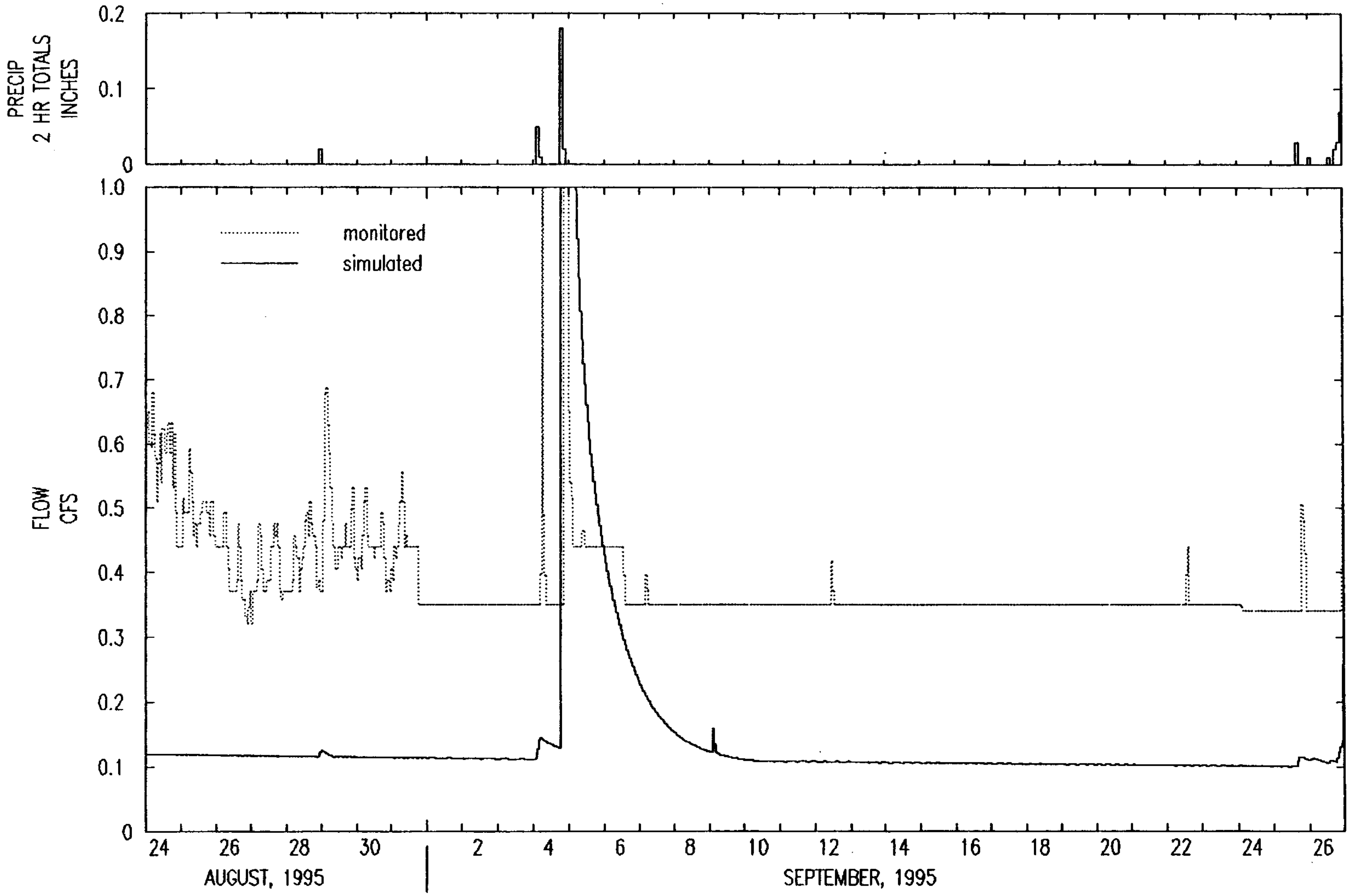
DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW



NOVEMBER, 1994
TIME, IN DAYS
DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW



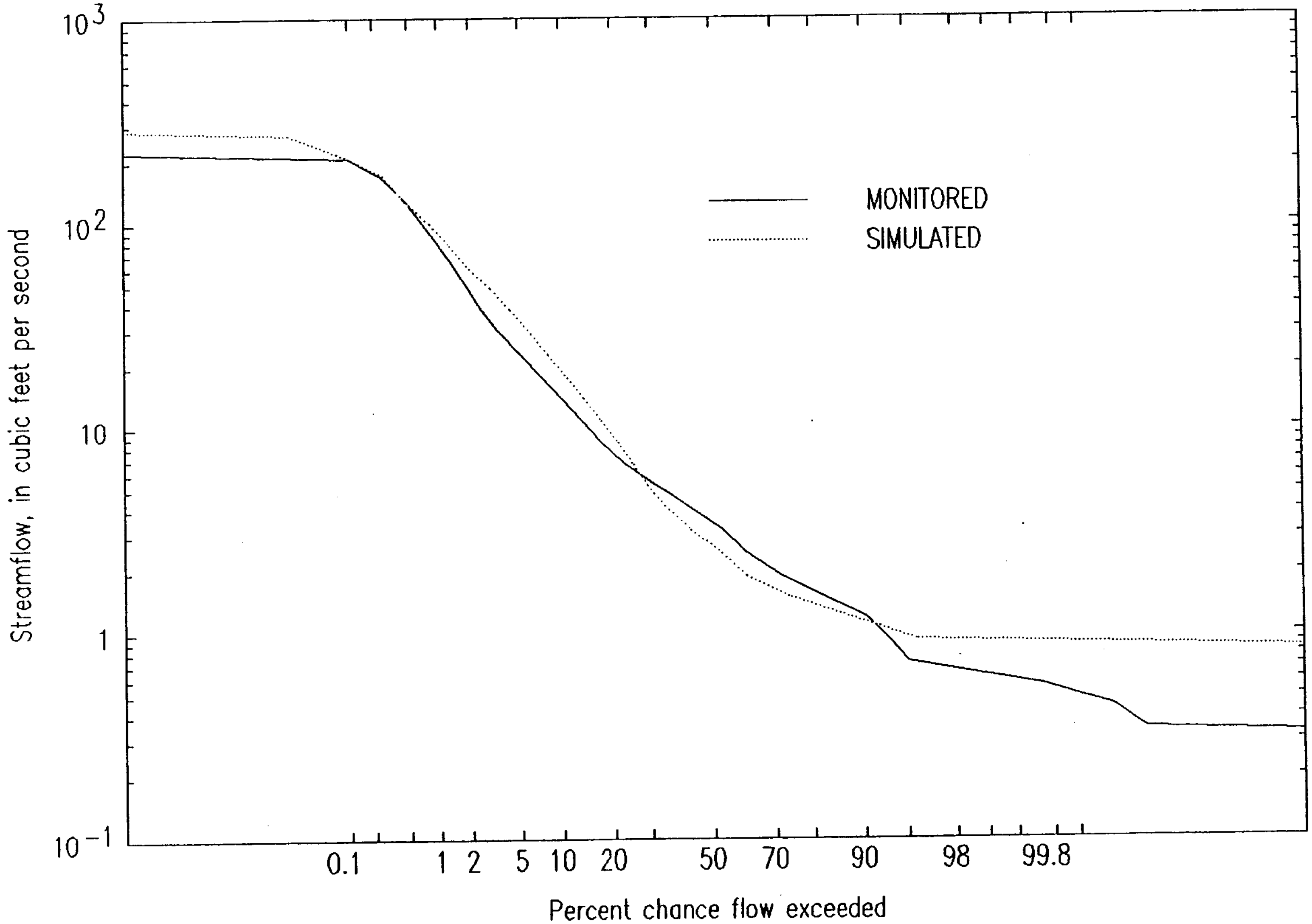
DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW



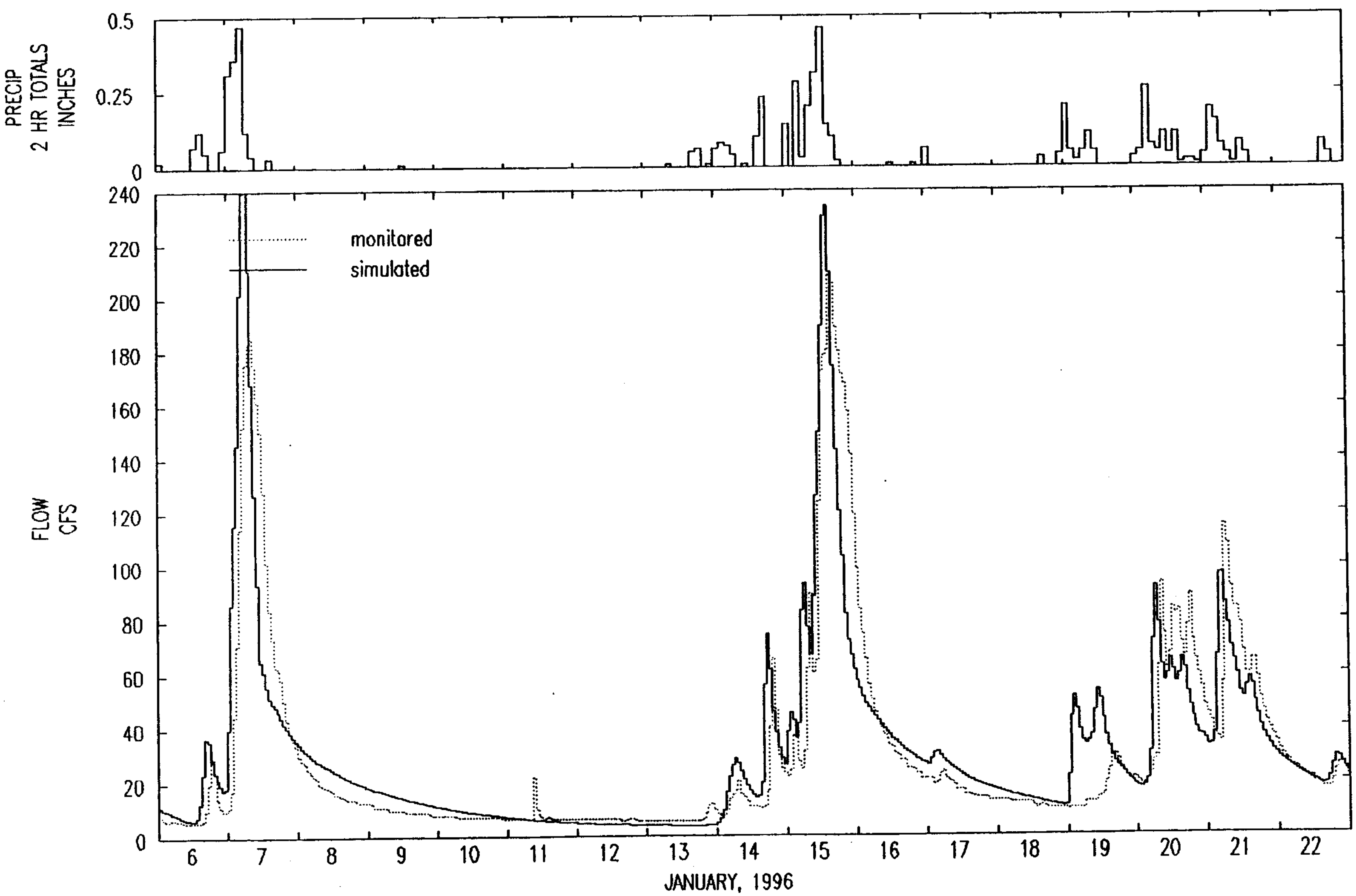
TIME, IN DAYS

DES MOINES CREEK
CALIBRATION PLOT
TYEE POND INFLOW

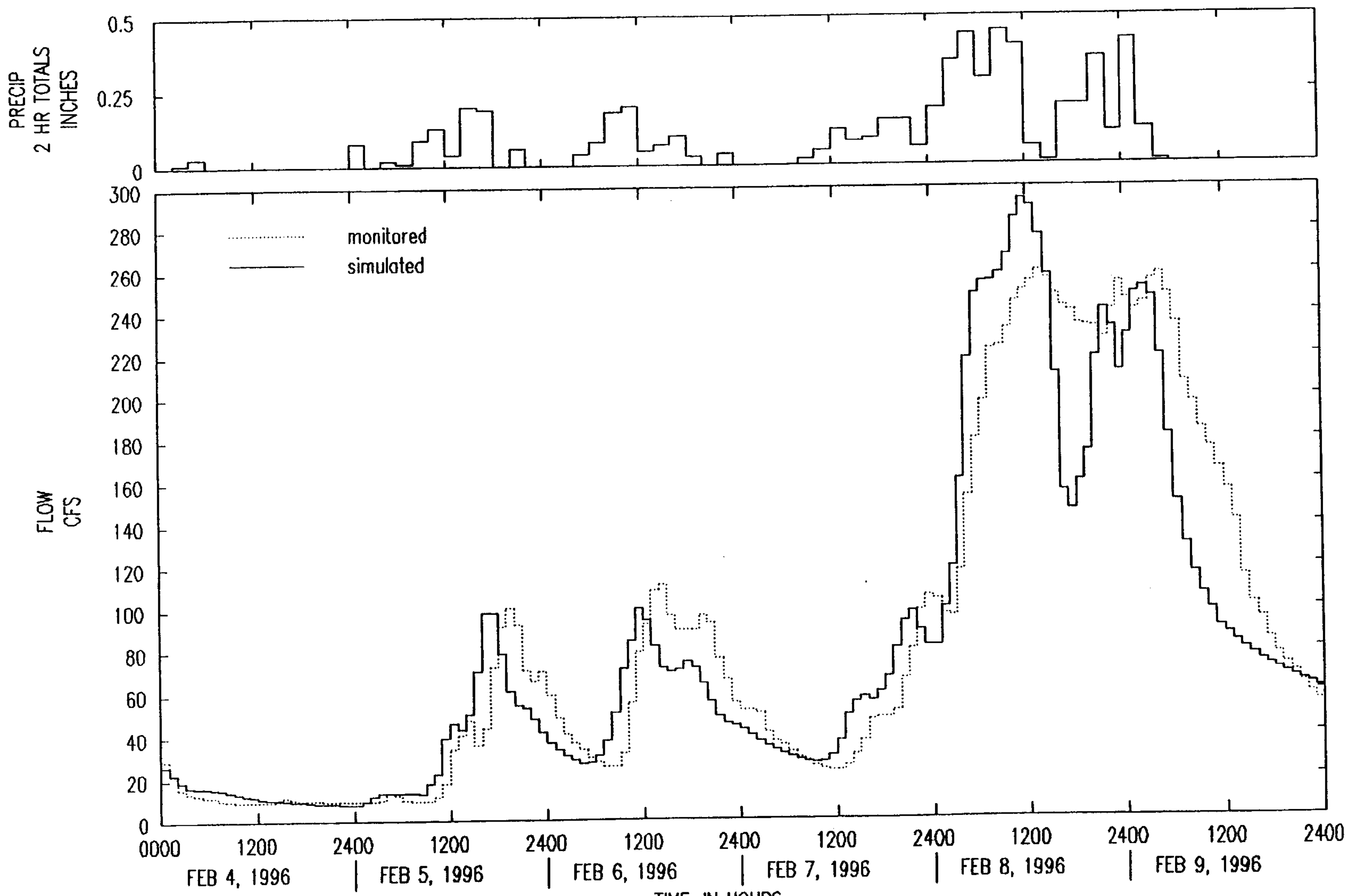
U.S. GEOLOGICAL SURVEY
PARAMETER VALUE HYDROGRAPHS



USGS VS MONITORED VALUES NEAR MOUTH

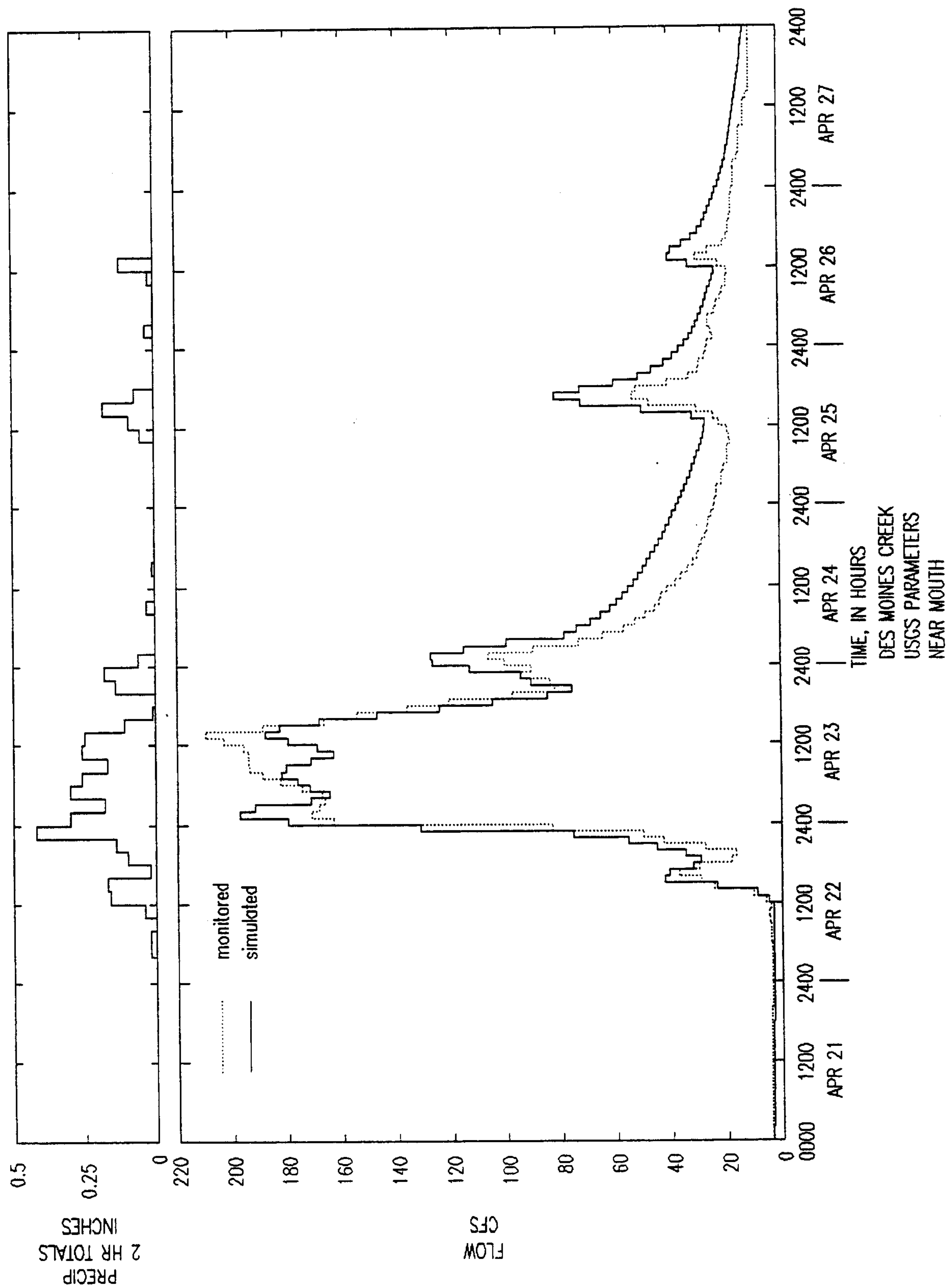


DES MOINES CREEK
USGS PARAMETERS
NEAR MOUTH

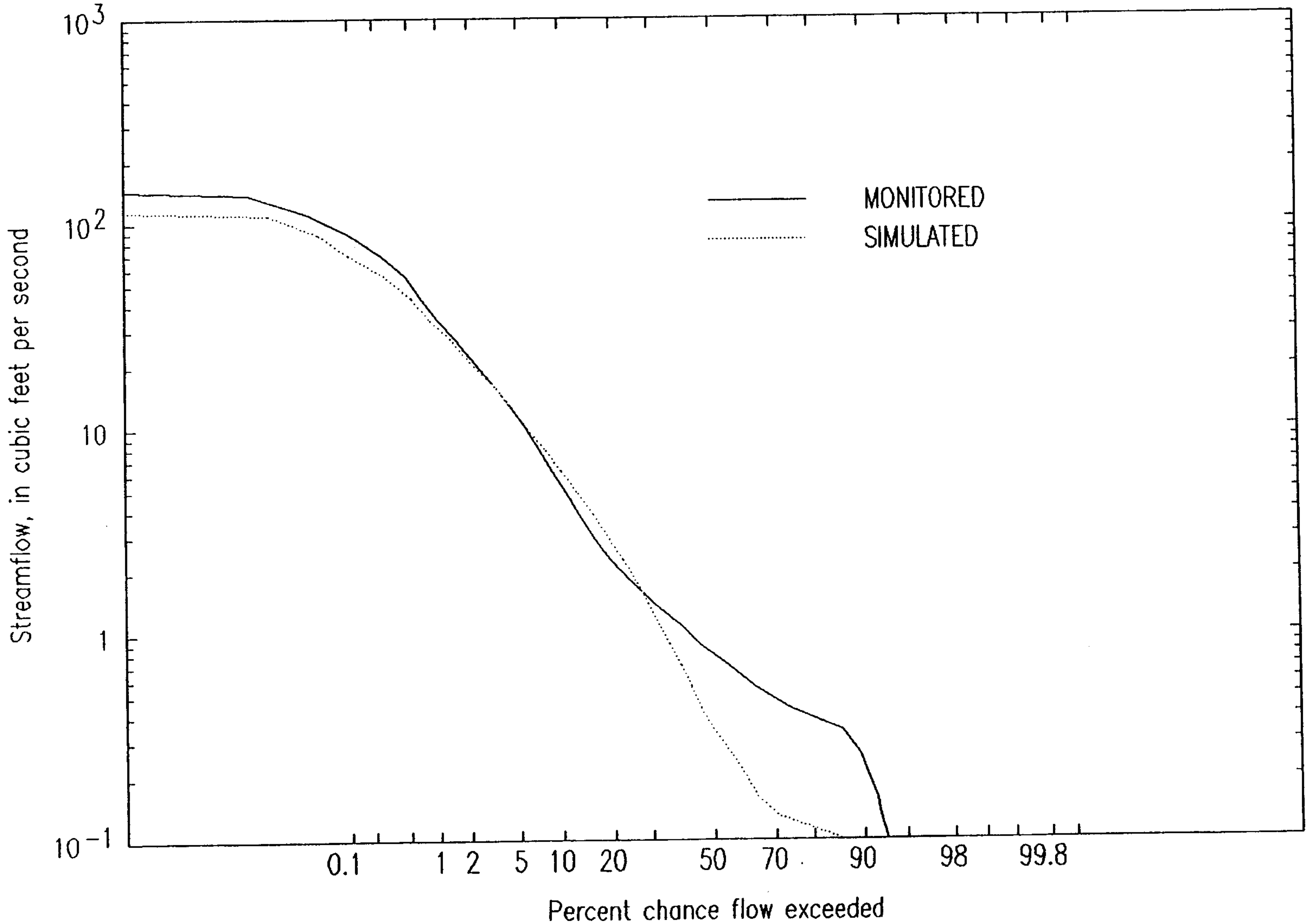


DES MOINES CREEK
USGS PARAMETERS
NEAR MOUTH

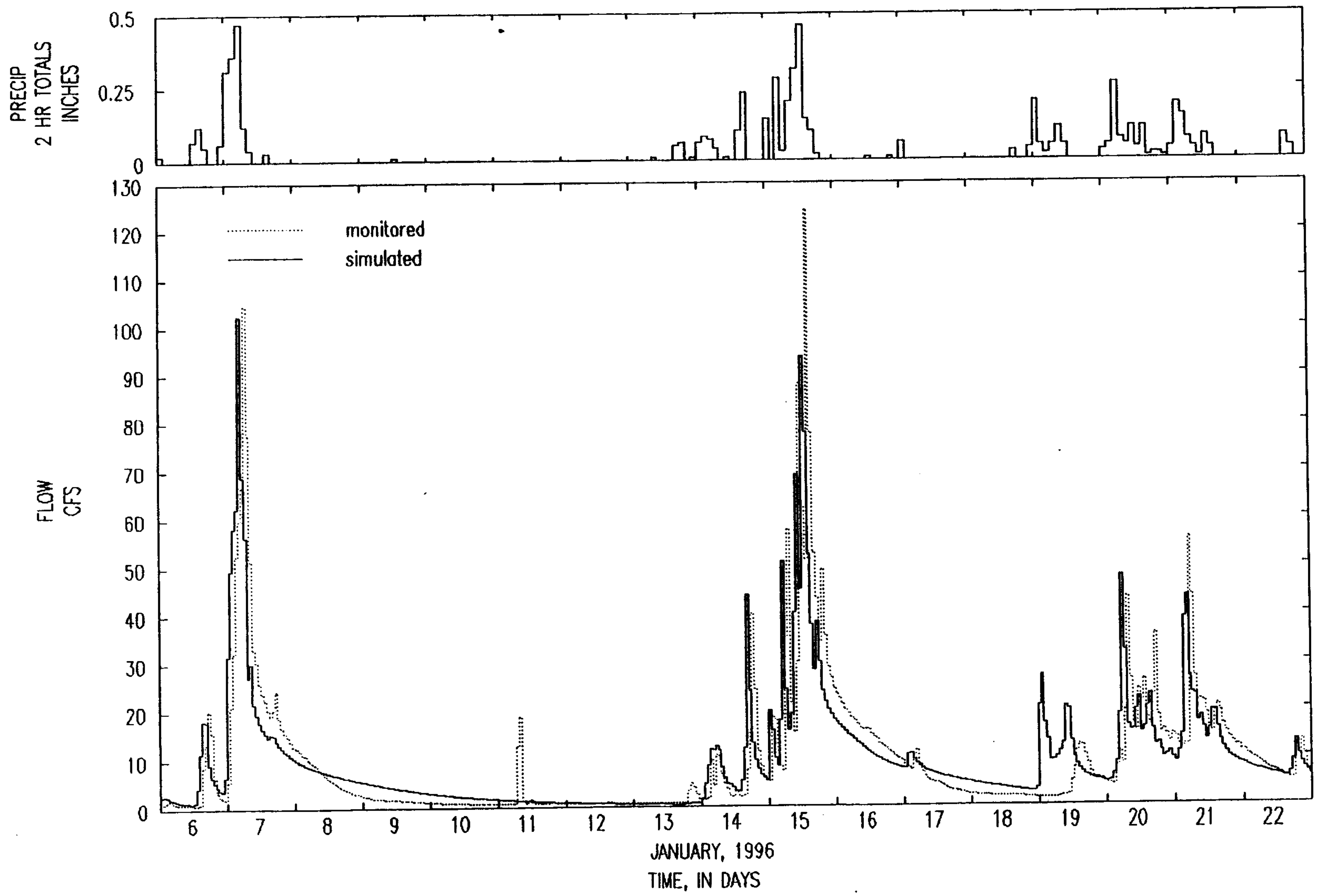
AR 010907


PRECIP
2 HR TOTALS
INCHES
FLOW
CFS
monitored
simulated
TIME, IN HOURS
DES MOINES CREEK
USGS PARAMETERS
NEAR MOUTH
APR 21
APR 22
APR 23
APR 24
APR 25
APR 26
APR 27

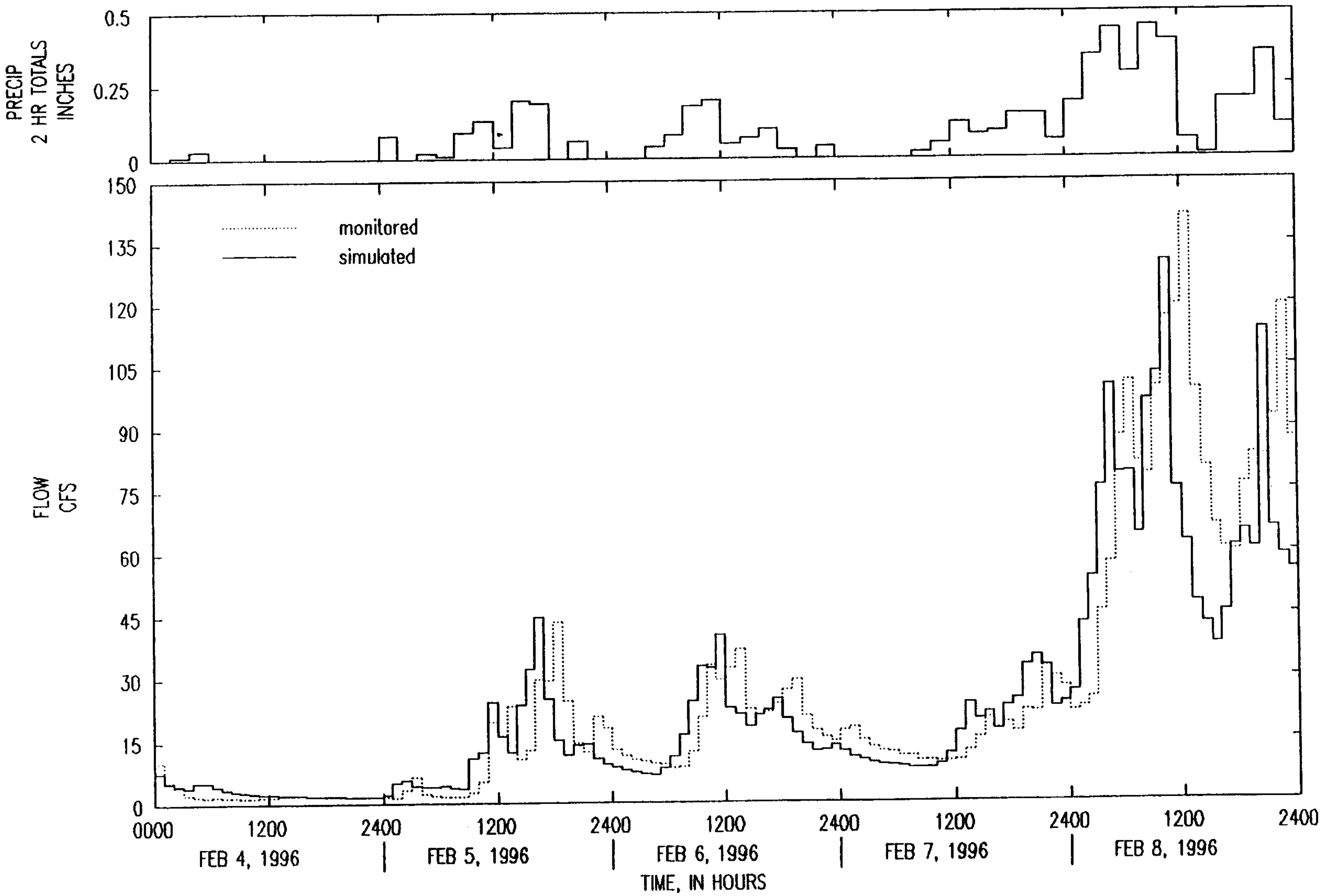
AR 010908



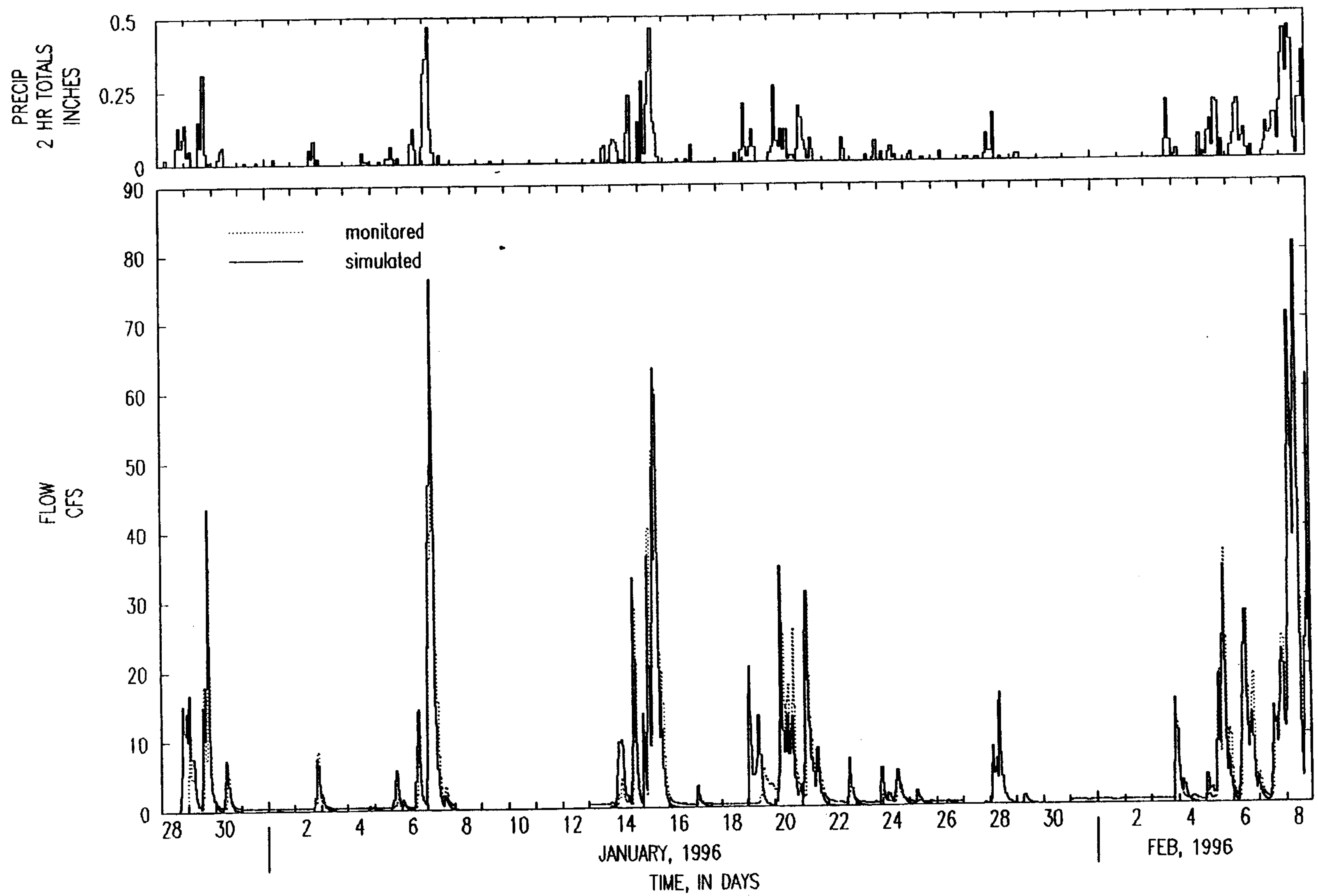
USGS VS MONITORED VALUES AT TYEE POND INFLOW



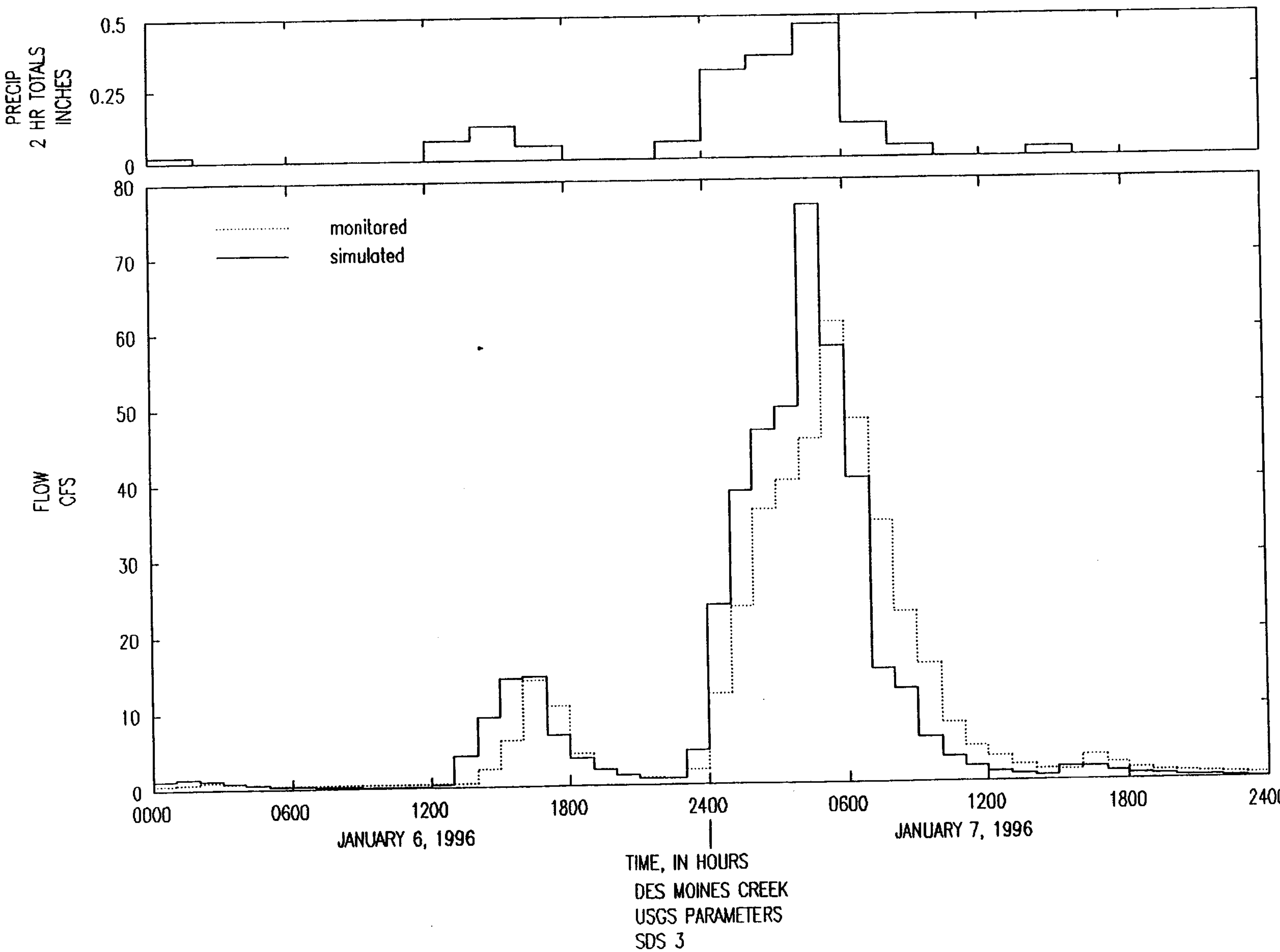
DES MOINES CREEK
USGS PARAMETERS
TYEE POND INFLOW



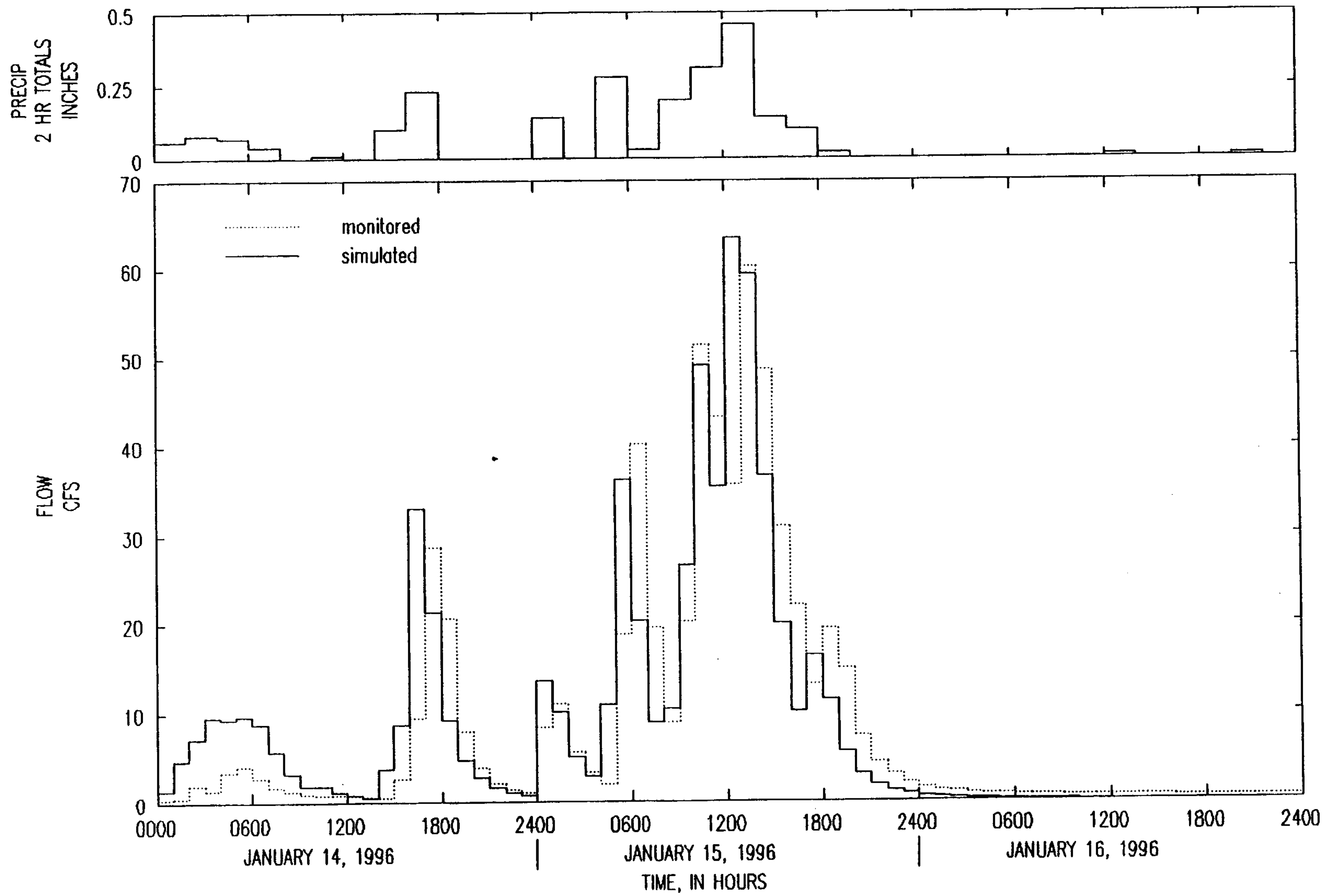
DES MOINES CREEK
USGS PARAMETERS
TYEE POND INFLOW



DES MOINES CREEK
USGS PARAMETERS
SDS 3

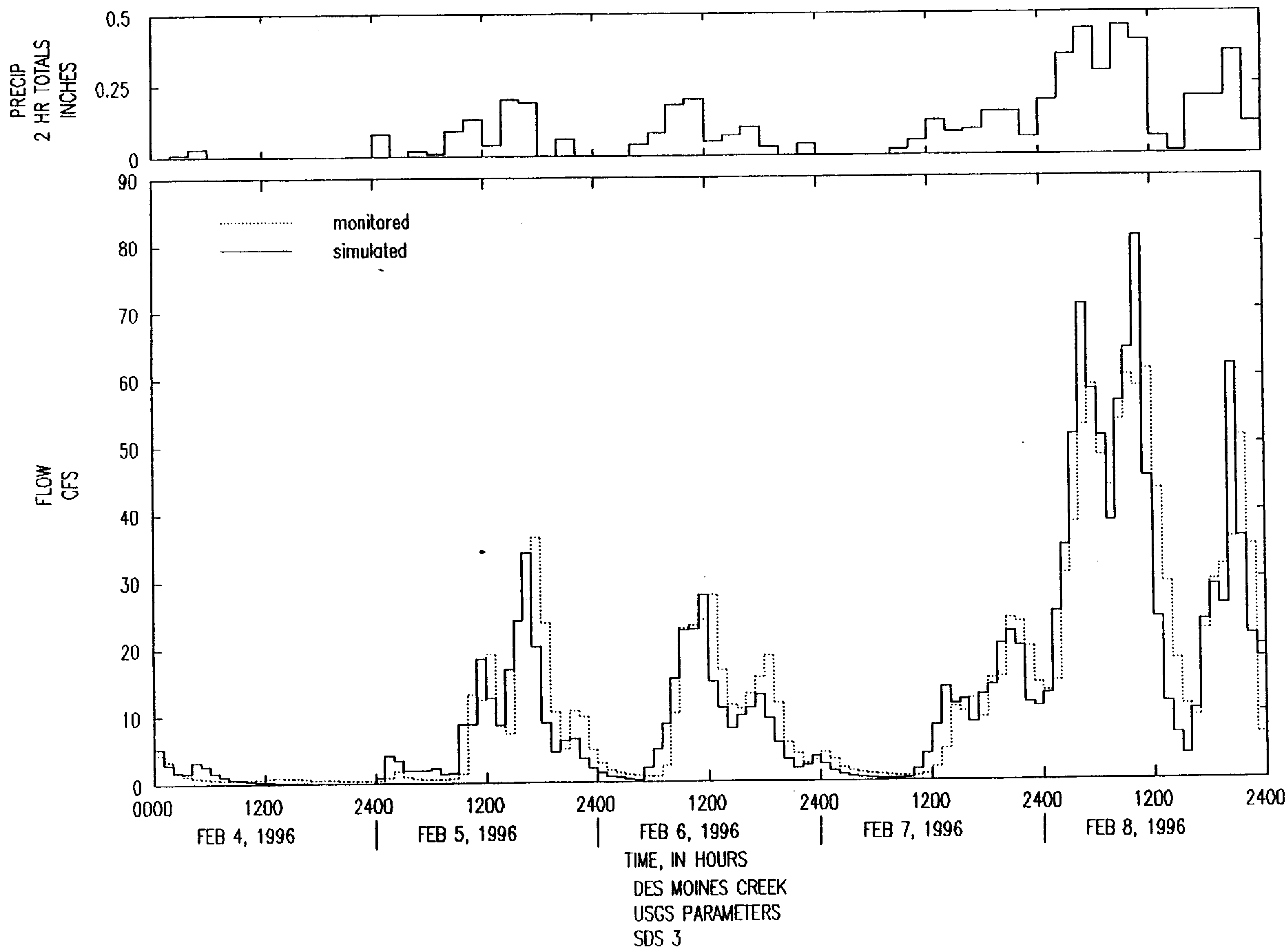


PRECIP
2 HR TOTALS
INCHES
0.5
0.25
0
FLOW
CFS
80
70
60
50
40
30
20
10
0
monitored
simulated
0000
0600
1200
1800
2400
0600
1200
1800
2400
JANUARY 6, 1996
JANUARY 7, 1996
TIME, IN HOURS
DES MOINES CREEK
USGS PARAMETERS
SDS 3



DES MOINES CREEK
USGS PARAMETERS
SDS 3

AR 010914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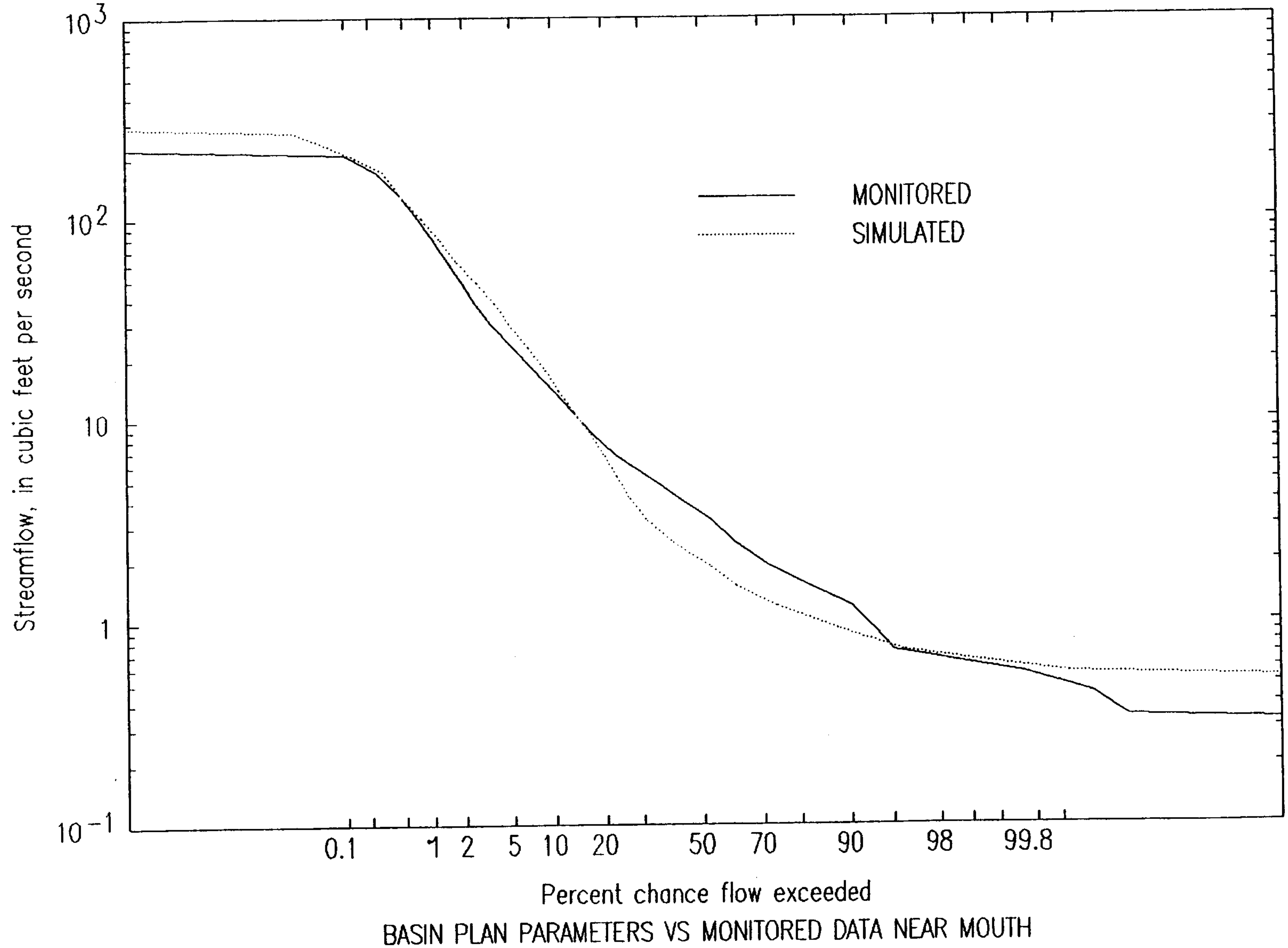
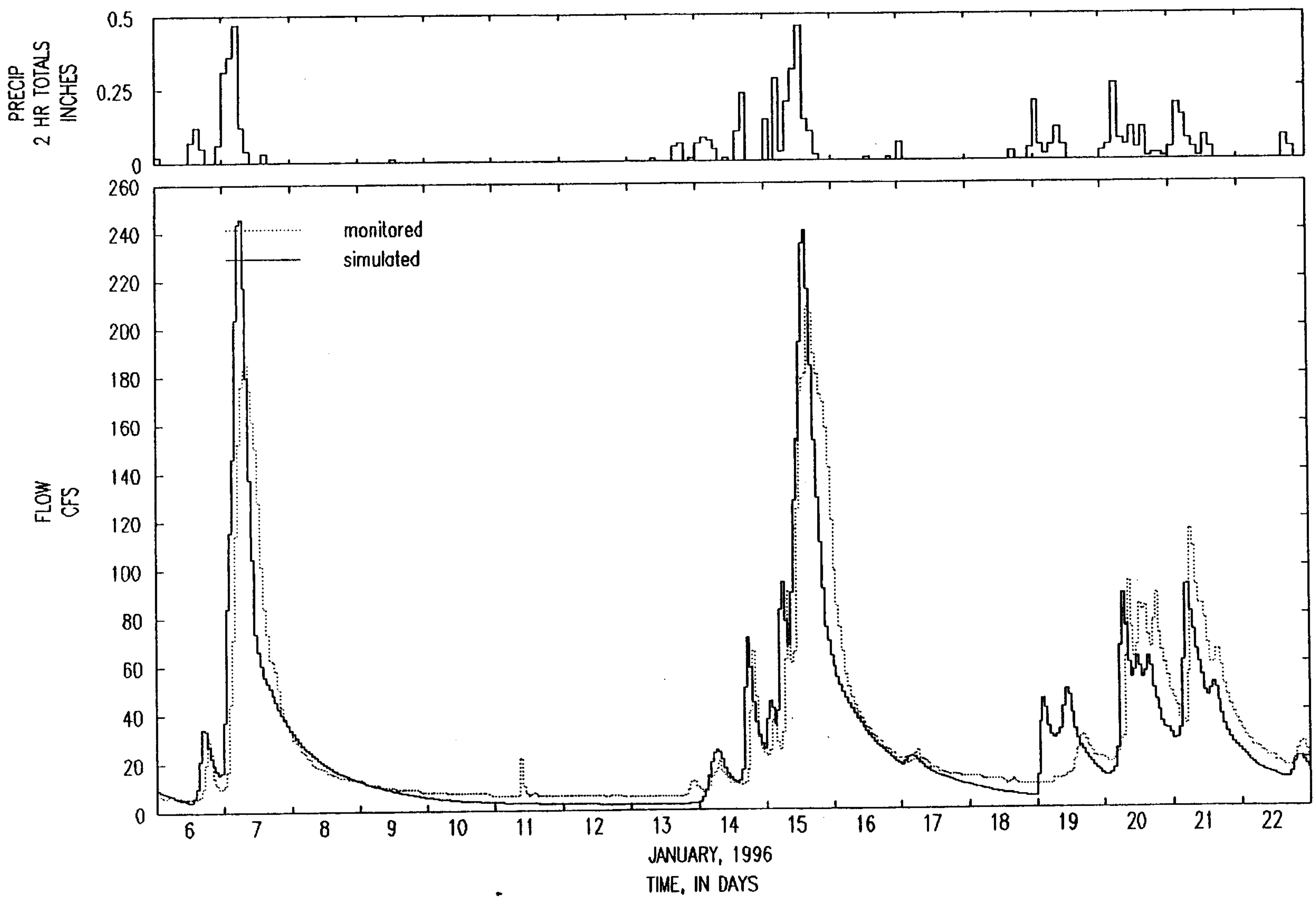
2 HR TOTALS
INCHES
0.5
0.25
0
FLOW
CFS
90
80
70
60
50
40
30
20
10
0
monitored
simulated
0000
1200
2400
1200
2400
1200
2400
1200
2400
1200
2400
FEB 4, 1996
FEB 5, 1996
FEB 6, 1996
FEB 7, 1996
FEB 8, 1996
TIME, IN HOURS
DES MOINES CREEK
USGS PARAMETERS
SDS 3

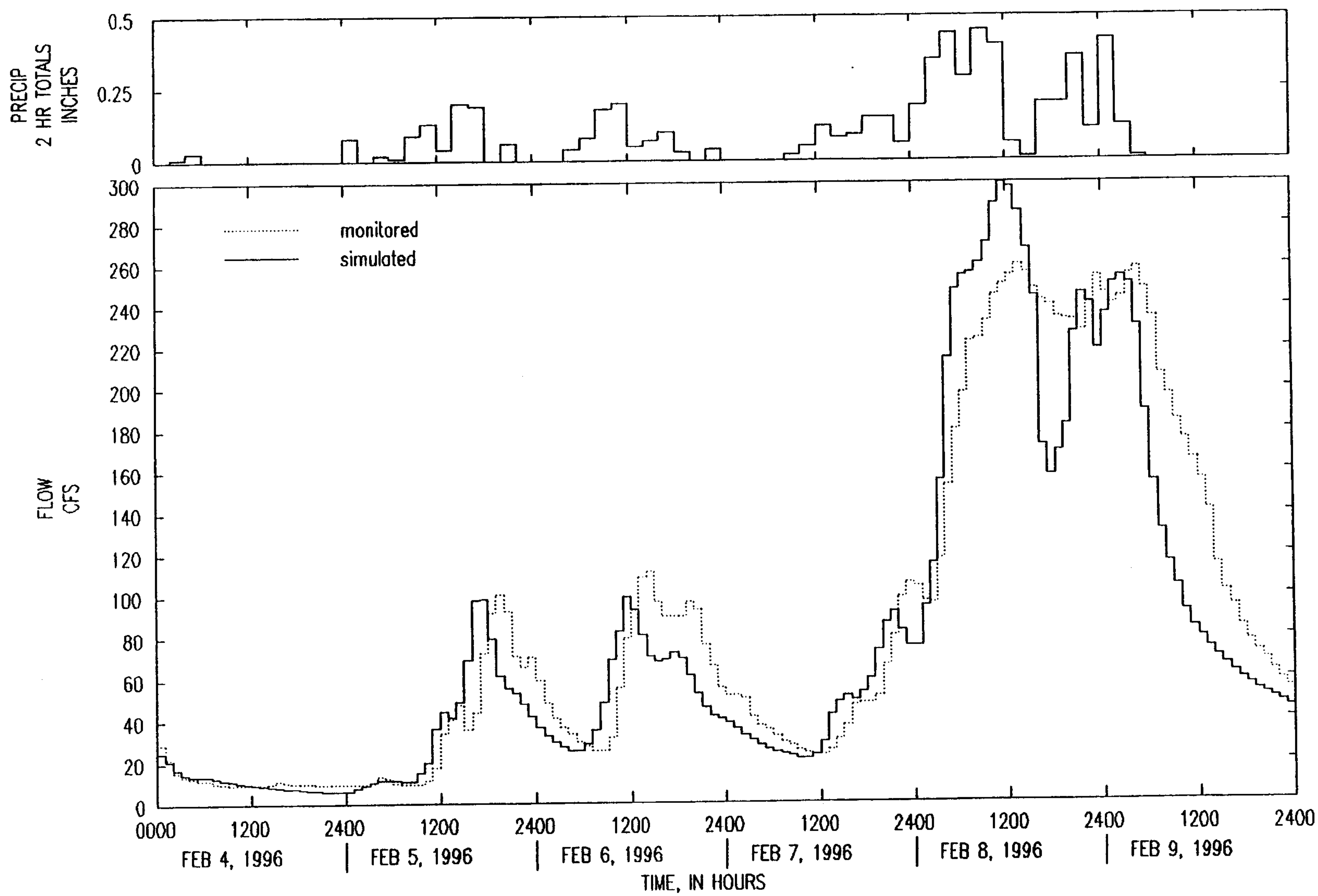
DES MOINES CREEK BASIN PLAN
PARAMETER VALUE HYDROGRAPHS



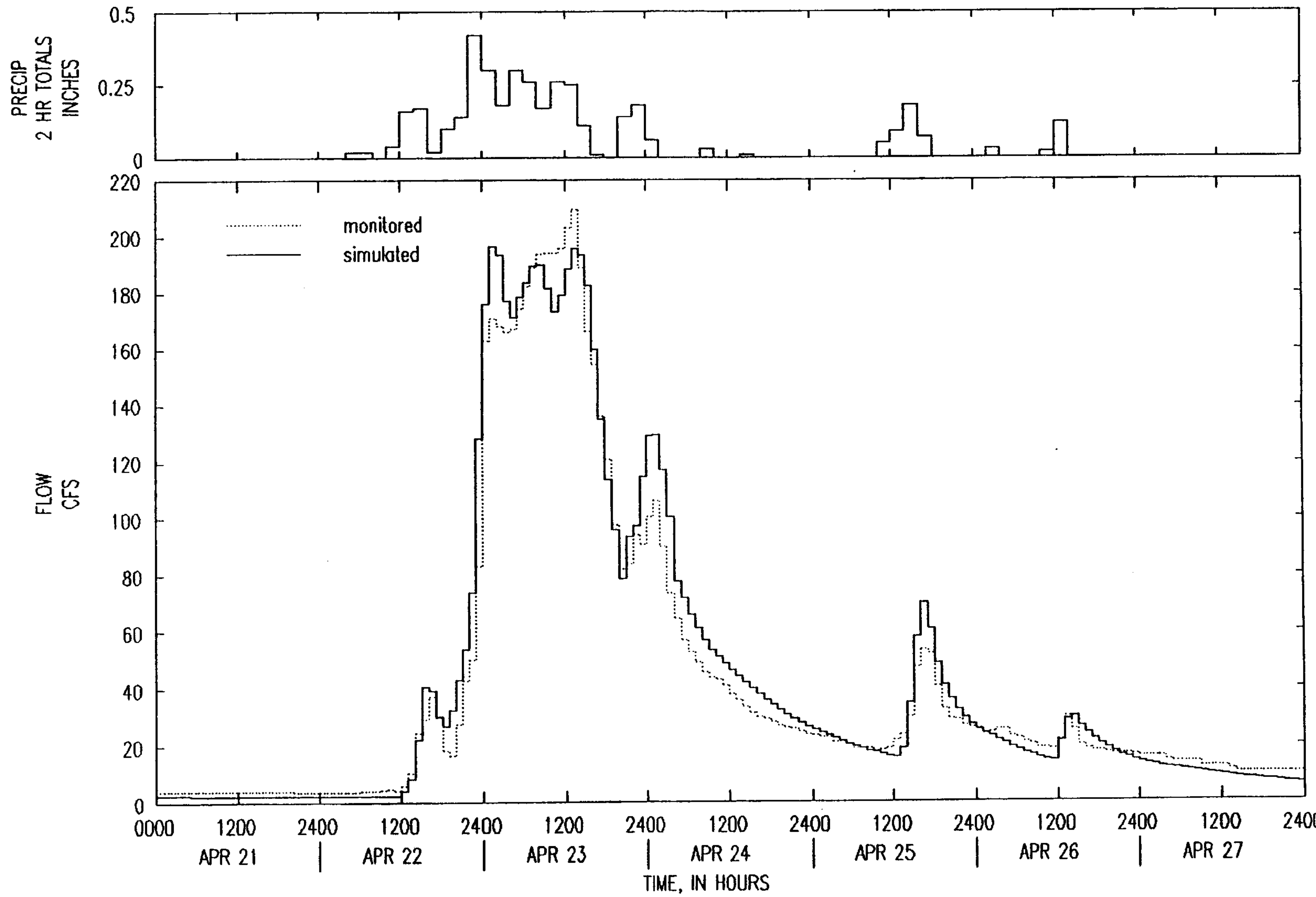
Streamflow, in cubic feet per second
10^3
10^2
10
1
10^{-1}
0.1
1
2
5
10
20
50
70
90
98
99.8
MONITORED
SIMULATED
Percent chance flow exceeded
BASIN PLAN PARAMETERS VS MONITORED DATA NEAR MOUTH



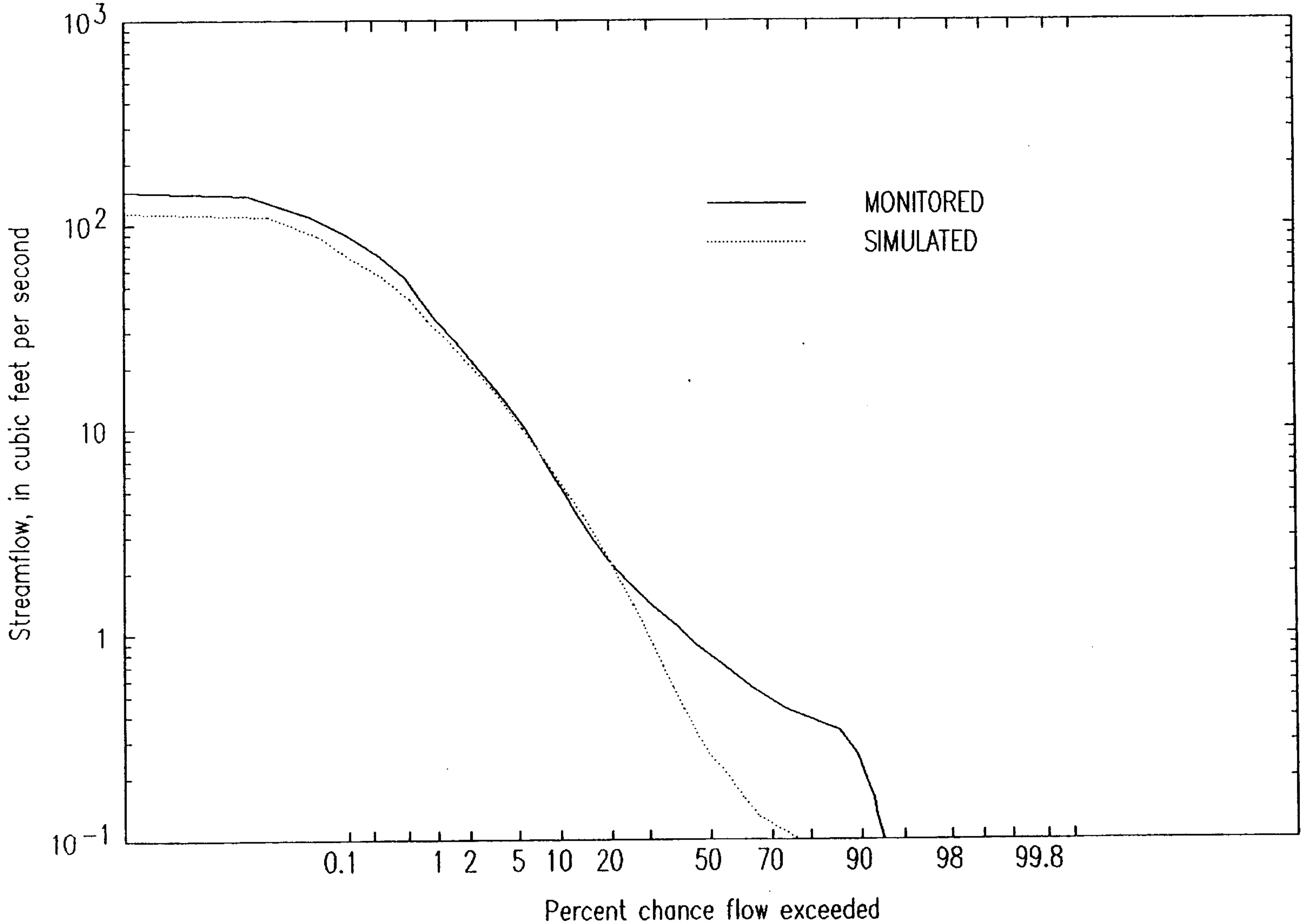
DES MOINES CREEK
BASIN PLAN PARAMETERS
NEAR MOUTH



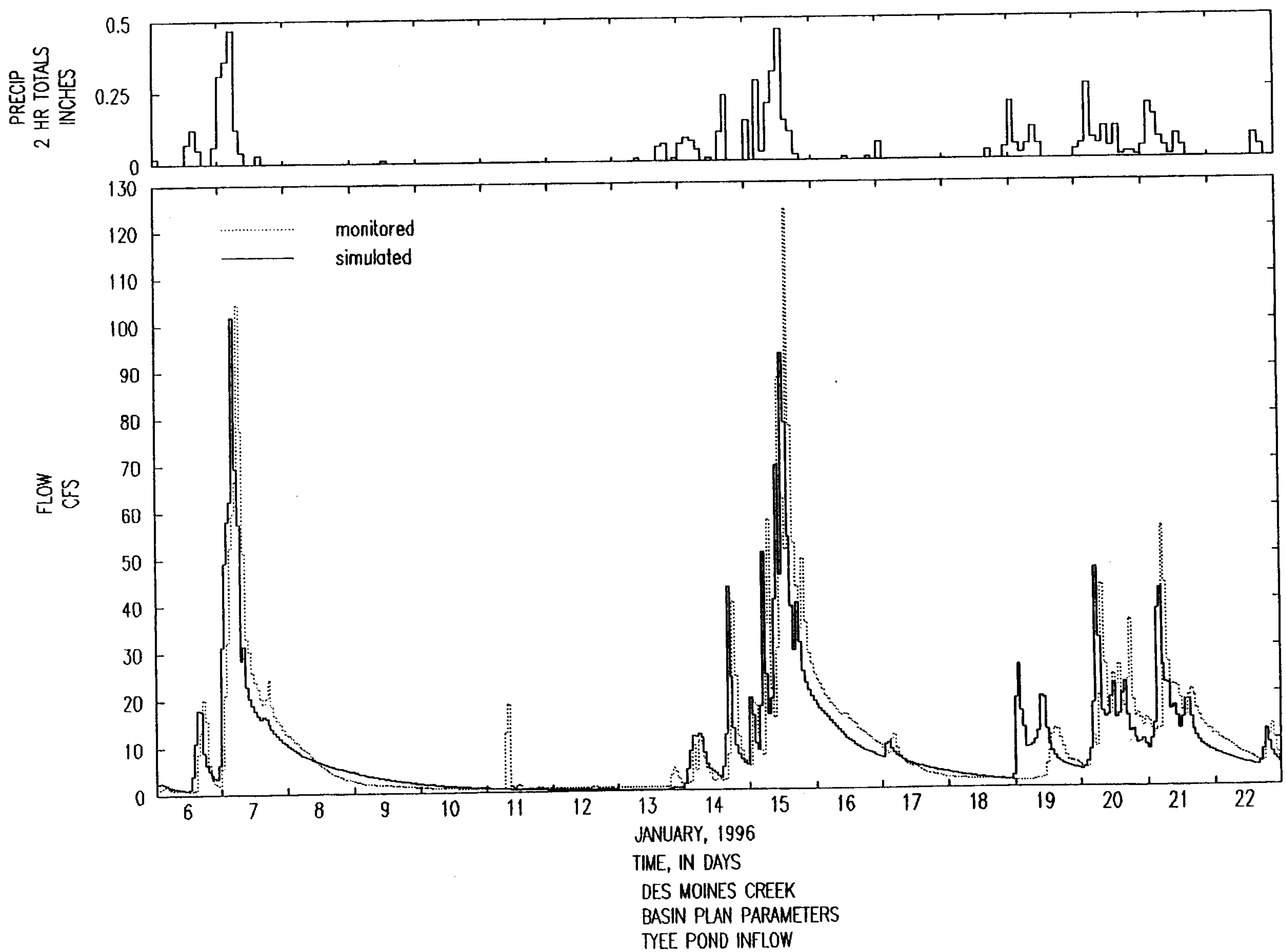
DES MOINES CREEK
BASIN PLAN PARAMETERS
NEAR MOUTH

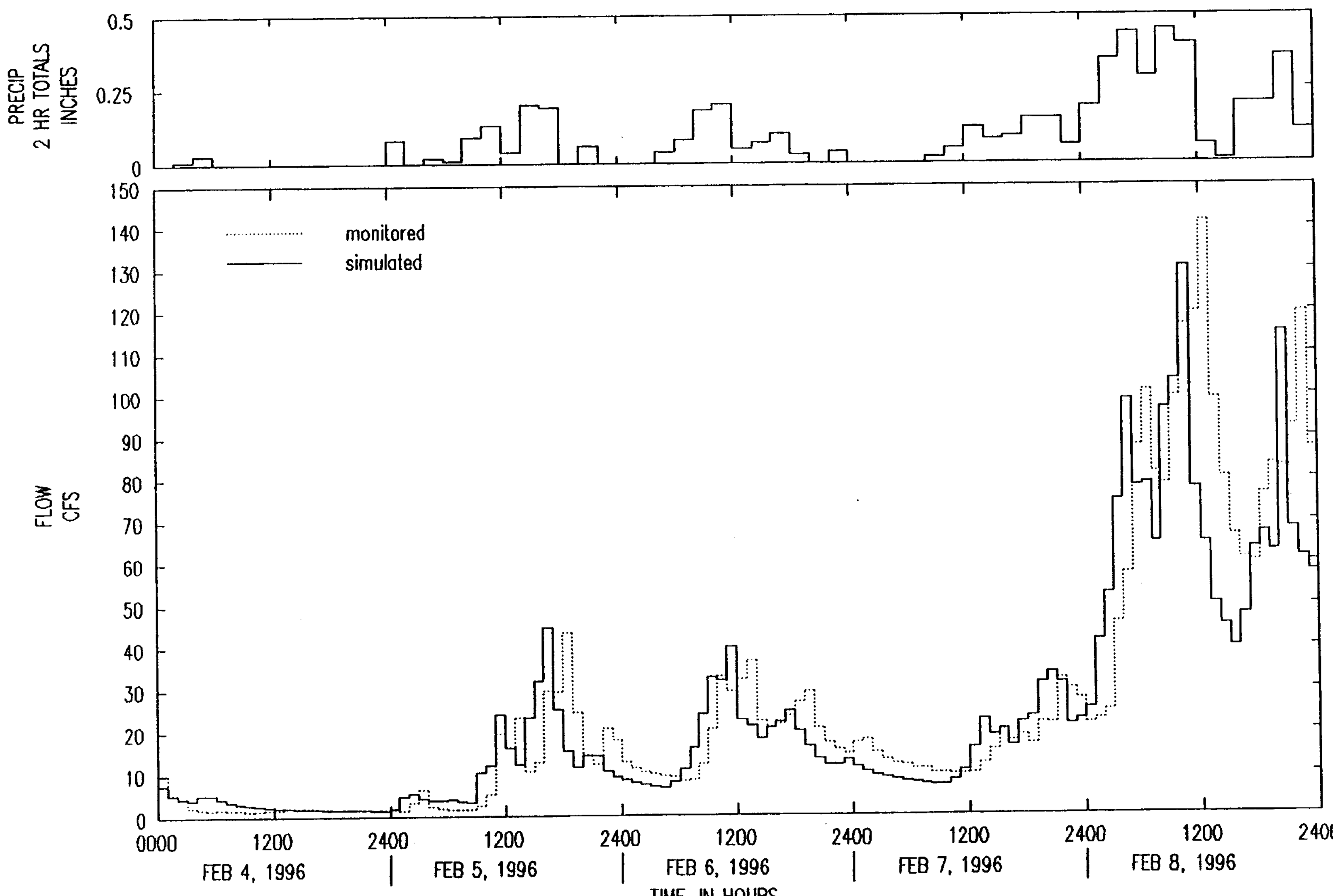


DES MOINES CREEK
BASIN PLAN PARAMETERS
NEAR MOUTH

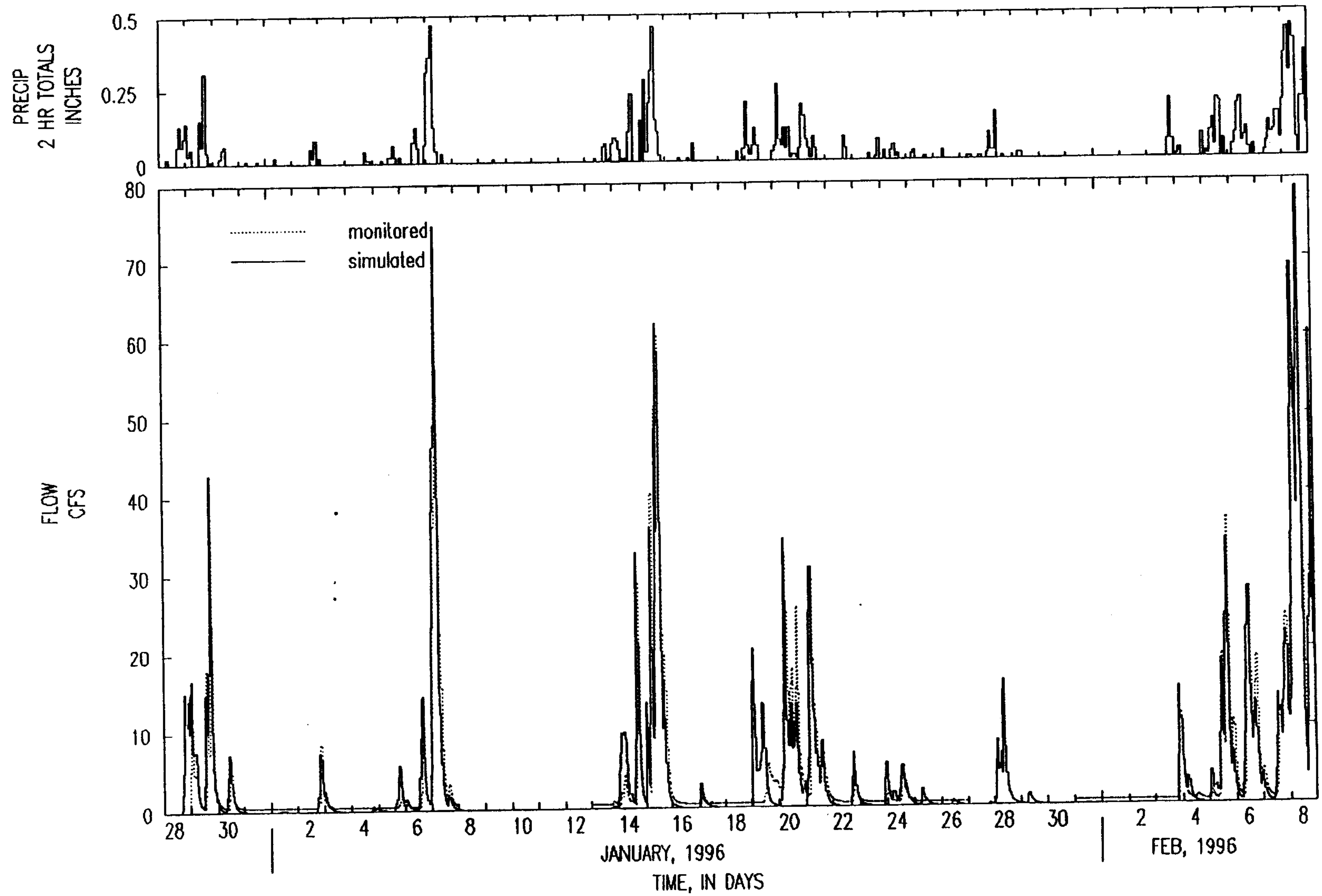


BASIN PLAN PARAMETERS VS MONITORED VALUES AT TYEE POND INFLOW

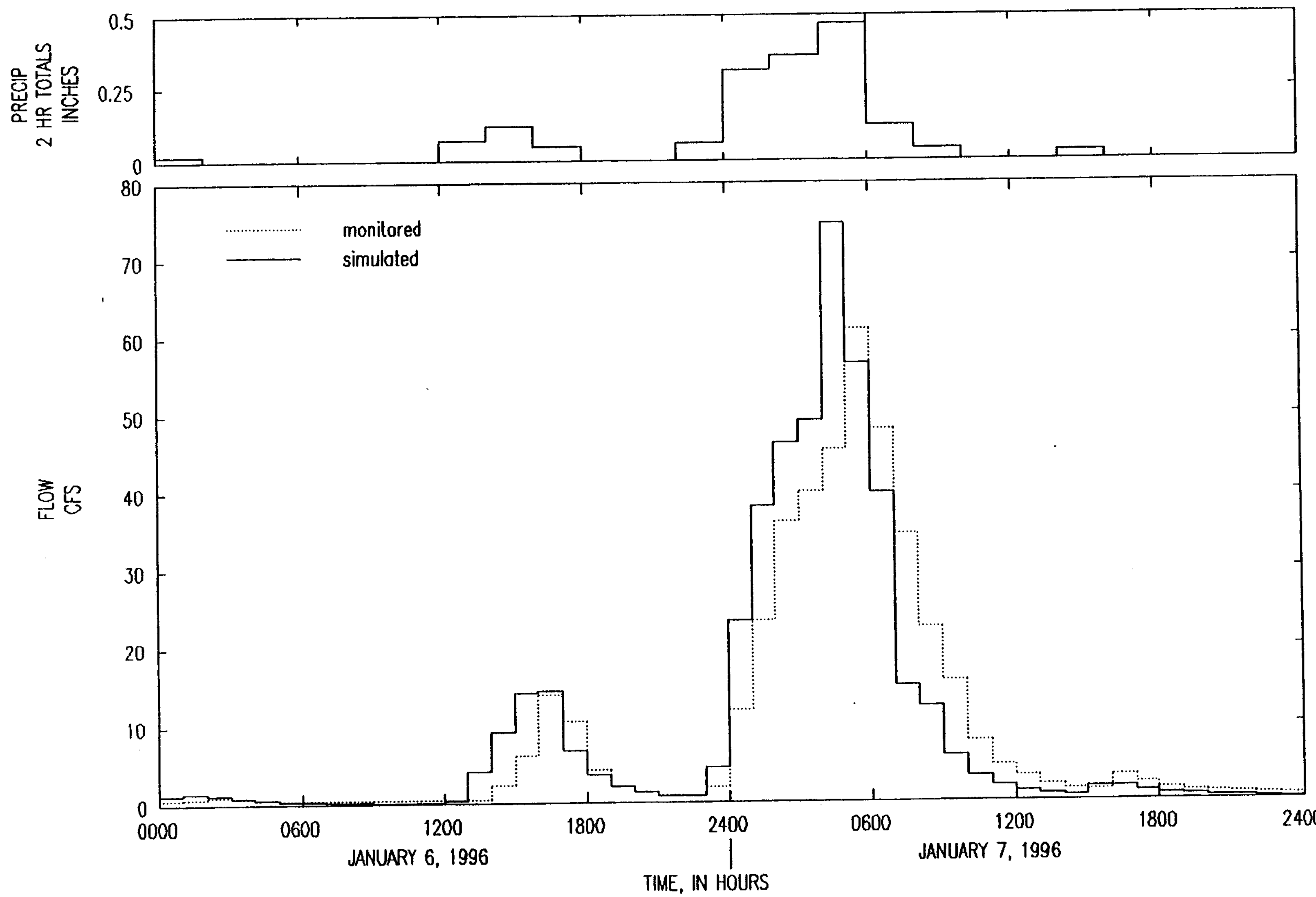

PRECIP
2 HR TOTALS
INCHES
0.5
0.25
0
FLOW
CFS
130
120
110
100
90
80
70
60
50
40
30
20
10
0
monitored
simulated
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
JANUARY, 1996
TIME, IN DAYS
DES MOINES CREEK
BASIN PLAN PARAMETERS
TYEE POND INFLOW



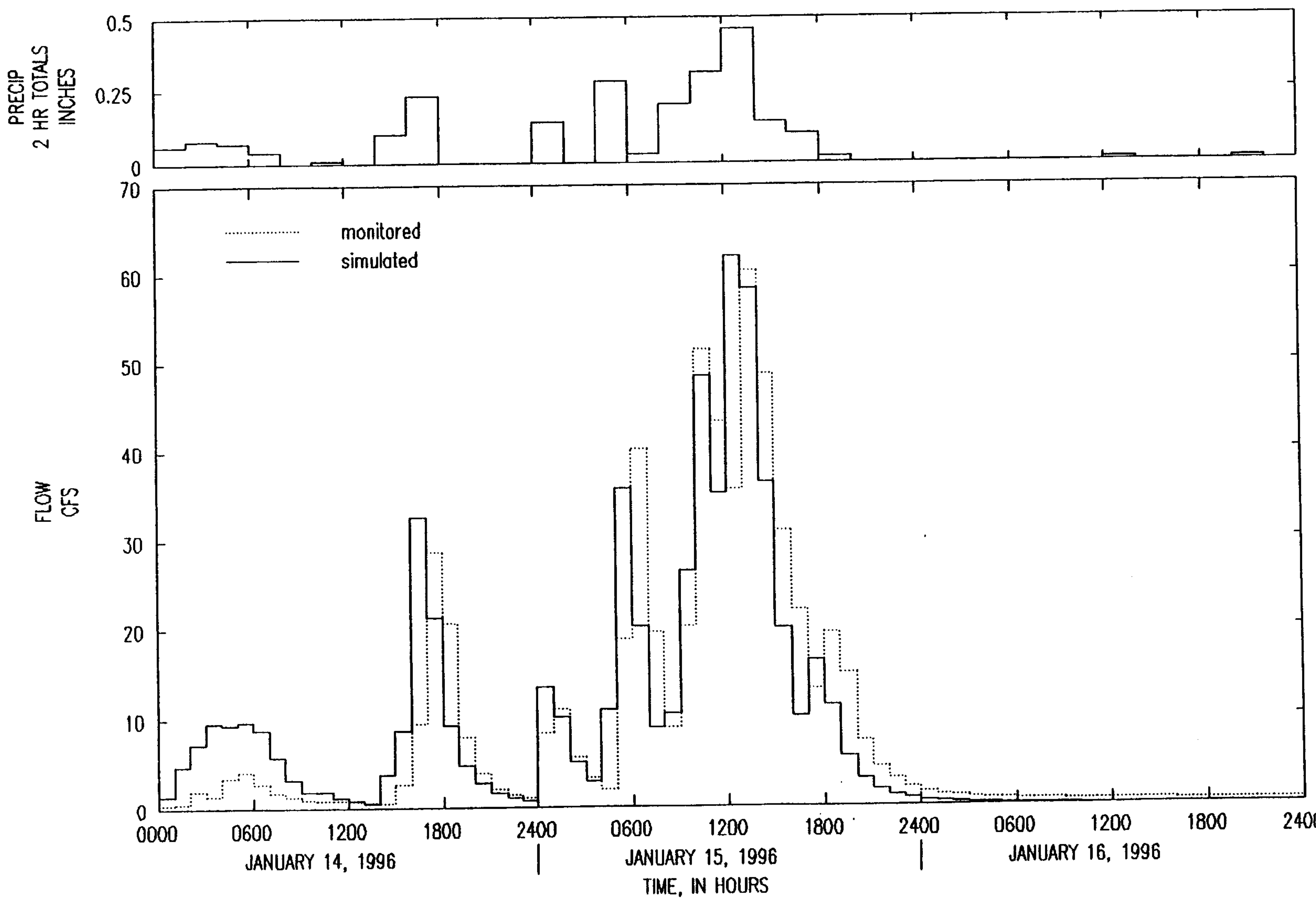
DES MOINES CREEK
BASIN PLAN PARAMETERS
TYEE POND INFLOW



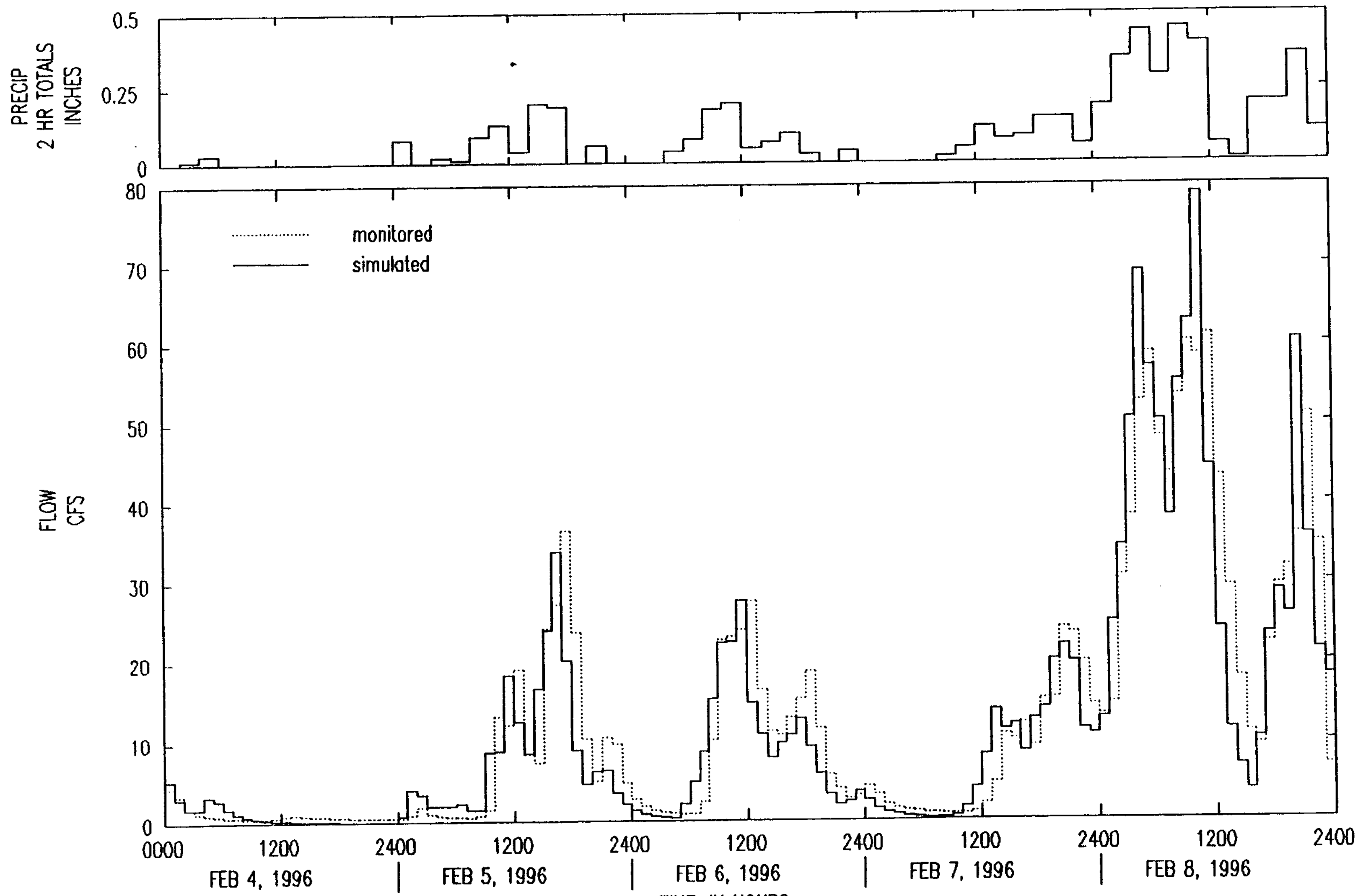
DES MOINES CREEK
BASIN PLAN PARAMETERS
SDS 3



DES MOINES CREEK
BASIN PLAN PARAMETERS
SDS 3

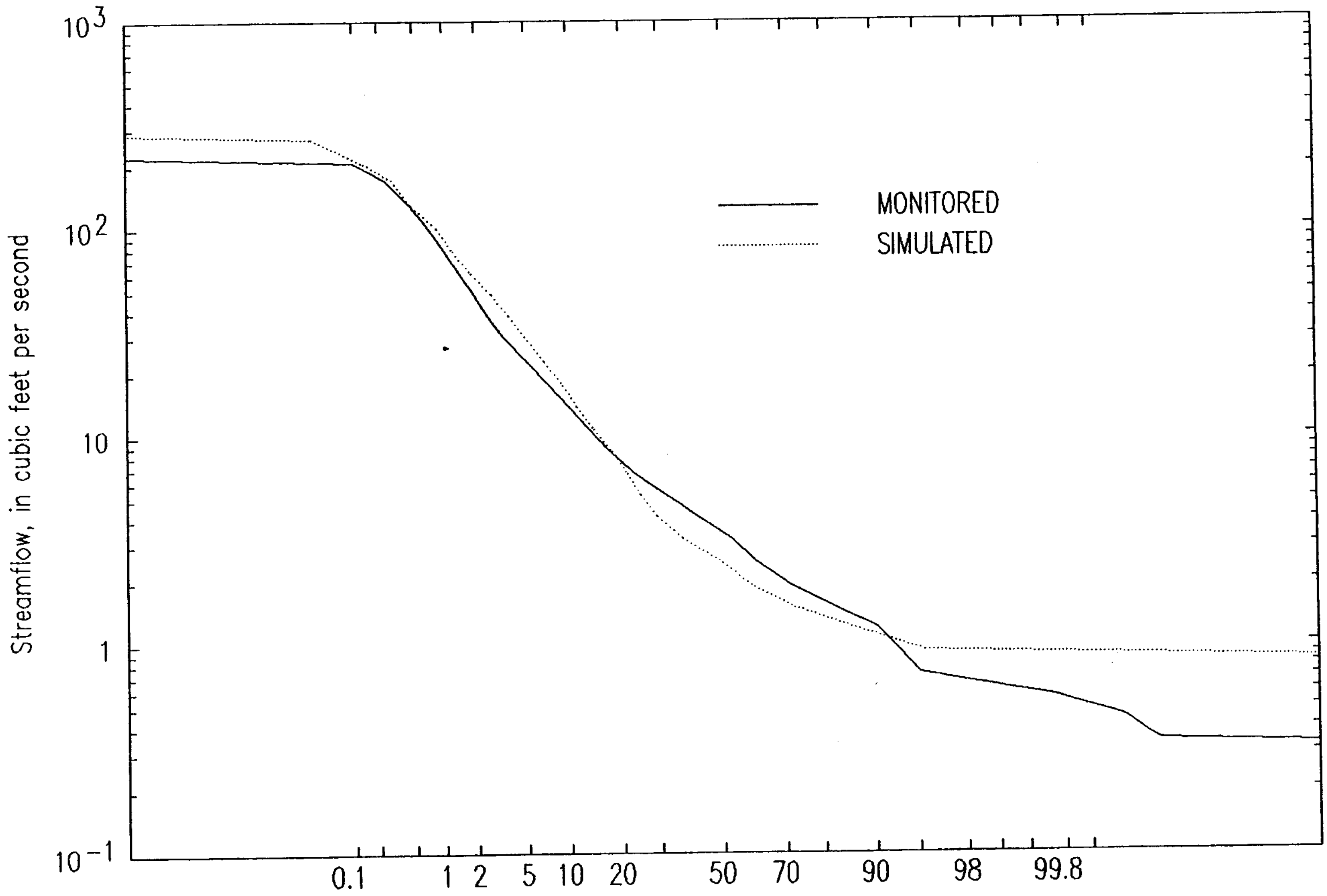


DES MOINES CREEK
BASIN PLAN PARAMETERS
SDS 3



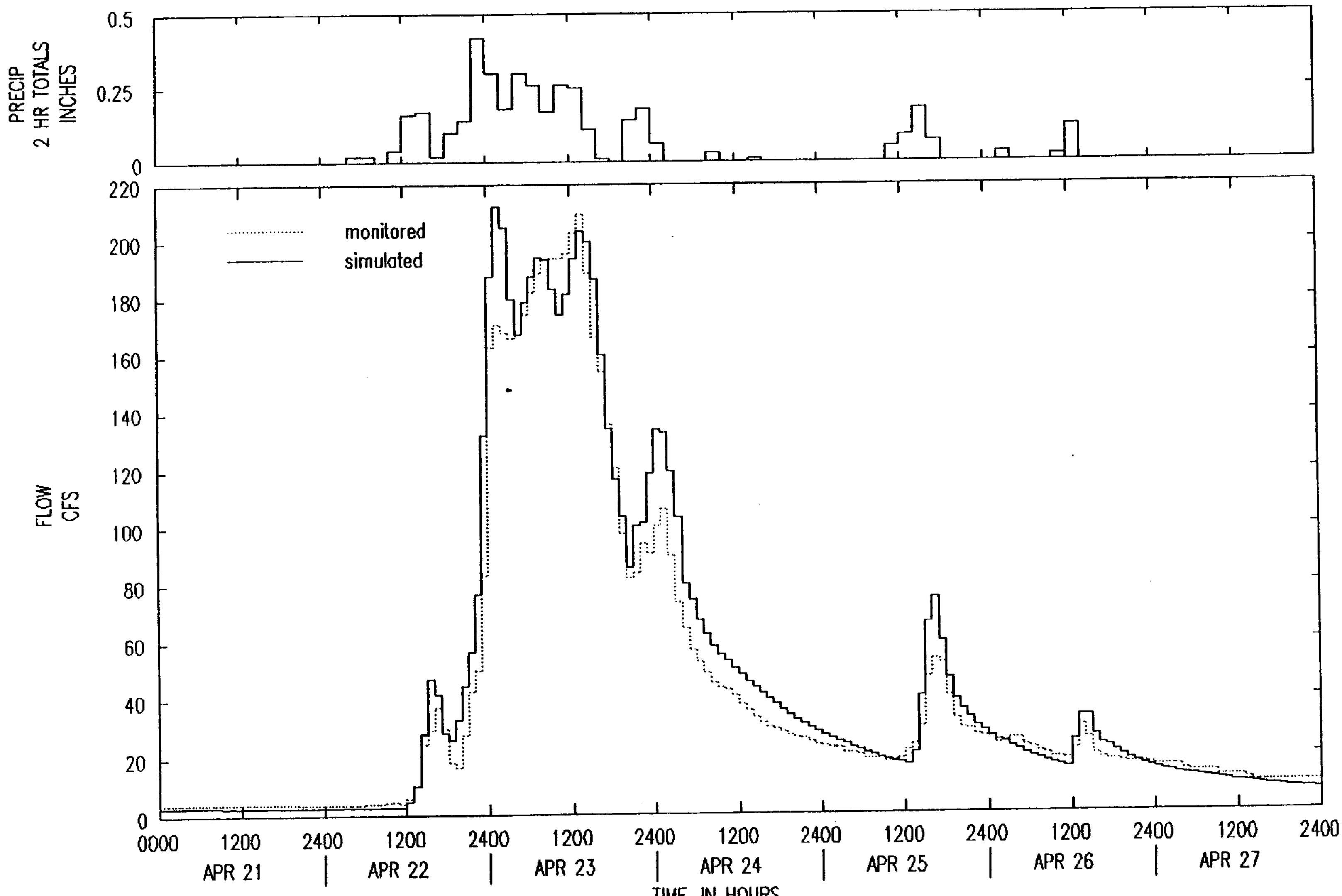
DES MOINES CREEK
BASIN PLAN PARAMETERS
SDS 3

NOVEMBER 1999 SMP
DES MOINES CREEK MODEL HYDROGRAPHS

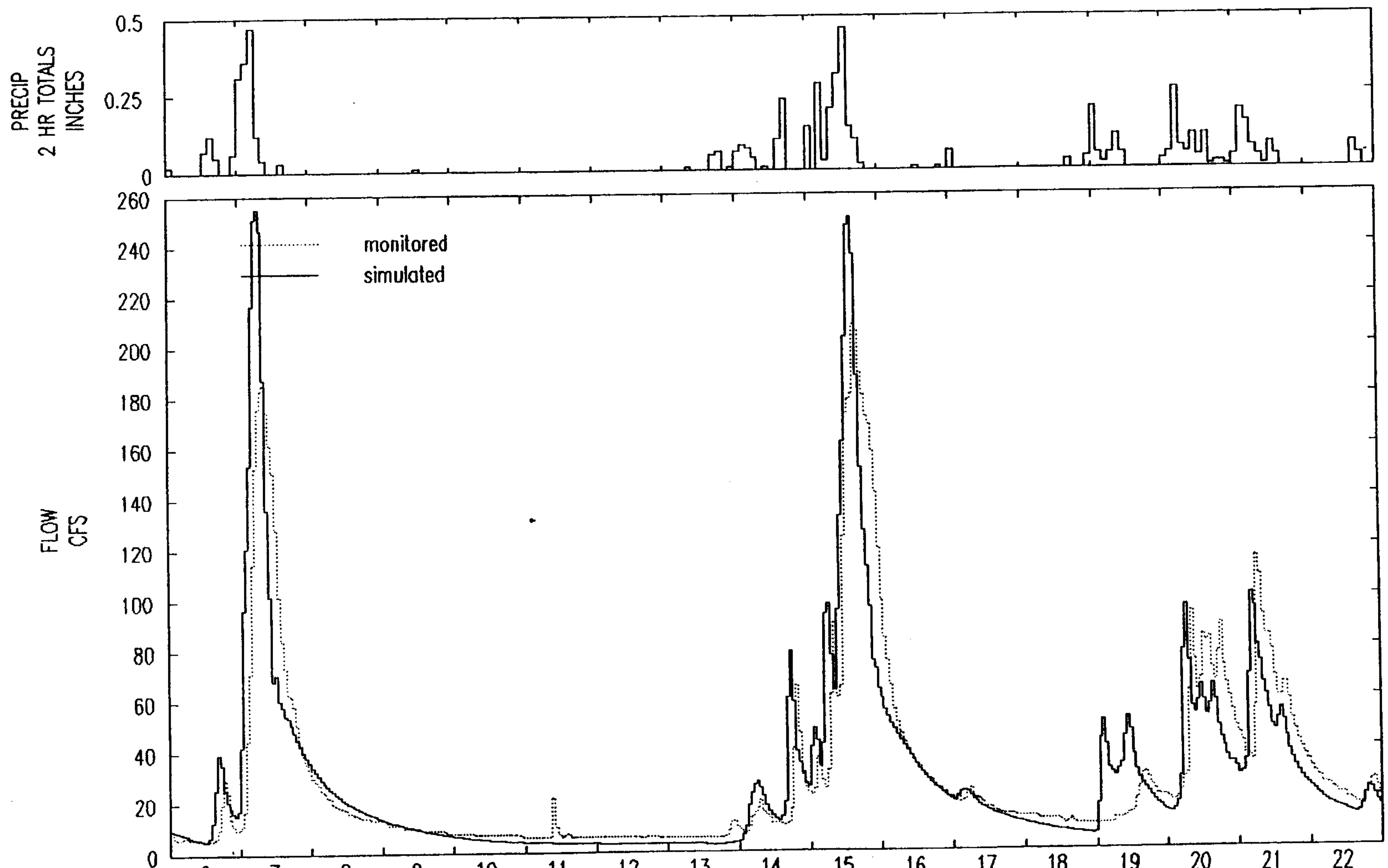


NOV. 1999 SMP VERSION OF 1994 CONDITIONS MODEL

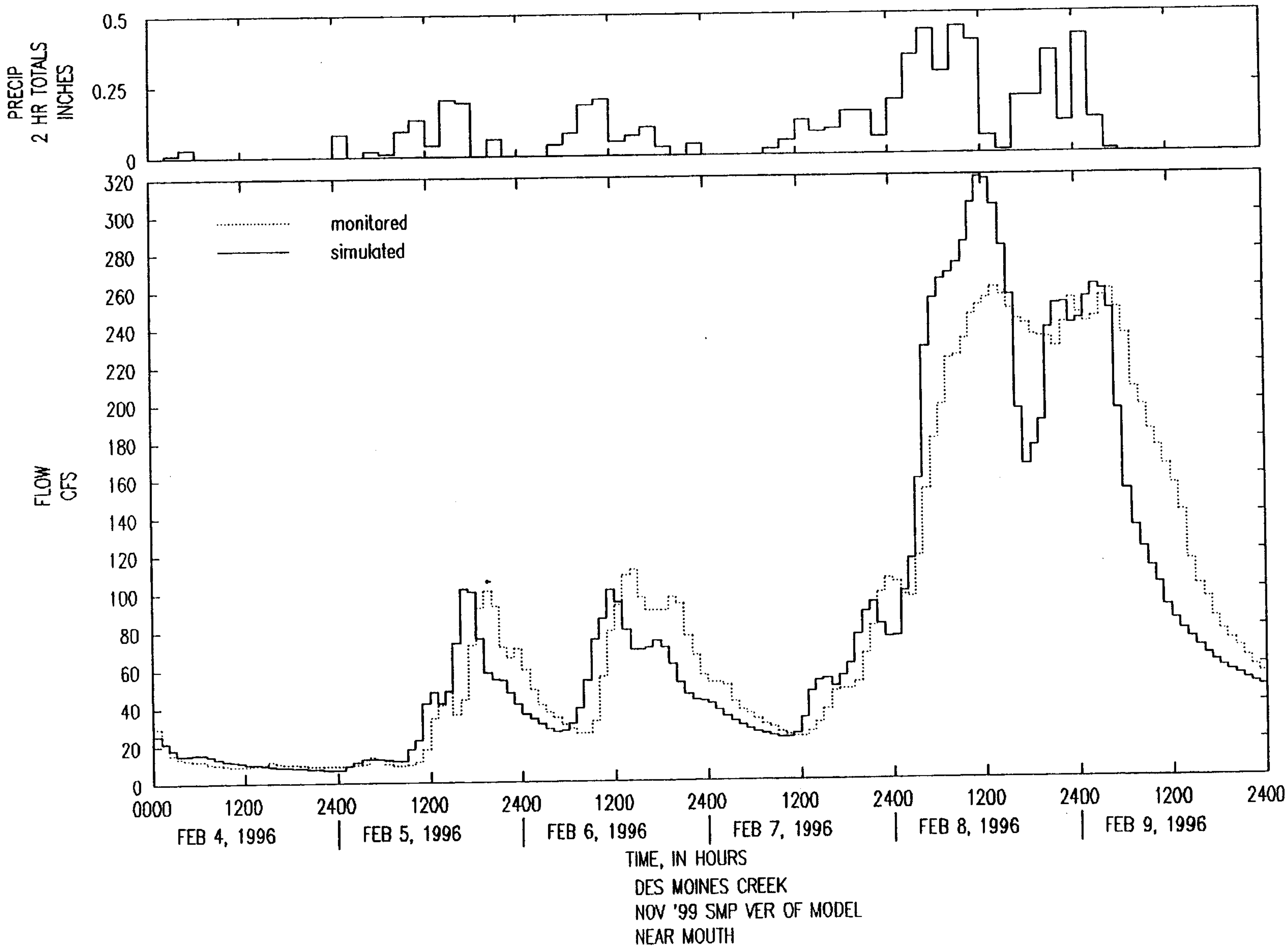
Near Mouth

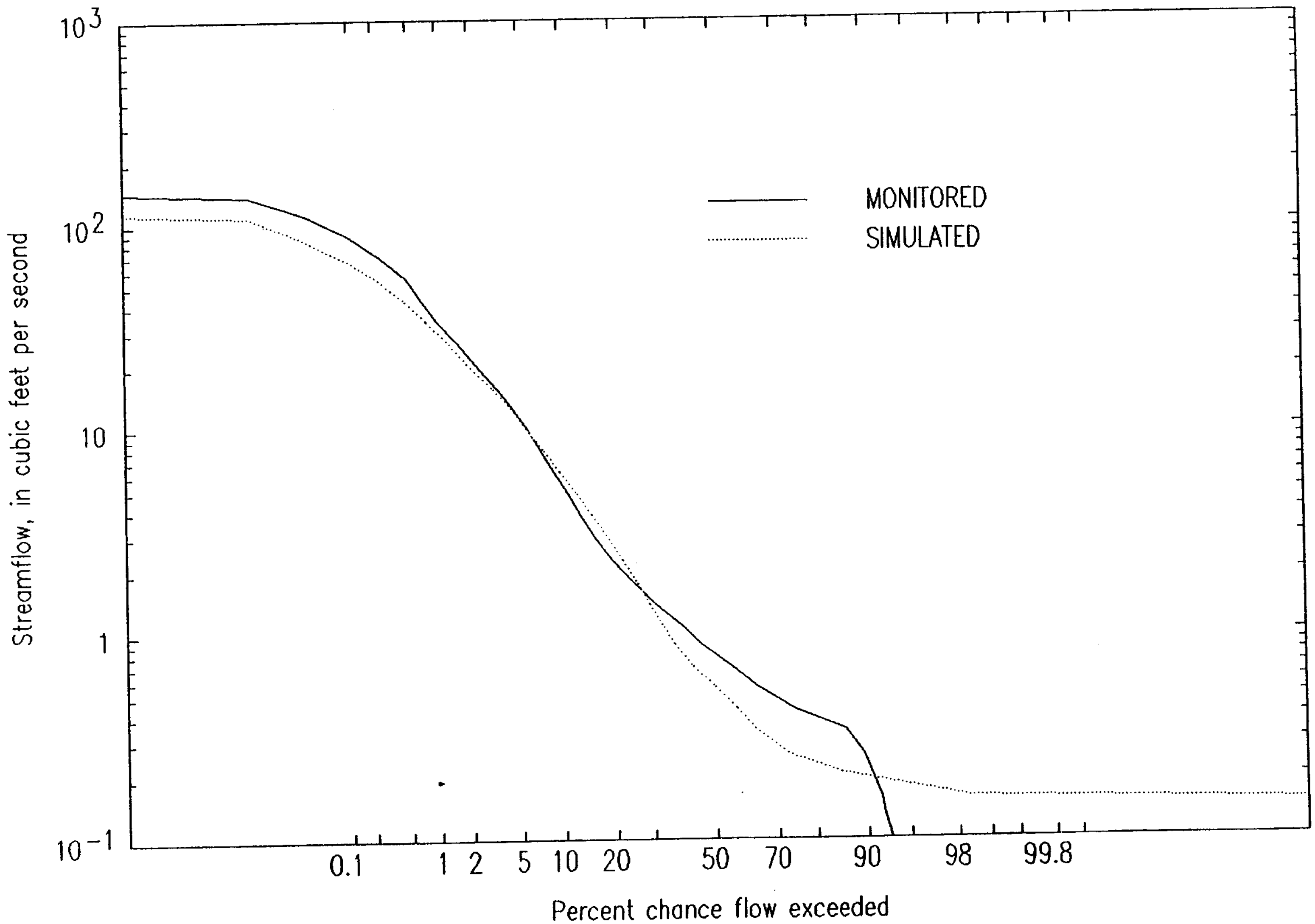


DES MOINES CREEK
NOV '99 SMP VER OF MODEL
NEAR MOUTH

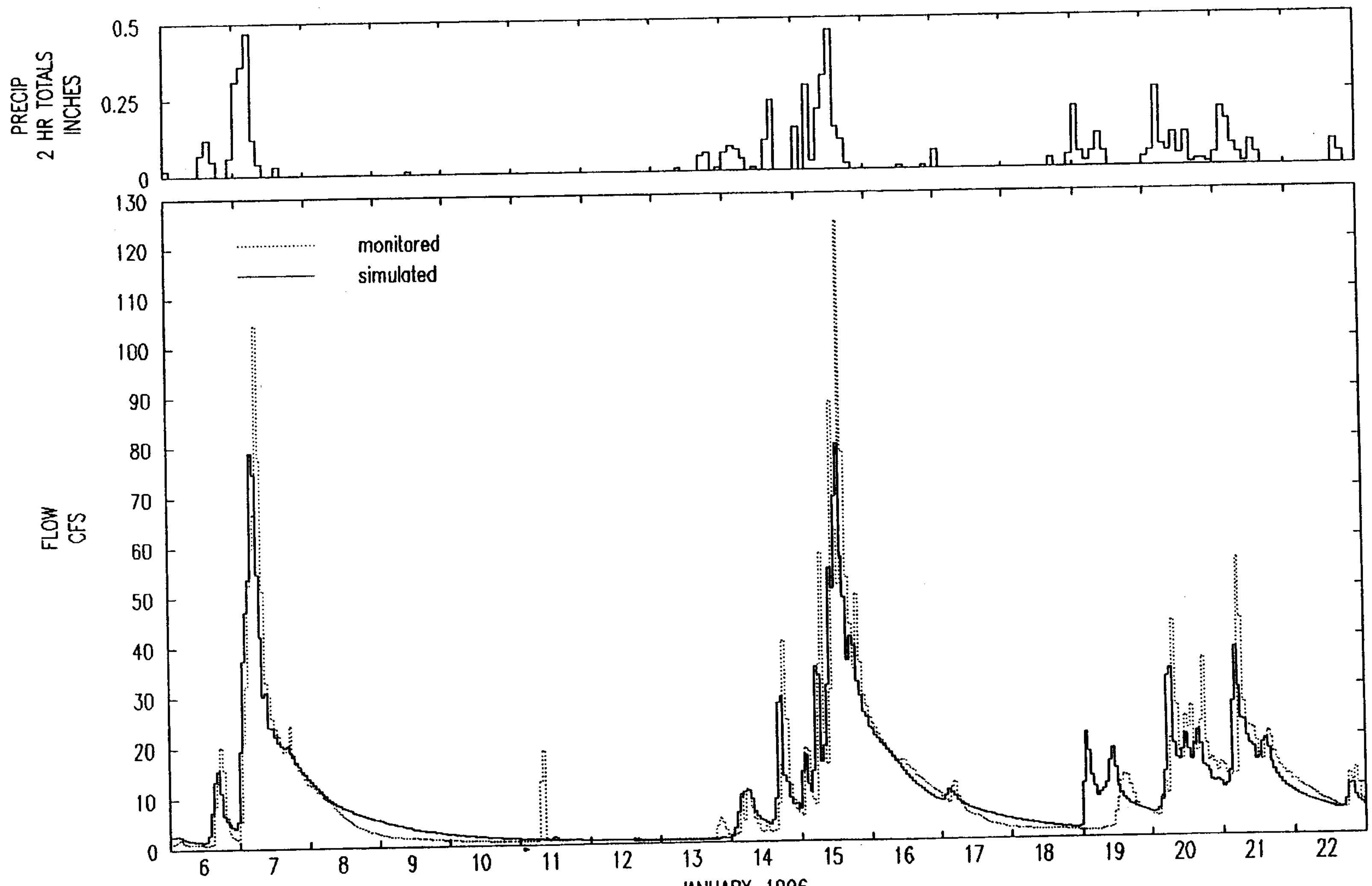


JANUARY, 1996
TIME, IN DAYS
DES MOINES CREEK
NOV '99 SMP VER OF MODEL
NEAR MOUTH

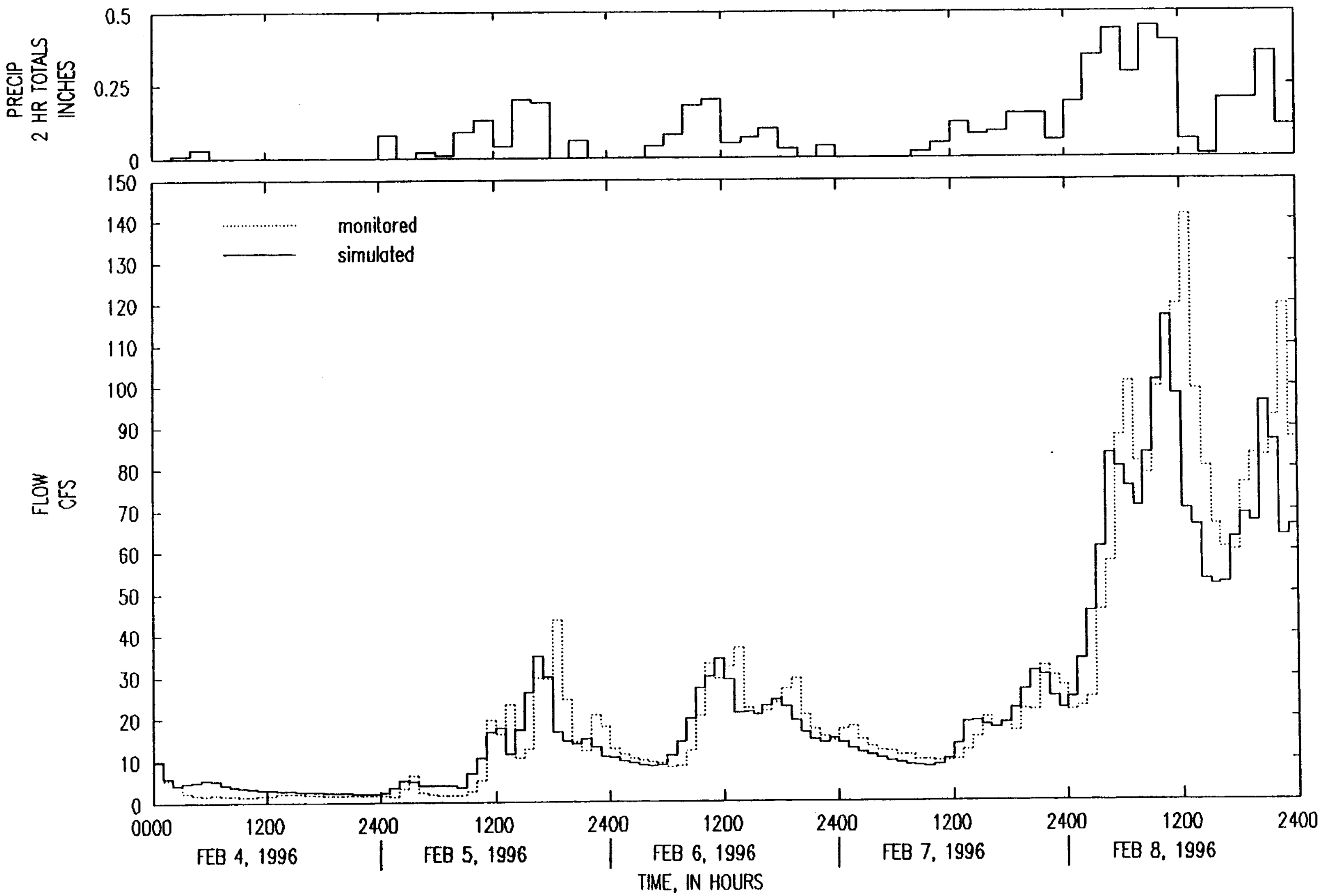

PRECIP
2 HR TOTALS
INCHES
0.5
0.25
0
FLOW
CFS
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
monitored
simulated
0000
1200
2400
FEB 4, 1996
FEB 5, 1996
FEB 6, 1996
FEB 7, 1996
FEB 8, 1996
FEB 9, 1996
TIME, IN HOURS
DES MOINES CREEK
NOV '99 SMP VER OF MODEL
NEAR MOUTH



NOV. 1999 SMP VERSION OF 1994 CONDITIONS MODEL @ TYEE POND INFLOW

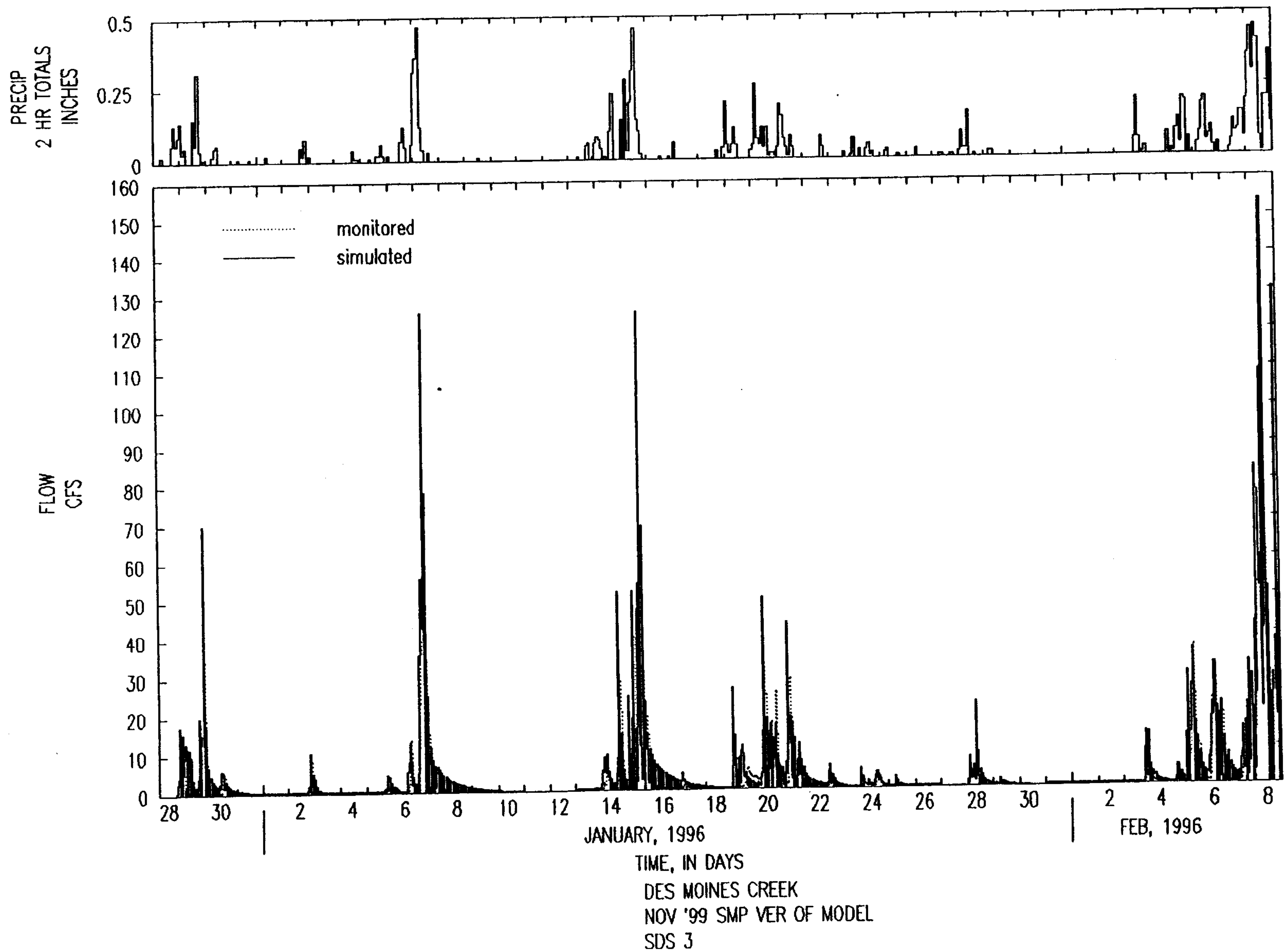


DES MOINES CREEK
NOV '99 SMP VER OF MODEL
TYEE POND INFLOW

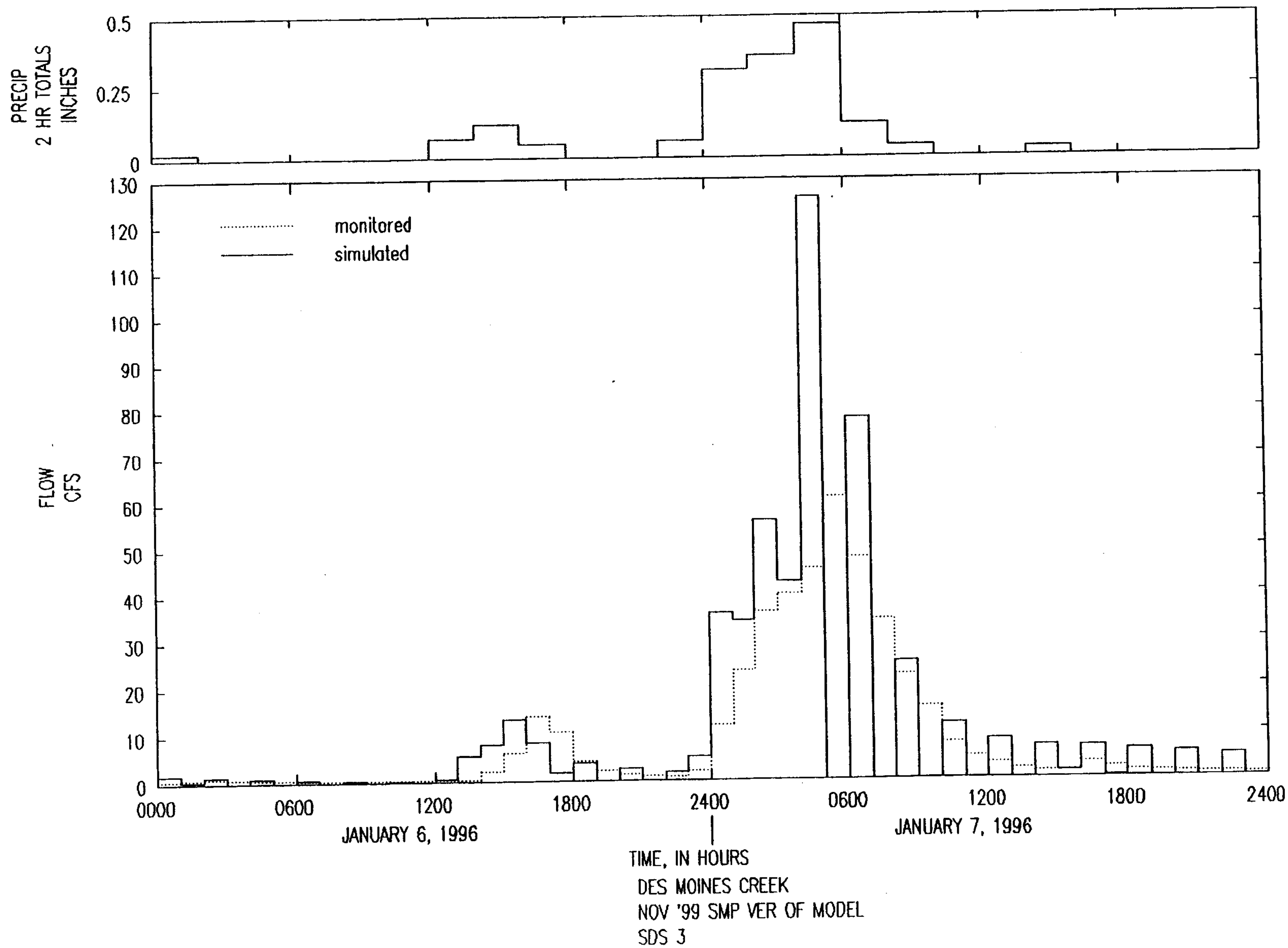


DES MOINES CREEK
NOV '99 SMP VER OF MODEL
TYEE POND INFLOW

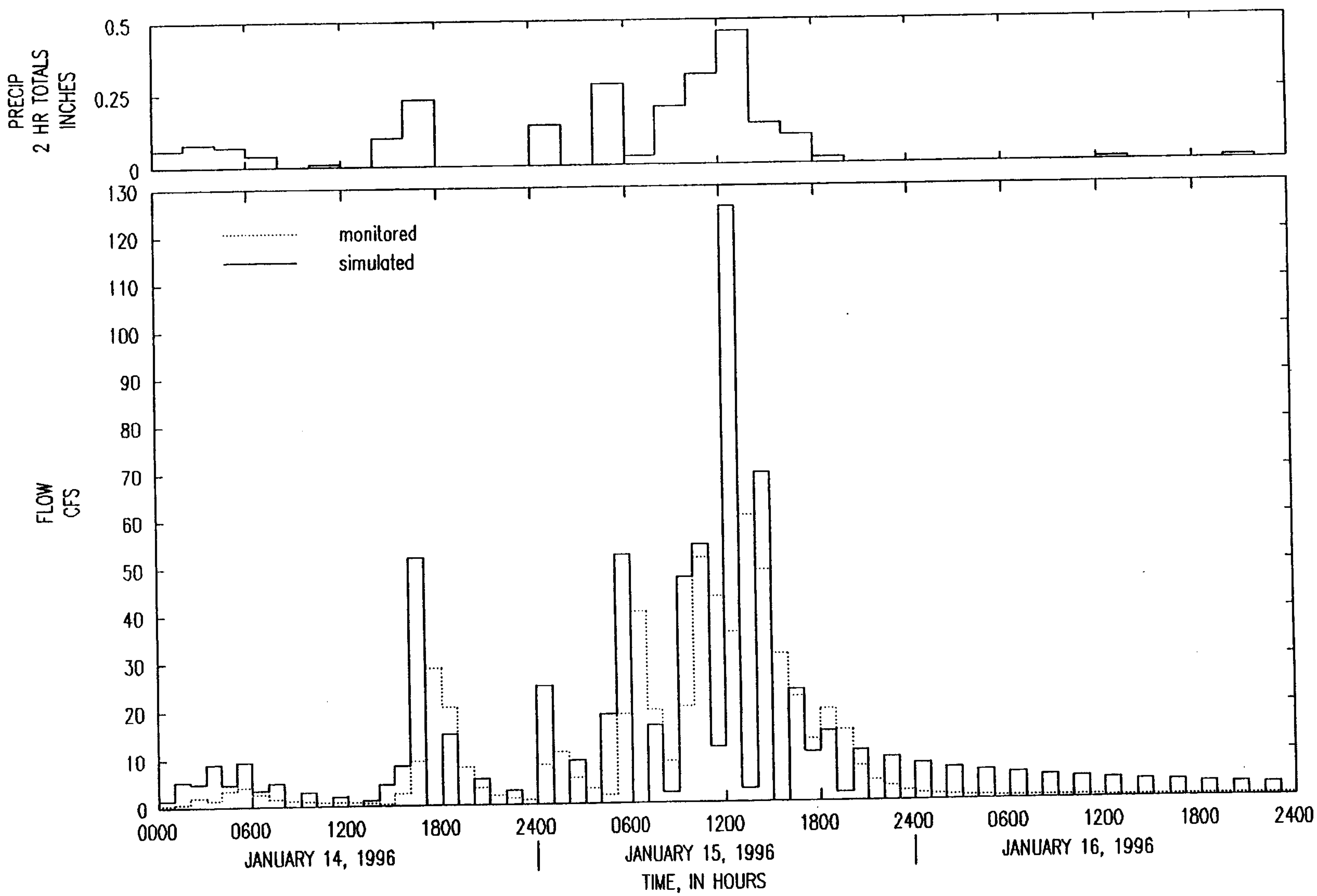
AR 010935



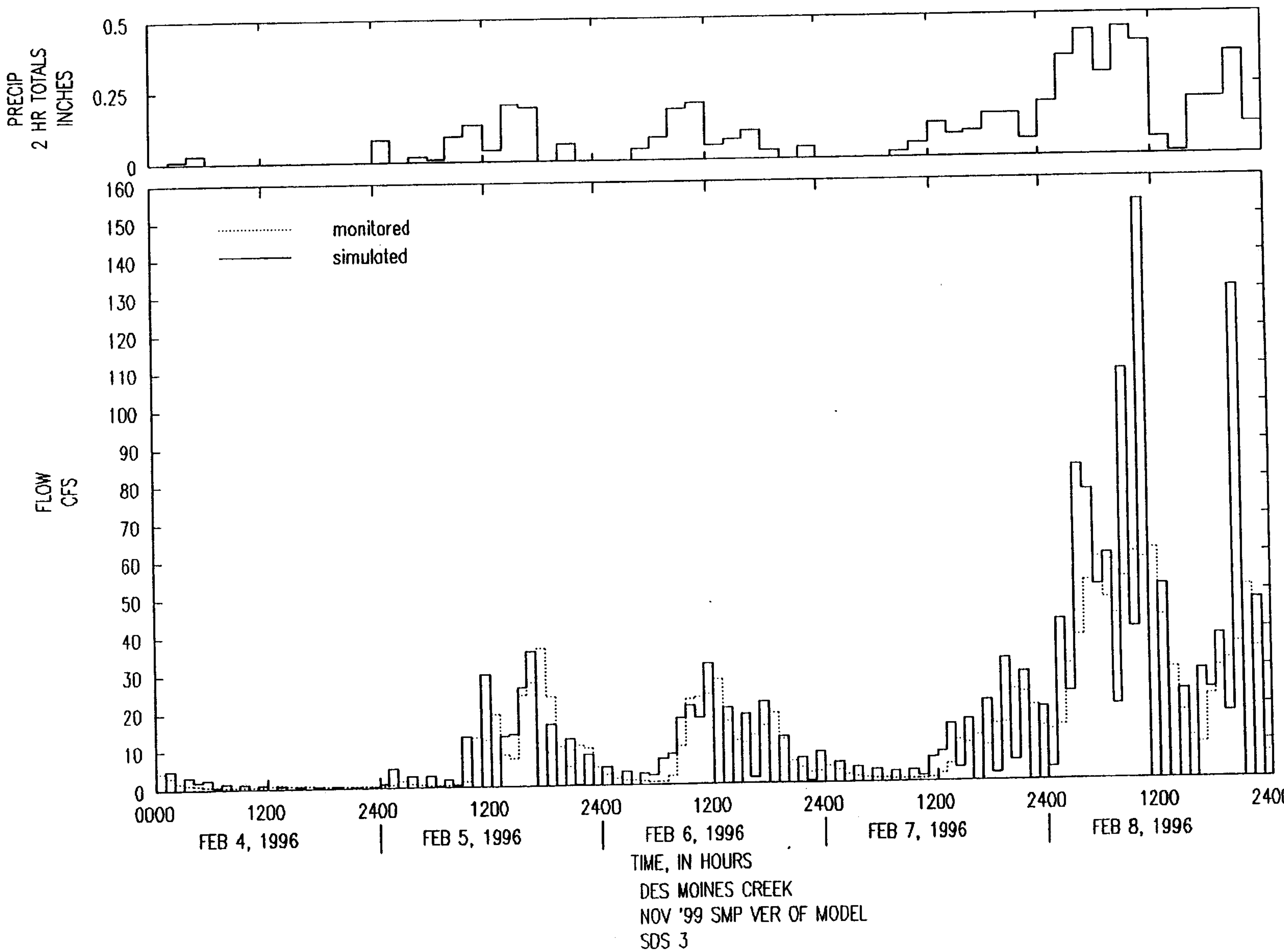
PRECIP
2 HR TOTALS
INCHES
0.5
0.25
0
FLOW
CFS
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
monitored
simulated
28
30
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
2
4
6
8
JANUARY, 1996
FEB, 1996
TIME, IN DAYS
DES MOINES CREEK
NOV '99 SMP VER OF MODEL
SDS 3


PRECIP
2 HR TOTALS
INCHES
0.5
0.25
0
FLOW
CFS
130
120
110
100
90
80
70
60
50
40
30
20
10
0
monitored
simulated
0000
0600
1200
1800
2400
0600
1200
1800
2400
JANUARY 6, 1996
JANUARY 7, 1996
TIME, IN HOURS
DES MOINES CREEK
NOV '99 SMP VER OF MODEL
SDS 3

AR 010937



DES MOINES CREEK
NOV '99 SMP VER OF MODEL
SDS 3



PRECIP
2 HR TOTALS
INCHES
0.5
0.25
0
FLOW
CFS
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
monitored
simulated
0000
1200
2400
1200
2400
1200
2400
1200
2400
1200
2400
FEB 4, 1996
FEB 5, 1996
FEB 6, 1996
FEB 7, 1996
FEB 8, 1996
TIME, IN HOURS
DES MOINES CREEK
NOV '99 SMP VER OF MODEL
SDS 3

Table B1-1. Des Moines Creek Subbasin Parameters - 1994 Base Condition

Land Use			Sub-basin Areas (acres)															
		% of total basin	Bow Lake		East Branch										West Branch (NW Ponds)			
			DM-1[b]		DM-2[b]		DM-3[a]		DM-4		DM-5		DM-6		DM-7		DM-8	
Land Use	Soil Type	equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
AP	TGF	0%					1.18	-	-	-	0.16	-	-	-	-	-	-	-
	TGM	0%					0.74	-	-	-	1.64	-	-	-	-	-	-	-
	LAC	0%					0.76	-	-	-	-	-	-	-	-	-	-	-
	OGF	0%					-	-	-	-	-	-	-	-	-	-	-	-
	OGM	0%					-	-	-	-	-	-	-	-	-	-	-	-
C	TGF	85%					3.95	22.40	3.44	19.51	0.04	0.22	0.61	3.46	-	-	1.86	10.53
	TGM	85%					3.42	19.36	3.41	19.30	1.64	9.32	0.10	0.54	-	-	-	-
	TGS	85%					-	-	-	-	-	-	0.04	0.25	-	-	-	-
	LAC	85%					4.29	24.33	-	-	-	-	-	-	2.14	12.15	-	-
	OGF	85%					-	-	-	-	0.02	0.10	-	-	0.65	3.68	2.27	12.89
	OGM	85%					-	-	-	-	0.75	4.24	-	-	0.07	0.39	-	-
TR	TGF	30%					-	-	-	-	-	-	-	-	-	-	6.12	2.62
	OGF	30%					-	-	-	-	-	-	-	-	-	-	0.68	0.29
	OGM	30%					-	-	-	-	-	-	-	-	-	-	-	-
MF	TGF	47%					-	-	-	-	-	-	-	-	-	-	-	-
	TGM	47%					-	-	-	-	-	-	-	-	-	-	-	-
	OGF	47%					-	-	-	-	-	-	-	-	-	-	-	-
	OGM	47%					-	-	-	-	-	-	-	-	-	-	-	-
	OGS	47%					-	-	-	-	-	-	-	-	-	-	-	-
HD	TGF	30%					9.67	4.15	-	-	-	-	-	-	0.96	0.41	-	-
	TGM	30%					0.43	0.19	-	-	-	-	-	-	-	-	-	-
	LAC	30%					1.39	0.59										
LD	TGF	13%					14.66	2.19	-	-	-	-	-	-	26.29	3.93	0.64	0.09
	TGM	13%					7.21	1.08	-	-	-	-	-	-	-	-	-	-
	TGS	13%					-	-	-	-	-	-	-	-	-	-	-	-
	LAC	13%					1.21	0.18	-	-	-	-	-	-	5.93	0.89	-	-
	OGF	13%					-	-	-	-	-	-	-	-	37.32	5.58	10.38	1.55
	OGM	13%					-	-	-	-	-	-	-	-	11.53	1.72	-	-
	OGS	13%					-	-	-	-	-	-	-	-	0.09	0.01	-	-
G	TGF	0%					-	-	-	-	2.04	-	5.06	-	-	-	-	-
	TGM	0%					-	-	-	-	1.18	-	8.03	-	-	-	-	-
	LAC	0%					-	-	-	-	-	-	-	-	-	-	-	-
	OGF	0%					-	-	-	-	2.10	-	11.00	-	-	-	-	-
	OGM	0%					-	-	-	-	1.74	-	-	-	-	-	-	-

AR 010940

Table B1-1. Des Moines Creek Subbasin Parameters - 1994 Base Condition

Land Use			Sub-basin Areas (acres)															
		% of total basin	Bow Lake		East Branch										West Branch (NW Ponds)			
			DM-1[b]		DM-2[b]		DM-3[a]		DM-4		DM-5		DM-6		DM-7		DM-8	
Land Use	Soil Type	equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
F	TFF	0%					-	-	2.67	-	1.57	-	9.72	-	4.21	-	2.42	-
	TFM	0%					-	-	4.22	-	14.15	-	9.72	-	-	-	-	-
	TFS	0%					-	-	-	-	-	-	2.33	-	-	-	-	-
	LAC	0%					-	-	-	-	-	-	-	-	22.06	-	-	-
	OFF	0%					-	-	-	-	0.05	-	-	-	15.36	-	8.51	-
	OFM	0%					-	-	-	-	1.31	-	-	-	8.23	-	-	-
--	SA	0%					0.33		0.44		2.05		4.05		6.61		1.94	
	Lake		12.19		-		-		-		-		0.03		-		-	
	Other						0.03		0.02		0.07		0.00		0.11		0.11	
Basin total:			-		-		49.26	74.46	14.17	38.81	30.44	13.88	50.66	4.25	141.46	28.76	34.83	27.99
PERLND areas:																		
(14)	TFF		-		-		-		2.67		1.57		9.72		4.21		2.42	
(16)	TFM		10.32		-		-		4.22		14.15		9.72		-		-	
(18)	TFS		-		-		-		-		-		2.33		-		-	
(24)	TGF		-		-		29.47		3.44		2.23		5.67		27.25		8.62	
(26)	TGM		132.94		14.78		11.80		3.41		4.46		8.13		-		-	
(28)	TGS		-		-		-		-		-		0.04		-		-	
	LAC						7.66		-		-		-		30.13		-	
(34)	OF		7.19		-		-		-		1.36		-		23.59		8.51	
(44)	OG		92.36		-		-		-		4.61		11.00		49.66		13.34	
(54)	SA		14.11		-		0.33		0.44		2.05		4.05		6.61		1.94	
	subtotal:		256.92		14.78		49.26		14.17		30.44		50.66		141.46		34.83	
IMPLND areas:																		
	EIA			171.29		9.85		74.46		38.81		13.88		4.25		28.76		27.99
Basin total:			428.21		24.64		123.72		52.98		44.32		54.91		170.22		62.81	
Percent Impervious				40.0%		40.0%		60.2%		73.3%		31.3%		7.7%		16.9%		44.6%

	DM-1[b]	DM-2[b]	DM-3[a]	DM-4	DM-5	DM-6	DM-7	DM-8
NETWORK FACTORS								
PERLND 16 (TF)	0.860	-	-	0.574	1.310	1.814	2.189	0.202
PERLND 26 (TG)	11.078	1.232	4.077	0.571	0.558	1.153	2.944	0.718
PERLND 34 (OF)	0.599	-	-	-	0.114	-	1.966	0.709
PERLND 44 (OG)	7.697	-	-	-	0.384	0.917	4.138	1.111
PERLND 54 (SA)	1.176	-	0.028	0.037	0.171	0.337	0.551	0.162
IMPLND 14 (EIA)	14.274	0.821	6.205	3.234	1.156	0.354	2.397	2.332
SUM	35.684	2.053	10.310	4.415	3.694	4.576	14.185	5.234

[a] - land use is extrapolated

[b] - areas prorated to new subbasin total areas from previous version of model.

shaded subbasins included in the STIA subbasin characteristics evaluation area.

AR 010941

Table B1-1. Des Moines Creek Subbasin Parameters - 1994 Base Condition

Land Use			Sub-basin Areas (acres)															
		% of total basin equal to EIA	West Branch (NW Ponds)						Upper Main				Lower Main Stem					
			DM-9		DM-10		DM-11		DM-12		DM-13[a]		DM-14[b]		DM-16[b]		DM-17[b]	
Land Use	Soil Type		Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
AP	TGF	0%	-	-	-	-	-	-	-	-	-	-						
	TGM	0%	-	-	-	-	-	-	-	-	-	-						
	LAC	0%	-	-	-	-	-	-	-	-	-	-						
	OGF	0%	-	-	-	-	-	-	-	-	-	-						
	OGM	0%	-	-	-	-	-	-	-	-	-	-						
C	TGF	85%	-	-	-	-	1.36	7.71	-	-	3.61	20.48						
	TGM	85%	-	-	-	-	-	-	-	-	0.37	2.11						
	TGS	85%	-	-	-	-	-	-	-	-	0.16	0.89						
	LAC	85%	-	-	-	-	1.12	6.35	-	-	-	-						
	OGF	85%	-	-	-	-	2.89	16.38	-	-	-	-						
	OGM	85%	-	-	-	-	-	-	-	-	-	-						
TR	TGF	30%	-	-	-	-	2.27	0.97	-	-	-	-						
	OGF	30%	-	-	-	-	-	-	-	-	-	-						
	OGM	30%	-	-	-	-	-	-	-	-	-	-						
MF	TGF	47%	-	-	-	-	-	-	-	-	-	-						
	TGM	47%	-	-	-	-	-	-	-	-	-	-						
	OGF	47%	-	-	-	-	-	-	-	-	-	-						
	OGM	47%	-	-	-	-	-	-	-	-	-	-						
	OGS	47%	-	-	-	-	-	-	-	-	-	-						
HD	TGF	30%	-	-	-	-	-	-	-	-	0.06	0.02						
	TGM	30%	-	-	-	-	-	-	-	-	-	-						
	LAC	30%																
LD	TGF	13%	10.26	1.53	6.33	0.95	-	-	-	-	-	-						
	TGM	13%	2.89	0.43	-	-	-	-	-	-	-	-						
	TGS	13%	-	-	-	-	-	-	-	-	-	-						
	LAC	13%	1.25	0.19	2.50	0.37	-	-	-	-	-	-						
	OGF	13%	8.69	1.30	0.67	0.10	-	-	-	-	1.47	0.22						
	OGM	13%	26.74	4.00	5.39	0.81	-	-	-	-	0.04	0.01						
	OGS	13%	1.04	0.16	-	-	-	-	-	-	-	-						
G	TGF	0%	-	-	-	-	1.41	-	-	-	9.54	-						
	TGM	0%	-	-	-	-	-	-	-	-	8.89	-						
	LAC	0%	-	-	0.02	-	-	-	0.01	-	-	-						
	OGF	0%	-	-	0.06	-	2.70	-	23.44	-	16.28	-						
	OGM	0%	-	-	0.00	-	-	-	1.94	-	4.34	-						

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Table B1-1. Des Moines Creek Subbasin Parameters - 1994 Base Condition

Land Use			Sub-basin Areas (acres)															
			West Branch (NW Ponds)						Upper Main				Lower Main Stem					
		% of total basin equal to EIA	DM-9		DM-10		DM-11		DM-12		DM-13[a]		DM-14[b]		DM-16[b]		DM-17[b]	
Land Use	Soil Type		Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
F	TFF	0%	-	-	0.18	-	3.13	-	-	-	5.95	-						
	TFM	0%	-	-	-	-	-	-	-	-	20.98	-						
	TFS	0%	-	-	-	-	-	-	-	-	5.28	-						
	LAC	0%	0.02	-	11.14	-	0.73	-	6.13	-	0.00	-						
	OFF	0%	-	-	8.78	-	12.33	-	0.02	-	0.02	-						
	OFM	0%	0.19	-	14.43	-	-	-	4.49	-	14.43	-						
--	SA	0%	0.12		8.52		12.43		6.51		0.82							
	Lake		-		0.96		5.33		0.63		0.85		-		0.44		-	
	Other		0.02		0.06		0.02		-		0.06							
Basin total:			51.20	7.60	58.02	2.23	40.37	31.42	42.53	-	92.25	23.73	-		-		-	
PERLND areas:																		
(14)	TFF		-		0.18		3.13		-		5.95		-		-		-	
(16)	TFM		-		-		-		-		20.98		5.78		7.76		24.93	
(18)	TFS		-		-		-		-		5.28		-		-		-	
(24)	TGF		10.26		6.33		5.04		-		13.21		-		-		-	
(26)	TGM		2.89		-		-		-		9.26		3.54		66.87		27.13	
(28)	TGS		-		-		-		-		0.16		-		-		-	
	LAC		1.27		13.66		1.85		6.14		0.00							
(34)	OF		0.19		23.21		12.33		4.51		14.45		23.28		7.67		36.04	
(44)	OG		36.47		6.12		5.59		25.37		22.14		14.34		96.28		39.36	
(54)	SA		0.12		8.52		12.43		6.51		0.82		-		2.19		-	
	subtotal:		51.20		58.02		40.37		42.53		92.25		46.94		180.77		127.45	
IMPLND areas:																		
	EIA			7.60		2.23		31.42		-		23.73		4.08		50.99		31.86
Basin total:			58.80		60.24		71.79		42.53		115.98		51.02		231.75		159.31	
Percent Impervious				12.9%		3.7%		43.8%		0.0%		20.5%		8.0%		22.0%		20.0%
			DM-9		DM-10		DM-11		DM-12		DM-13[a]		DM-14[b]		DM-16[b]		DM-17[b]	
NETWORK FACTORS																		
PERLND 16 (TF)			0.002		0.943		0.321		0.511		2.684		0.481		0.647		2.078	
PERLND 26 (TG)			1.200		0.738		0.514		0.001		1.886		0.295		5.573		2.261	
PERLND 34 (OF)			0.016		1.934		1.028		0.376		1.204		1.940		0.639		3.003	
PERLND 44 (OG)			3.039		0.510		0.466		2.114		1.845		1.195		8.023		3.280	
PERLND 54 (SA)			0.010		0.710		1.036		0.543		0.068		-		0.183		-	
IMPLND 14 (EIA)			0.633		0.185		2.618		-		1.978		0.340		4.249		2.655	
SUM			4.900		5.020		5.983		3.544		9.665		4.252		19.313		13.276	

[a] - land use is extrapolated
[b] - areas prorated to new subbasin total areas from previous version of model.
shaded subbasins included in the STIA subbasin characteristics evaluation area.

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Table B1-1. Des Moines Creek Subbasin Parameters - 1994 Base Condition

Land Use			Sub-basin Areas (acres)															
			Lower Main Stem										SDS Basins					
		% of total basin	DM-18[b]		DM-19[b]		DM-20[b]		DM-21[b]		DM-22[b]		SDE-4		SDS-1		SDS-3	
Land Use	Soil Type	equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
AP	TGF	0%											43.19	114.48			236.45	170.63
	TGM	0%											1.11	2.93	0.00	7.41	21.50	15.52
	LAC	0%											0.01	0.04				
	OGF	0%																
	OGM	0%																
C	TGF	85%											1.30	3.36	1.18	2.85		
	TGM	85%											0.07	0.18	0.30	0.72		
	TGS	85%																
	LAC	85%											0.20	0.52				
	OGF	85%																
	OGM	85%																
TR	TGF	30%																
	OGF	30%																
	OGM	30%																
MF	TGF	47%																
	TGM	47%																
	OGF	47%																
	OGM	47%																
	OGS	47%																
HD	TGF	30%																
	TGM	30%																
	LAC	30%																
LD	TGF	13%																
	TGM	13%																
	TGS	13%																
	LAC	13%																
	OGF	13%																
	OGM	13%																
	OGS	13%																
G	TGF	0%											9.69	0.94				
	TGM	0%																
	LAC	0%																
	OGF	0%																
	OGM	0%																

Table B1-1. Des Moines Creek Subbasin Parameters - 1994 Base Condition

Land Use			Sub-basin Areas (acres)															
			Lower Main Stem										SDS Basins					
		% of total basin	DM-18[b]		DM-19[b]		DM-20[b]		DM-21[b]		DM-22[b]		SDE-4		SDS-1		SDS-3	
Land Use	Soil Type	equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
F	TFF	0%											-	-	-	-	-	-
	TFM	0%											-	-	-	-	-	-
	TFS	0%											-	-	-	-	-	-
	LAC	0%											-	-	-	-	-	-
	OFF	0%											-	-	-	-	-	-
	OFM	0%											-	-	-	-	-	-
--	SA	0%											-		-		0.47	
	Lake		-		-		-		-		-		-		-		-	
	Other												0.08		0.00		0.06	
Basin total:			-		-		-		-		-		55.57	122.46	1.48	10.98	258.42	186.14
PERLND areas:																		
(14)	TFF		-		-		-		-		-		-		-		-	
(16)	TFM		9.47		2.19		48.08		25.72		4.58		-		-		-	
(18)	TFS		-		-		-		-		-		-		-		-	
(24)	TGF		-		-		-		-		-		54.17		1.18		236.45	
(26)	TGM		3.32		72.22		79.49		75.68		55.85		1.18		0.30		21.50	
(28)	TGS		-		-		-		-		-		-		-		-	
	LAC												0.22		-		-	
(34)	OF		37.81		2.00		33.40		17.14		2.62		-		-		-	
(44)	OG		13.27		66.63		55.22		50.46		31.44		-		-		-	
(54)	SA		3.60		-		1.39		-		0.19		-		-		0.47	
	subtotal:		67.48		143.04		217.58		168.99		94.67		55.57		1.48		258.42	
IMPLND areas:																		
	EIA			3.55		31.40		44.56		37.10		23.67		122.46		10.98		186.14
Basin total:			71.03		174.44		262.14		206.09		118.34		178.03		12.46		444.56	
Percent Impervious				5.0%		18.0%		17.0%		18.0%		20.0%		68.8%		88.1%		41.9%
			DM-18[b]		DM-19[b]		DM-20[b]		DM-21[b]		DM-22[b]		SDE-4		SDS-1		SDS-3	
NETWORK FACTORS																		
PERLND 16 (TF)			0.789		0.182		4.007		2.143		0.381		-		-		-	
PERLND 26 (TG)			0.277		6.019		6.624		6.306		4.654		4.631		0.123		21.496	
PERLND 34 (OF)			3.151		0.167		2.784		1.429		0.218		-		-		-	
PERLND 44 (OG)			1.106		5.552		4.602		4.205		2.620		-		-		-	
PERLND 54 (SA)			0.300		-		0.116		-		0.016		-		-		0.039	
IMPLND 14 (EIA)			0.296		2.617		3.714		3.091		1.972		10.205		0.915		15.512	
SUM			5.919		14.537		21.845		17.174		9.862		14.836		1.038		37.047	

[a] - land use is extrapolated
[b] - areas prorated to new subbasin total areas from previous version of model.
shaded subbasins included in the STIA subbasin characteristics evaluation area.

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Table B1-1. Des Moines Creek Subbasin Parameters - 1994 Base Condition

Land Use			Sub-basin Areas (acres)							
			SDS Basins				IWS Basins			
		% of total basin	SDS-4		SDS-2,5,6,7		PRIMARY		SDS1OF	
Land Use	Soil Type	equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
AP	TGF	0%	6.15	6.93	59.48	11.31	6.00	186.47	0.28	21.17
	TGM	0%	-	-	-	-	1.09	133.92	0.15	11.62
	LAC	0%	-	-	-	-	0.03	0.98	-	-
	OGF	0%	9.96	11.22	-	-	0.03	0.91	-	-
	OGM	0%	0.82	0.92	-	-	0.07	2.26	-	-
C	TGF	85%	-	-	0.13	0.13	0.03	1.13	0.00	0.02
	TGM	85%	-	-	-	-	0.01	0.38	0.00	0.04
	TGS	85%	-	-	-	-	-	-	-	-
	LAC	85%	-	-	-	-	-	-	-	-
	OGF	85%	-	-	0.51	0.51	-	-	-	-
	OGM	85%	-	-	-	-	-	-	-	-
TR	TGF	30%	0.01	-	0.21	0.36	0.00	0.06	-	-
	OGF	30%	-	-	-	-	-	-	-	-
	OGM	30%	-	-	-	-	0.00	0.45	-	-
MF	TGF	47%	-	-	-	-	-	-	-	-
	TGM	47%	-	-	-	-	-	-	-	-
	OGF	47%	-	-	-	-	-	-	-	-
	OGM	47%	-	-	-	-	-	-	-	-
	OGS	47%	-	-	-	-	-	-	-	-
HD	TGF	30%	-	-	-	-	-	-	-	-
	TGM	30%	-	-	-	-	-	-	-	-
	LAC	30%	-	-	-	-	-	-	-	-
LD	TGF	13%	-	-	-	-	-	-	-	-
	TGM	13%	-	-	-	-	-	-	-	-
	TGS	13%	-	-	-	-	-	-	-	-
	LAC	13%	-	-	-	-	-	-	-	-
	OGF	13%	-	-	-	-	-	-	-	-
	OGM	13%	-	-	-	-	-	-	-	-
	OGS	13%	-	-	-	-	-	-	-	-
G	TGF	0%	2.89	0.04	36.22	0.81	0.01	5.82	-	-
	TGM	0%	-	-	-	-	-	-	-	-
	LAC	0%	-	-	-	-	-	-	-	-
	OGF	0%	16.02	0.22	-	-	0.01	4.69	-	-
	OGM	0%	2.07	0.03	-	-	0.00	2.53	-	-

Table B1-1. Des Moines Creek Subbasin Parameters - 1994 Base Condition

Land Use			Sub-basin Areas (acres)									
		% of total basin	SDS Basins				IWS Basins					
			SDS-4		SDS-2,5,6,7		PRIMARY		SDS1OF			
Land Use	Soil Type	equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious		
F	TFF	0%			2.73	0.01	2.66					
	TFM	0%										
	TFS	0%										
	LAC	0%										
	OFF	0%	0.22		8.12	0.02	1.89					
	OFM	0%										
–	SA	0%	0.00		0.52		0.00					
	Lake						6.65					
	Other		0.04		0.12		0.02		0.00			
Basin total:			38.15	19.37	107.91	13.15	11.84	239.59	0.43	32.85	Total	Percent
PERLND areas:												
(14)	TFF				2.73		2.66				35.24	0.96%
(16)	TFM										187.89	5.10%
(18)	TFS										7.61	0.21%
(24)	TGF		9.05		96.03		6.04		0.28		514.73	13.97%
(26)	TGM						1.10		0.15		596.00	16.18%
(28)	TGS										0.20	0.01%
	LAC						0.03				60.95	1.65%
(34)	OF		0.22		8.12		1.89				265.54	7.21%
(44)	OG		28.87		0.51		0.11				663.13	18.00%
(54)	SA		0.00		0.52		0.00				66.33	1.80%
	subtotal:		38.15		107.91		11.84		0.43		2397.61	65.09%
IMPLND areas:												
	EIA			19.37		13.15		239.59		32.85	1286.03	34.91%
Basin total:			57.52		121.06		251.43		33.28		3683.64	100.00%
Percent Impervious				33.7%		10.9%		95.3%		98.7%		

	SDS-4	SDS-2,5,6,7	PRIMARY	SDS1OF	Total	Percent
NETWORK FACTORS						
PERLND 16 (TF)		0.228	0.222		22.57	7.35%
PERLND 26 (TG)	0.755	8.002	0.598	0.036	94.32	30.73%
PERLND 34 (OF)	0.018	0.676	0.158		22.13	7.21%
PERLND 44 (OG)	2.406	0.042	0.009		55.26	18.00%
PERLND 54 (SA)	0.000	0.043	0.000		5.53	1.80%
IMPLND 14 (EIA)	1.614	1.096	19.966	2.738	107.17	34.91%
SUM	4.793	10.088	20.953	2.774	306.97	100.00%

[a] - land use is extrapolated

[b] - areas prorated to new subbasin total areas from previous version of model.

shaded subbasins included in the STIA subbasin characteristics evaluation area.

MILLER/WALKER CREEK HSPF MODEL CALIBRATION REPORT

VOLUME 3—APPENDIX B2

Prepared for

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December 2000
556-2912-001 (28)

CERTIFICATE OF ENGINEER

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned.

(affix seal here)

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Douglas Beyerlein, P.E., Senior Engineer

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1. INTRODUCTION

As part of Parametrix's study of the drainage impacts of the proposed Seattle-Tacoma International Airport (STIA) Master Plan Update (MPU) on both Walker and Miller Creeks, the Environmental Protection Agency's Hydrological Simulation Program – FORTRAN (HSPF) model was used to simulate the hydrology of the study area. Information resulting from this computer simulation effort will be used to evaluate the hydrologic impacts of urbanization in the watershed.

This report discusses the calibration effort for both the Walker and Miller Creek HSPF models. The calibration team consisted of Joe Brascher (Aqua Terra) and Dave Harms (formerly of Parametrix). Every aspect of each model was reviewed by the team, and the best possible data were used.

The calibration period consisted of water-years 1993 through 1996. Simulated streamflow volumes over the calibration period were within 10 percent of recorded volumes. Some difficulty was encountered in matching the magnitude of simulated streamflow peaks with recorded streamflow peaks. Sixty-five calibration runs were performed for Miller Creek and 21 calibration runs were performed for Walker Creek in an effort to match the magnitude of the recorded streamflow peaks. The best possible match for the given data has been achieved. Investigation of the recorded streamflow data at both gage sites for Miller Creek and both gage sites for Walker Creek demonstrates possible errors as a result of gage malfunctions and shifting control situations. The team concluded that these errors may have contributed to the inability to match observed streamflows with simulated streamflows.

2. CALIBRATION

2.1 HYDROMETEORLOGIC DATA

Two streamflow gages located in the Miller Creek watershed and two streamflow gages located in the Walker Creek watershed were used in the calibration effort (Figure B2-1). Data for the streamflow gages were collected by the King County Department of Natural Resources. The calibration period covered water-years 1993 through 1996. The team selected this time period because it is believed to contain the most reliable data. However, the observed data from these water-years still contained several gaps. The dates of the missing data are listed in Table B2-1.

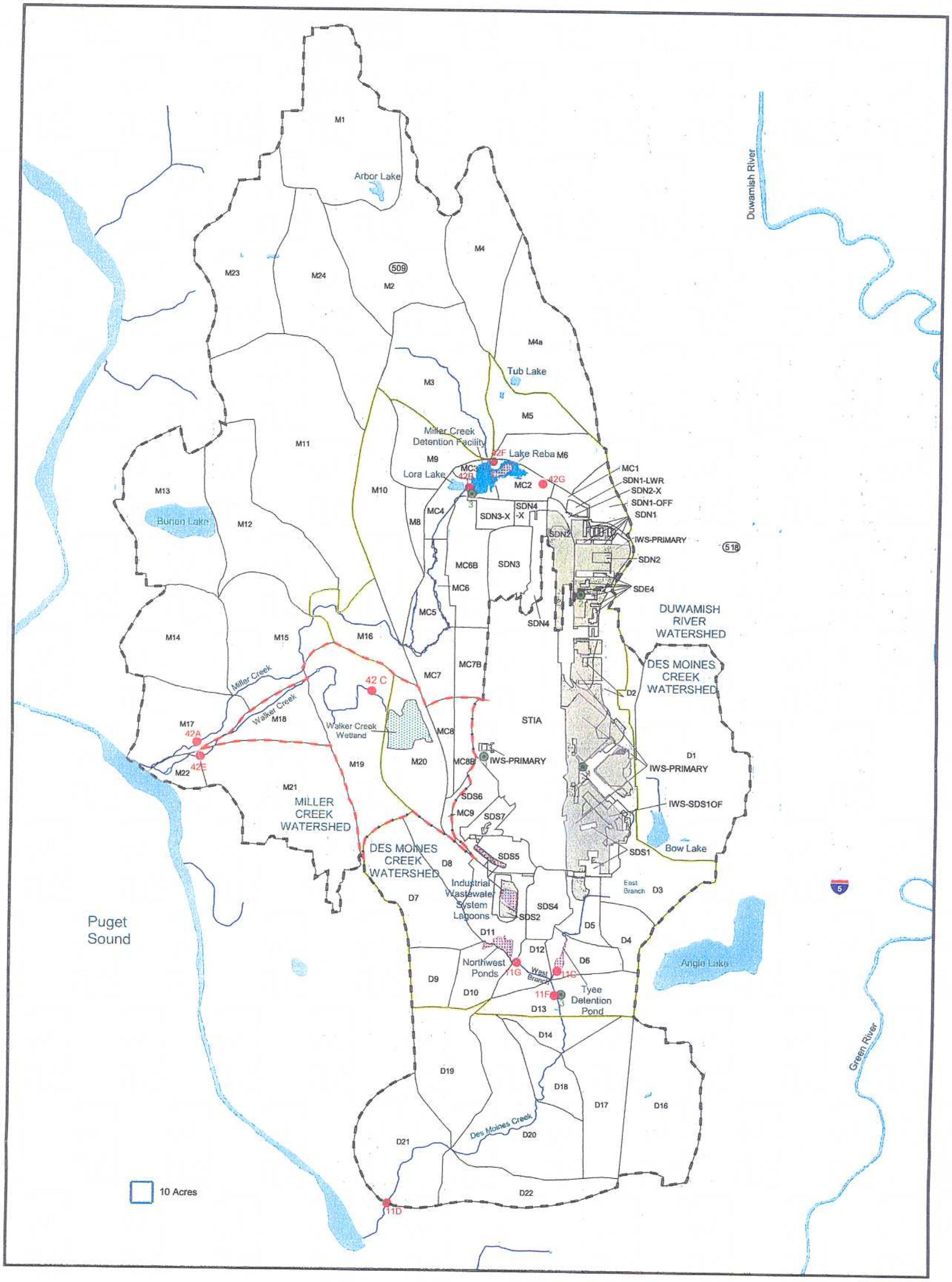
Table B2-1. Dates of missing records at Miller and Walker Creek gages.

		# obs
RDF		
	10/1/92 1:00 – 10/15/92 17:00	352
	11/23/93 16:00 – 12/29/93 13:00	861
	9/17/94 3:00 – 10/14/94 1:00	646
	12/5/94 14:00 – 1/3/95 14:00	696
SR518		
	10/1/92 1:00 – 11/24/92 17:00	1312
	11/23/93 17:00 – 12/16/93 16:00	551
	11/28/94 16:00 – 1/3/95 16:00	864
Walker Creek		
	2/2/93 16:00 – 3/18/93 14:00	1054
	5/23/94 9:00 – 6/27/94 11:00	842
Mouth of Miller Creek		
	10/1/92 1:00 – 10/8/92 15:00	182
	12/2/93 12:00 – 12/29/93 15:00	651
	11/29/94 13:00 – 12/30/94 10:00	741
	6/21/95 17:00 – 10/1/95 0:00	2431

2.2 PRECIPITATION RECORD

Precipitation data for the calibration period of 10/1/92 - 8/30/96 were hourly records taken at STIA. Due to the proximity to the Miller Creek watershed, these data can be used without any modifications.

The 46-month period of rainfall record was selected from the 49 years of record at STIA for the calibration period since this represented a wide range of precipitation conditions. The average annual rainfall for the 49 years of record was 38.3 inches. For the period of record, 1993 had the third lowest annual rainfall total (28.8 inches) and 1996 had the second highest annual rainfall total (50.7 inches). By comparison, the 1994 annual rainfall total was 3.5 inches below average, and the 1995 annual rainfall total was 4.3 inches above average. Therefore, the time interval between 1993 and 1996 provided a range of precipitation conditions for calibration at a time when the land use could be accurately estimated.



Parametrix, Inc. Sea-Tac Airport Stormwater Management Plan/556-2912-001(28) 6/00 File: K:\Gis\2912\Arcview\rrseatac-apdxa_may2001.apr
Source: Roads based on King County data. Water bodies derived from USGS hypsography data. Detention boundaries are approximate.
Note: Subbasin boundaries shown outside of STIA area are for illustration and reference only.
STIA subbasins assume existing (1994) conditions.

July 2001
556-2912-001 (28)

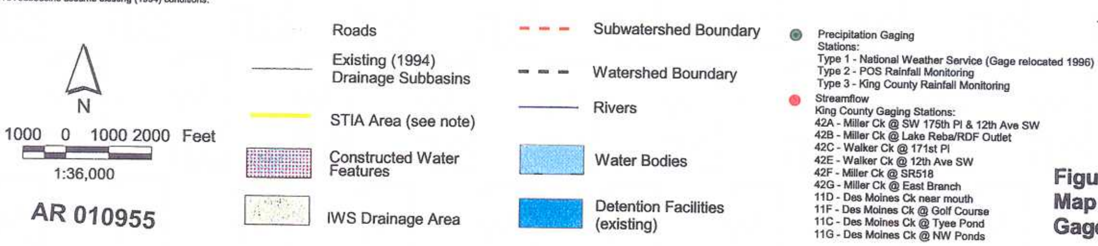


Figure B2-1
Map of Basins with Gage Locations

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2.3 EVAPORATION DATA

Daily evaporation data recorded at the Washington State Research and Extension Center gage at Puyallup have been used for this modeling effort. These data have been appended starting in water-year 1992 by King County monthly average evaporation data.

2.4 SOILS

Both the Miller and Walker Creek watersheds contain a mixture of glacial till, outwash, and wetland soils. Consideration was given to separating out an additional soil/geology type to represent non-typical glacial till soils that are present in both the Miller and Walker Creek watersheds. These glacial till soils are characterized by unusually deep layers of permeable material overlaying the till layer. U.S. Geological Survey (USGS) regional parameters for till soils are based on the assumption that the impermeable layer of till is underneath a few feet of highly permeable soil. Investigation of available soils data conducted by Parametrix staff indicated that there are areas within the Miller Creek basin where the impermeable till layer is beneath a much deeper layer of highly permeable soil – over 20 feet of depth. Since the till layer presumably is at approximately the same elevation throughout the basin (considering how it was formed), overall runoff volume should not be affected by the depth of permeable material over it. The depth of permeable material would have an impact on flow attenuation. Since the areas of deep till (greater than 20 feet deep) are spread throughout the basin and not located within one specific area, the team believes that the resulting calibration parameter values for till soils are average values representative of the basin as a whole and not biased toward a certain portion of the basin.

2.5 MODEL PARAMETERS

The HSPF regional parameters were used as a starting point for the calibration of both the Miller and Walker Creek watershed models. Based upon our professional judgment, changes were made to the PERLND parameters to better reflect the hydrology of the watershed. A complete listing of the HSPF model parameters for Miller and Walker Creeks is provided in Tables B2-2 and B2-3.

2.6 LAND USE DATA

The land use data for this model were taken from the Environmental Impact Statement prepared several years earlier. The source of these data is believed to be Montgomery Water Group. Since there is uncertainty about the original source of the land use data, and spot verification of land use indicated sizable discrepancies from observable data such as aerial photography, it was decided to use the latest version of King County Department of Natural Resources' land use for the calibration period. The King County land use is based on 1994 aerial photos. Soils data were obtained from King County for similar reasons. When King County's land use data were input to the model, a consistent drop in impervious area for the subbasins was observed (Tables B2-4 through B2-7). Model calibration using this data also did not distinguish between separate slope categories.

Table B2-2. Miller Creek PERLND parameter values: July 2000 calibration.

PERLND #	PERLND Type	LZSN	INFILT	LSUR	SLSUR	KVARY	AGWRC	INFEXP	INFILD	DEEPFR	BASETP
16	TFM	9.0	0.32	400	0.100	0.5	0.996	2	2	0.33	0
26	TGM	9.0	0.12	400	0.100	0.5	0.996	2	2	0.33	0
34	OF	10.0	2.00	400	0.050	0.3	0.996	2	2	0.33	0
44	OG	10.0	0.80	400	0.050	0.3	0.996	2	2	0.33	0
54	SAT	8.0	2.00	100	0.001	0.5	0.996	10	2	0.33	0

PERLND #	PERLND Type	AGWETP	CEPSC	UZSN	NSUR	INTFW	IRC	LZETP
16	TFM	0.0	0.2	0.75	0.35	9.0	0.7	0.70
26	TGM	0.0	0.1	0.38	0.25	9.0	0.7	0.25
34	OF	0.0	0.2	0.75	0.35	0.0	0.7	0.70
44	OG	0.0	0.1	0.75	0.25	0.0	0.7	0.25
54	SAT	0.7	0.1	2.25	0.50	1.0	0.7	0.80

Table B2-3. Walker Creek PERLND parameter values: July 2000 calibration.

PERLND #	PERLND Type	LZSN	INFILT	LSUR	SLSUR	KVARY	AGWRC	INFEXP	INFILD	DEEPFR	BASETP
16	TFM	4.5	0.08	400	0.100	0.5	0.996	2	2	0	0
26	TGM	4.5	0.03	400	0.100	0.5	0.996	2	2	0	0
34	OF	5.0	2.00	400	0.050	0.3	0.996	2	2	0	0
44	OG	5.0	0.80	400	0.050	0.3	0.996	2	2	0	0
54	SAT	4.0	2.00	100	0.001	0.5	0.996	10	2	0	0
64	Des Moines TGF	4.5	0.12	400	0.100	0.5	0.999	2	2	0	0

PERLND #	PERLND Type	AGWETP	CEPSC	UZSN	NSUR	INTFW	IRC	LZETP
16	TFM	0.0	0.2	0.50	0.35	2.0	0.15	0.70
26	TGM	0.0	0.1	0.25	0.25	2.0	0.15	0.25
34	OF	0.0	0.2	0.50	0.35	0.0	0.50	0.70
44	OG	0.0	0.1	0.50	0.25	0.0	0.50	0.25
54	SAT	0.7	0.1	3.00	0.50	1.0	0.70	0.80
64	Des Moines TGF	0.0	0.1	0.25	0.25	3.0	0.50	0.25

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Table B2-4. Miller Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)													
															MC-1 to MC-7	
		% of total	M-5		M-6		M-8		M-9		M-10		M-16		MC-1	
Land Use	Soil Type	basin equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Impervious	Pervious	Effective Impervious
STIA	M	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qw	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TIA	100%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COMM	Qvr	85%	0.53	3.01	-	-	-	-	-	-	5.35	30.34	0.02	0.12	-	-
	Qvrl	85%	-	-	-	-	-	-	-	-	-	-	0.46	2.60	-	-
	Qvt	85%	2.18	12.34	0.23	1.31	-	-	-	-	-	-	-	-	-	-
TRANS	M	0%	-	-	0.03	-	-	-	-	-	-	-	-	-	0.10	-
	Qvr	0%	-	-	3.44	-	-	-	3.83	-	11.34	-	7.22	-	3.73	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	3.48	-	-	-
	Qvt	0%	-	-	-	-	-	-	0.36	-	4.32	-	-	-	-	-
	Qw	0%	-	-	0.01	-	-	-	0.01	-	-	-	-	-	-	-
	TIA	100%	-	-	-	4.79	-	-	-	7.21	-	16.75	-	5.32	-	0.09
MF	Qvr	47%	0.62	0.55	-	-	6.68	5.92	5.13	4.55	19.97	17.71	1.19	1.06	-	-
	Qvrl	47%	-	-	-	-	-	-	-	-	-	-	0.20	0.17	-	-
HD	Qvr	15%	-	-	-	-	0.48	0.08	46.38	8.18	6.98	1.23	15.22	2.69	-	-
	Qvrl	15%	-	-	-	-	-	-	-	-	-	-	16.63	2.94	-	-
	Qvt	15%	-	-	5.92	1.05	-	-	13.96	2.46	19.60	3.46	-	-	-	-
	Qw	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LD	M	4%	-	-	-	-	-	-	-	-	-	-	0.16	0.01	-	-
	Qu	4%	-	-	-	-	-	-	-	-	-	-	0.01	0.00	-	-
	Qvr	4%	9.67	0.40	-	-	14.21	0.59	1.26	0.05	51.59	2.15	5.78	0.24	-	-
	Qvrl	4%	-	-	-	-	-	-	-	-	-	-	9.37	0.39	-	-
	Qvt	4%	-	-	-	-	-	-	-	-	8.02	0.33	-	-	-	-
	Qw	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OG	M	0%	-	-	0.18	-	-	-	-	-	-	-	-	-	0.07	-
	Qvr	0%	39.22	-	9.95	-	0.84	-	0.10	-	-	-	1.98	-	4.48	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	0.00	-	-	-
	Qvt	0%	8.11	-	34.71	-	-	-	-	-	-	-	-	-	-	-
	Qw	0%	0.47	-	-	-	-	-	-	-	-	-	-	-	-	-
F	M	0%	-	-	0.06	-	-	-	-	-	-	-	1.17	-	-	-

Table B2-4. Miller Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)													
															MC-1 to MC-7	
		% of total basin	M-5		M-6		M-8		M-9		M-10		M-16		MC-1	
Land Use	Soil Type	equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Impervious	Pervious	Effective Impervious
	Qu	0%	-	-	-	-	-	-	-	-	-	-	0.77	-	-	-
	Qvr	0%	-	-	21.75	-	-	-	0.05	-	-	-	19.26	-	-	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	9.76	-	-	-
	Qvt	0%	-	-	10.60	-	-	-	4.94	-	4.15	-	-	-	-	-
	Qw	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wetland	0%	10.27		0.80		-		-		-		-		0.27	
	Lake		0.44		-		-		-		-		-		-	
	Mcrk-df		-		0.07		-		-		-		-		-	
	Other		-		0.01		-		-		0.00		-		-	
Basin total:			71.07	16.31	87.70	7.14	22.21	6.60	76.02	22.46	131.32	71.97	92.69	15.54	8.65	0.09
PERLND areas:																
(16)	Till-Forest		-		10.66		-		4.94		4.15		10.93		-	
(26)	Till-Grass		10.29		41.08		-		14.32		31.94		30.30		0.17	
(34)	Outwash-Forest		-		21.75		-		0.05		-		20.03		-	
(44)	Outwash-Grass		50.04		13.39		22.21		56.70		95.23		31.42		8.21	
(54)	Wetland		10.74		0.82		-		0.01		-		-		0.27	
	subtotal:		71.07		87.70		22.21		76.02		131.32		92.69		8.65	
IMPLND areas:																
	EIA			16.31		7.14		6.60		22.46		71.97		15.54		0.09
Basin total:			87.38		94.85		28.80		98.48		203.30		108.23		8.74	
Percent Impervious:				18.7%		7.5%		22.9%		22.8%		35.4%		14.4%		1.1%

Table B2-4. Miller Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)													
			MC-1 to MC-7												SDS Basins	
			MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		SDN-1	
Land Use	Soil Type	% of total basin equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
STIA	M	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	-	-	-	-	-	-	-	-	-	-	-	-	0.47	-
	Qvt	0%	-	-	-	-	-	-	-	-	-	-	-	-	1.73	-
	Qw	0%	-	-	-	-	-	-	-	-	-	-	-	-	0.17	-
	TIA	100%	-	-	-	-	-	-	-	-	-	-	-	-	-	7.08
COMM	Qvr	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvrl	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRANS	M	0%	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	2.55	-	1.32	-	-	-	-	-	-	-	0.02	-	0.78	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qw	0%	0.22	-	0.43	-	-	-	-	-	-	-	-	-	0.03	-
	TIA	100%	-	0.27	-	0.01	-	-	-	-	-	-	-	-	-	1.22
MF	Qvr	47%	-	-	-	-	0.07	0.06	0.71	0.63	-	-	-	-	-	-
	Qvrl	47%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HD	Qvr	15%	-	-	-	-	7.87	1.39	0.30	0.05	1.54	0.27	3.54	0.62	-	-
	Qvrl	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	15%	-	-	-	-	-	-	-	-	-	-	12.49	2.20	-	-
	Qw	15%	-	-	-	-	0.90	0.16	-	-	-	-	-	-	-	-
LD	M	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qu	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	4%	-	-	2.55	0.11	3.43	0.14	30.04	1.25	16.21	0.68	25.23	1.05	-	-
	Qvrl	4%	-	-	-	-	-	-	-	-	-	-	0.08	0.00	-	-
	Qvt	4%	-	-	-	-	-	-	13.49	0.56	-	-	0.05	0.00	-	-
	Qw	4%	-	-	-	-	0.33	0.01	-	-	-	-	-	-	-	-
OG	M	0%	0.62	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	7.88	-	1.16	-	5.95	-	-	-	-	-	4.74	-	0.86	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	0%	-	-	-	-	-	-	-	-	-	-	0.04	-	1.50	-
	Qw	0%	0.56	-	0.05	-	7.41	-	-	-	-	-	-	-	-	-
F	M	0%	0.08	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B2-4. Miller Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)													
			MC-1 to MC-7												SDS Basins	
		% of total	MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		SDN-1	
Land Use	Soil Type	basin equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
	Qu	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	6.72	-	5.44	-	-	-	-	-	-	-	-	-	-	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qw	0%	4.17	-	1.28	-	-	-	-	-	-	-	-	-	-	-
	Wetland	0%	10.30		0.52		5.77		5.95		6.54		4.16		-	
	Lake		2.98		-		3.35		0.64		0.40		0.24		-	
	Mcrk-df		7.00		13.17		-		-		-		-		-	
	Other		-		-		-		-		-		-		-	
Basin total:			33.11	0.27	12.75	0.11	31.73	1.77	50.50	2.50	24.29	0.95	50.34	3.88	5.54	8.29
PERLND areas:																
(16)	Till-Forest		0.08		-		-		-		-		-		-	
(26)	Till-Grass		0.64		-		-		13.49		-		12.66		3.23	
(34)	Outwash-Forest		6.72		5.44		-		-		-		-		-	
(44)	Outwash-Grass		10.43		5.03		17.32		31.06		17.75		33.53		2.11	
(54)	Wetland		15.25		2.28		14.41		5.95		6.54		4.16		0.20	
	subtotal:		33.11		12.75		31.73		50.50		24.29		50.34		5.54	
IMPLND areas:																
	EIA			0.27		0.11		1.77		2.50		0.95		3.88		8.29
Basin total:			33.38		12.87		33.50		53.00		25.24		54.23		13.84	
Percent Impervious:				0.8%		0.9%		5.3%		4.7%		3.8%		7.2%		59.9%

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Table B2-4. Miller Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)													
			SDS Basins													
		% of total basin equal to EIA	SDN1-LWR		SDN1-OFF		SDN-2		SDN-2X		SDN-3		SDN-3X		SDN-4	
Land Use	Soil Type		Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
STIA	M	0%	-	-	-	-	8.43	-	-	-	7.17	-	-	-	19.66	-
	Qvr	0%	-	-	-	-	1.02	-	-	-	0.00	-	-	-	0.02	-
	Qvt	0%	-	-	-	-	-	-	-	-	18.87	-	-	-	0.06	-
	Qw	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TIA	100%	-	-	-	-	-	33.22	-	-	-	15.82	-	-	-	2.61
COMM	Qvr	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvrl	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRANS	M	0%	-	-	0.68	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	0.10	-	3.28	-	-	-	0.10	-	-	-	-	-	-	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	0%	-	-	1.76	-	-	-	-	-	-	-	-	-	-	-
	Qw	0%	-	-	1.63	-	-	-	-	-	-	-	-	-	-	-
	TIA	100%	-	0.38	-	7.88	-	-	-	0.28	-	-	-	-	-	-
MF	Qvr	47%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvrl	47%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HD	Qvr	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvrl	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	15%	-	-	20.51	3.62	-	-	-	-	-	-	-	-	-	-
	Qw	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LD	M	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qu	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvrl	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qw	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OG	M	0%	-	-	0.00	-	1.98	-	1.37	-	0.21	-	-	-	4.70	-
	Qvr	0%	4.87	-	0.33	-	2.02	-	5.74	-	0.00	-	5.34	-	3.16	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	0%	-	-	6.17	-	-	-	-	-	23.53	-	5.17	-	-	-
	Qw	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F	M	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B2-4. Miller Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)													
			SDS Basins													
		% of total	SDN1-LWR		SDN1-OFF		SDN-2		SDN-2X		SDN-3		SDN-3X		SDN-4	
Land Use	Soil Type	basin equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
	Qu	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	-	-	-	-	-	-	-	-	-	-	13.64	-	-	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	0%	-	-	-	-	-	-	-	-	-	-	0.65	-	-	-
	Qw	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wetland	0%	0.07		0.04		-		-		-		0.57		-	
	Lake		-		-		-		-		-		-		-	
	Mcrk-df		-		-		-		-		-		-		-	
	Other		-		0.04		-		-		-		-		-	
Basin total:			5.04	0.38	34.41	11.50	13.45	33.22	7.21	0.28	49.79	15.82	25.38	-	27.62	2.61
PERLND areas:																
(16)	Till-Forest		-		-		-		-		-		0.65		-	
(26)	Till-Grass		-		29.12		10.41		1.37		49.79		5.17		24.43	
(34)	Outwash-Forest		-		-		-		-		-		13.64		-	
(44)	Outwash-Grass		4.97		3.62		3.04		5.84		0.00		5.34		3.19	
(54)	Wetland		0.07		1.67		-		-		-		0.57		-	
	subtotal:		5.04		34.41		13.45		7.21		49.79		25.38		27.62	
IMPLND areas:																
	EIA			0.38		11.50		33.22		0.28		15.82		-		2.61
Basin total:			5.42		45.90		46.67		7.49		65.62		25.38		30.23	
Percent Impervious:				7.0%		25.0%		71.2%		3.7%		24.1%		0.0%		8.6%

Table B2-4. Miller Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)									
			SDS Basins									
		% of total basin equal to EIA	SDN-4X		MC-6B		MC-7B		Total		Percent of Total	
Land Use	Soil Type		Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
STIA	M	0%	1.29	-	0.82	-	4.92	-	42.29	-	3.39%	0.00%
	Qvr	0%	0.65	-	-	-	-	-	2.17	-	0.17%	0.00%
	Qvt	0%	-	-	-	-	0.46	-	21.13	-	1.69%	0.00%
	Qw	0%	-	-	-	-	-	-	0.17	-	0.01%	0.00%
	TIA	100%	-	0.00	-	-	-	0.66	-	59.40	0.00%	4.76%
COMM	Qvr	85%	-	-	-	-	-	-	5.91	33.48	0.47%	2.68%
	Qvrl	85%	-	-	-	-	-	-	0.46	2.60	0.04%	0.21%
	Qvt	85%	-	-	-	-	-	-	2.41	13.65	0.19%	1.09%
TRANS	M	0%	-	-	-	-	-	-	0.83	-	0.07%	0.00%
	Qvr	0%	-	-	-	-	-	-	37.71	-	3.02%	0.00%
	Qvrl	0%	-	-	-	-	-	-	3.48	-	0.28%	0.00%
	Qvt	0%	-	-	-	-	-	-	6.43	-	0.52%	0.00%
	Qw	0%	-	-	-	-	-	-	2.33	-	0.19%	0.00%
	TIA	100%	-	-	-	-	-	-	-	44.19	0.00%	3.54%
MF	Qvr	47%	-	-	-	-	-	-	34.37	30.48	2.76%	2.44%
	Qvrl	47%	-	-	-	-	-	-	0.20	0.17	0.02%	0.01%
HD	Qvr	15%	-	-	12.21	2.15	0.89	0.16	95.41	16.84	7.65%	1.35%
	Qvrl	15%	-	-	-	-	-	-	16.63	2.94	1.33%	0.24%
	Qvt	15%	-	-	-	-	6.81	1.20	79.29	13.99	6.36%	1.12%
	Qw	15%	-	-	-	-	-	-	0.90	0.16	0.07%	0.01%
LD	M	4%	-	-	-	-	-	-	0.16	0.01	0.01%	0.00%
	Qu	4%	-	-	-	-	-	-	0.01	0.00	0.00%	0.00%
	Qvr	4%	-	-	23.70	0.99	2.44	0.10	186.09	7.75	14.92%	0.62%
	Qvrl	4%	-	-	-	-	-	-	9.45	0.39	0.76%	0.03%
	Qvt	4%	-	-	-	-	-	-	21.56	0.90	1.73%	0.07%
	Qw	4%	-	-	-	-	-	-	0.33	0.01	0.03%	0.00%
OG	M	0%	0.02	-	1.66	-	0.83	-	11.66	-	0.93%	0.00%
	Qvr	0%	9.35	-	17.01	-	5.14	-	130.14	-	10.43%	0.00%
	Qvrl	0%	-	-	-	-	-	-	0.00	-	0.00%	0.00%
	Qvt	0%	0.25	-	32.46	-	23.14	-	135.09	-	10.83%	0.00%
	Qw	0%	-	-	0.06	-	-	-	8.56	-	0.69%	0.00%
F	M	0%	-	-	-	-	-	-	1.31	-	0.11%	0.00%

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Table B2-4. Miller Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)									
			SDS Basins									
		% of total	SDN-4X		MC-6B		MC-7B		Total		Percent of Total	
Land Use	Soil Type	basin equal to EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
	Qu	0%	-	-	-	-	-	-	0.77	-	0.06%	0.00%
	Qvr	0%	1.16	-	7.81	-	-	-	75.83	-	6.08%	0.00%
	Qvrl	0%	-	-	-	-	-	-	9.76	-	0.78%	0.00%
	Qvt	0%	-	-	-	-	-	-	20.34	-	1.63%	0.00%
	Qw	0%	-	-	-	-	-	-	5.45	-	0.44%	0.00%
	Wetland	0%	-		4.55		1.92		51.73	-	4.15%	0.00%
	Lake		-		-		-		8.06		0.65%	0.00%
	Mcrk-df		-		-		-		20.24		1.62%	0.00%
	Other		-		-		-		0.04		0.00%	0.00%
Basin total:			12.73	0.00	100.27	3.14	46.54	2.12	1020.36	226.97	81.80%	18.20%
PERLND areas:												
(16)	Till-Forest		-		-		-		31.42		2.52%	
(26)	Till-Grass		1.57		34.94		36.16		351.08		28.15%	
(34)	Outwash-Forest		1.16		7.81		-		76.60		6.14%	
(44)	Outwash-Grass		10.01		52.91		8.46		491.81		39.43%	
(54)	Wetland		-		4.61		1.92		69.46		5.57%	
	subtotal:		12.73		100.27		46.54		1020.36		81.80%	
IMPLND areas:												
	EIA			0.00		3.14		2.12		226.97		18.20%
Basin total:			12.73		103.41		48.66		1247.33		100.00%	
Percent Impervious:				0.0%		3.0%		4.4%				

Table B2-5. Miller Creek subbasin characteristics - 1994 base condition (non-STIA basins).

Land Use			Sub-basin Areas (acres)															
		% of total basin equal to EIA	Non-STIA Basins of M-1 to M-24															
			M-1		M-2		M-3		M-4		M-4A		M-11		M-12		M-13	
Land Use	Soil Type		Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
Bare	M	85%	-	-	0.49	2.77	-	-	0.00	0.01	0.37	2.11	0.24	1.33	-	-	-	-
Ground	Qb	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asphalt	Qvi	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	85%	0.76	4.31	0.85	4.82	1.58	8.96	0.56	3.18	0.99	5.61	11.64	65.96	1.21	6.86	-	-
	Qvrl	85%	-	-	-	-	-	-	-	-	-	-	0.67	3.77	1.21	6.88	-	-
	Qvt	85%	3.62	20.53	1.99	11.26	0.10	0.56	0.12	0.71	0.54	3.03	9.34	52.91	5.32	30.15	1.09	6.20
	Qw	85%	-	-	-	-	-	-	-	-	0.07	0.37	-	-	0.25	1.42	-	-
	Qyal	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bare	M	85%	-	-	-	-	-	-	-	-	-	-	0.01	0.04	-	-	-	-
Rock	Qvr	85%	0.05	0.26	-	-	0.02	0.13	-	-	-	-	0.59	3.36	0.11	0.62	-	-
Concrete	Qvrl	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvt	85%	0.07	0.39	-	-	-	-	-	-	0.05	0.26	0.26	1.48	0.14	0.80	-	-
Develop	M	85%	-	-	0.22	1.27	-	-	-	-	0.08	0.47	0.11	0.61	-	-	-	-
High	Qb	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intensity	Qpf	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvi	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	85%	0.43	2.46	0.06	0.34	0.59	3.33	0.23	1.31	0.10	0.57	7.59	42.99	0.50	2.81	-	-
	Qvrl	85%	-	-	-	-	-	-	-	-	-	-	0.12	0.70	0.18	1.03	-	-
	Qvt	85%	0.87	4.95	0.47	2.68	0.24	1.38	0.08	0.45	1.70	9.64	5.96	33.78	2.64	14.97	0.87	4.95
	Qw	85%	0.00	0.02	-	-	-	-	-	-	0.00	0.02	-	-	0.27	1.52	-	-
	Qyal	85%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Develop	M	10%	-	-	0.43	0.05	-	-	0.87	0.10	1.89	0.21	0.67	0.07	-	-	-	-
Medium	Qb	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intensity	Qpf	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvi	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	10%	25.02	2.78	23.96	2.66	30.84	3.43	43.41	4.82	11.93	1.33	34.17	3.80	29.76	3.31	-	-
	Qvrl	10%	-	-	-	-	-	-	-	-	-	-	1.07	0.12	4.03	0.45	-	-
	Qvt	10%	153.51	17.06	113.34	12.59	51.26	5.70	37.01	4.11	19.59	2.18	161.00	17.89	65.20	7.24	122.70	13.63
	Qvu	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qw	10%	0.42	0.05	-	-	0.04	0.00	-	-	0.35	0.04	-	-	0.05	0.01	-	-
	Qyal	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Develop.	M	4%	-	-	-	-	-	-	1.01	0.04	1.81	0.08	0.45	0.02	-	-	-	-
Low	Qb	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intensity	Qpf	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qu	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvi	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	4%	10.82	0.45	13.18	0.55	42.19	1.76	44.72	1.86	49.05	2.04	10.49	0.44	21.25	0.89	-	-
	Qvrl	4%	-	-	-	-	-	-	-	-	-	-	0.15	0.01	3.02	0.13	-	-
	Qvt	4%	66.93	2.79	77.05	3.21	49.44	2.06	43.74	1.82	27.82	1.16	36.85	1.54	18.11	0.75	69.05	2.88
	Qvu	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qw	4%	1.98	0.08	-	-	-	-	-	-	0.82	0.03	-	-	0.07	0.00	-	-
	Qyal	4%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table B2-5. Miller Creek subbasin characteristics - 1994 base condition (non-STIA basins).

Land Use			Sub-basin Areas (acres)															
		% of total basin equal to	Non-STIA Basins of M-1 to M-24															
			M-1		M-2		M-3		M-4		M-4A		M-11		M-12		M-13	
Land Use	Soil Type	EIA	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
Grass	M	0%	-	-	0.62	-	-	-	0.01	-	2.76	-	-	-	-	-	-	-
	Qb	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qpf	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	0.95	-	0.65	-	27.67	-	3.14	-	16.01	-	1.17	-	2.16	-	-	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	-	-	0.62	-	-	-
	Qvt	0%	7.36	-	5.44	-	7.34	-	3.11	-	5.04	-	1.04	-	0.71	-	3.96	-
	Qw	0%	0.39	-	-	-	-	-	-	-	1.28	-	-	-	-	-	-	-
	Qyal	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forest	M	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qpf	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qu	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvi	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qvr	0%	3.07	-	0.46	-	16.02	-	3.75	-	22.06	-	1.32	-	5.64	-	-	-
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	-	-	0.08	-	-	-
	Qvt	0%	3.41	-	5.56	-	8.26	-	2.95	-	8.66	-	0.89	-	0.31	-	0.79	-
	Qw	0%	1.08	-	-	-	-	-	-	-	0.66	-	-	-	-	-	-	-
	Qyal	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Wetland		-		-		-		-		9.32		-		-		-	
	Lake		4.59		-		-		-		2.13		-		0.65		41.70	
	Other		-		-		-		-		-		-		-		-	
Basin total:			280.75	56.14	244.78	42.22	235.59	27.30	184.72	18.43	173.62	29.14	285.78	230.80	162.84	79.83	198.47	27.66
PERLND areas:																		
perlnd 16 Till-forest			3.41		5.56		8.26		2.95		8.66		0.89		0.39		0.79	
perlnd 26 Till-grass			232.36		200.05		108.38		85.95		61.64		217.92		101.18		197.68	
perlnd 34 Outwash-forest			3.07		0.46		16.02		3.75		22.06		1.32		5.64		-	
perlnd 44 Outwash-grass			38.03		38.71		102.89		92.06		78.09		65.65		54.98		-	
perlnd 54 Wetland			3.87		-		0.04		-		12.50		-		0.64		-	
subtotal:			280.75		244.78		235.59		184.72		182.95		285.78		162.84		198.47	
IMPLND areas:																		
EIA				56.14		42.22		27.30		18.43		29.14		230.80		79.83		27.66
Basin total:			336.89		286.99		262.89		203.14		212.09		516.59		242.67		226.12	
Percent Impervious:				16.7%		14.7%		10.4%		9.1%		13.7%		44.7%		32.9%		12.2%

Table B2-5. Miller Creek subbasin characteristics - 1994 base condition (non-STIA basins).

Land Use			Sub-basin Areas (acres)													
		% of total	Non-STIA Basins of M-1 to M-24													
		basin	M-14		M-15		M-17		M-23		M-24		Total		Percent of Total	
Land	Soil	equal to		Effective		Effective		Effective		Effective		Effective		Effective		Effective
Use	Type	EIA	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious
Bare	M	85%	-	-	-	-	-	-	-	-	1.19	6.75	2.29	12.98	0.07%	0.38%
Ground	Qb	85%	-	-	-	-	0.06	0.31	-	-	-	-	0.06	0.31	0.00%	0.01%
Asphalt	Qvi	85%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvr	85%	0.02	0.13	0.99	5.61	0.24	1.39	1.12	6.34	2.54	14.41	22.52	127.59	0.66%	3.76%
	Qvrl	85%	-	-	0.42	2.38	-	-	0.17	0.96	-	-	2.47	13.99	0.07%	0.41%
	Qvt	85%	0.81	4.60	0.03	0.19	-	-	3.61	20.44	3.69	20.88	30.26	171.45	0.89%	5.05%
	Qw	85%	-	-	-	-	0.01	0.04	-	-	-	-	0.32	1.83	0.01%	0.05%
	Qyal	85%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
Bare	M	85%	-	-	-	-	-	-	-	-	-	-	0.01	0.04	0.00%	0.00%
Rock	Qvr	85%	-	-	-	-	0.19	1.05	0.16	0.93	0.53	3.02	1.65	9.37	0.05%	0.28%
Concrete	Qvrl	85%	-	-	0.05	0.26	-	-	-	-	-	-	0.05	0.26	0.00%	0.01%
	Qvt	85%	0.12	0.66	-	-	-	-	0.16	0.91	0.07	0.39	0.86	4.89	0.03%	0.14%
Develop	M	85%	-	-	-	-	-	-	-	-	0.17	0.97	0.59	3.32	0.02%	0.10%
High	Qb	85%	-	-	-	-	0.03	0.16	-	-	-	-	0.03	0.16	0.00%	0.00%
Intensity	Qpf	85%	-	-	0.03	0.15	-	-	-	-	-	-	0.03	0.15	0.00%	0.00%
	Qvi	85%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvr	85%	0.02	0.13	0.14	0.77	0.56	3.15	0.33	1.88	1.45	8.20	11.99	67.96	0.35%	2.00%
	Qvrl	85%	-	-	0.12	0.66	-	-	0.22	1.27	-	-	0.64	3.65	0.02%	0.11%
	Qvt	85%	0.35	1.97	0.07	0.39	-	-	1.38	7.83	1.33	7.54	15.98	90.53	0.47%	2.67%
	Qw	85%	-	-	-	-	-	-	-	-	-	-	0.28	1.56	0.01%	0.05%
	Qyal	85%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
Develop	M	10%	-	-	-	-	-	-	-	-	2.47	0.27	6.33	0.70	0.19%	0.02%
Medium	Qb	10%	-	-	-	-	0.17	0.02	-	-	-	-	0.17	0.02	0.01%	0.00%
Intensity	Qpf	10%	0.16	0.02	1.37	0.15	2.75	0.31	-	-	-	-	4.28	0.48	0.13%	0.01%
	Qvi	10%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvr	10%	13.61	1.51	20.11	2.23	5.84	0.65	28.90	3.21	40.50	4.50	308.06	34.23	9.08%	1.01%
	Qvrl	10%	-	-	3.38	0.38	-	-	2.78	0.31	-	-	11.26	1.25	0.33%	0.04%
	Qvt	10%	82.83	9.20	27.53	3.06	1.20	0.13	111.89	12.43	103.71	11.52	1050.76	116.75	30.96%	3.44%
	Qvu	10%	-	-	-	-	0.07	0.01	-	-	-	-	0.07	0.01	0.00%	0.00%
	Qw	10%	-	-	-	-	0.38	0.04	-	-	-	-	1.24	0.14	0.04%	0.00%
	Qyal	10%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
Develop.	M	4%	-	-	-	-	-	-	-	-	0.19	0.01	3.46	0.14	0.10%	0.00%
Low	Qb	4%	-	-	-	-	0.05	0.00	-	-	-	-	0.05	0.00	0.00%	0.00%
Intensity	Qpf	4%	2.21	0.09	3.36	0.14	8.61	0.36	-	-	-	-	14.18	0.59	0.42%	0.02%
	Qu	4%	-	-	1.42	0.06	-	-	-	-	-	-	1.42	0.06	0.04%	0.00%
	Qvi	4%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvr	4%	23.03	0.96	55.70	2.32	51.91	2.16	14.46	0.60	17.88	0.74	354.68	14.78	10.45%	0.44%
	Qvrl	4%	-	-	7.20	0.30	-	-	2.73	0.11	-	-	13.10	0.55	0.39%	0.02%
	Qvt	4%	33.29	1.39	9.84	0.41	14.64	0.61	29.04	1.21	18.29	0.76	494.07	20.59	14.56%	0.61%
	Qvu	4%	-	-	-	-	0.40	0.02	-	-	-	-	0.40	0.02	0.01%	0.00%
	Qw	4%	-	-	-	-	0.98	0.04	-	-	-	-	3.84	0.16	0.11%	0.00%
	Qyal	4%	-	-	-	-	0.82	0.03	-	-	-	-	0.82	0.03	0.02%	0.00%

Table B2-5. Miller Creek subbasin characteristics - 1994 base condition (non-STIA basins).

Land Use			Sub-basin Areas (acres)													
		% of total	Non-STIA Basins of M-1 to M-24													
		basin	M-14		M-15		M-17		M-23		M-24		Total		Percent of Total	
Land	Soil	equal to		Effective		Effective		Effective		Effective		Effective		Effective		Effective
Use	Type	EIA	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious
Grass	M	0%	-	-	-	-	-	-	-	-	0.89	-	4.29	-	0.13%	0.00%
	Qb	0%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qpf	0%	0.20	-	0.45	-	0.99	-	-	-	-	-	1.63	-	0.05%	0.00%
	Qvr	0%	2.66	-	2.97	-	9.39	-	0.87	-	6.39	-	74.01	-	2.18%	0.00%
	Qvrl	0%	-	-	0.23	-	-	-	0.79	-	-	-	1.64	-	0.05%	0.00%
	Qvt	0%	1.28	-	0.70	-	0.47	-	3.37	-	3.43	-	43.23	-	1.27%	0.00%
	Qw	0%	-	-	-	-	0.55	-	-	-	-	-	2.22	-	0.07%	0.00%
	Qyal	0%	-	-	-	-	0.04	-	-	-	-	-	0.04	-	0.00%	0.00%
Forest	M	0%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qpf	0%	2.48	-	-	-	1.83	-	-	-	-	-	4.31	-	0.13%	0.00%
	Qu	0%	-	-	3.20	-	-	-	-	-	-	-	3.20	-	0.09%	0.00%
	Qvi	0%	-	-	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvr	0%	10.98	-	46.89	-	29.25	-	2.25	-	2.02	-	143.73	-	4.23%	0.00%
	Qvrl	0%	-	-	0.41	-	-	-	1.03	-	-	-	1.52	-	0.04%	0.00%
	Qvt	0%	0.24	-	6.18	-	0.90	-	2.06	-	-	-	40.22	-	1.18%	0.00%
	Qw	0%	-	-	-	-	0.27	-	-	-	-	-	2.01	-	0.06%	0.00%
	Qyal	0%	-	-	-	-	3.73	-	-	-	-	-	3.73	-	0.11%	0.00%
	Wetland		-		-		-		-		-		9.32		0.27%	
	Lake		-		-		0.24		0.94		0.33		50.58		1.49%	
	Other		-		-		-		-		-		-		0.00%	
Basin total:			174.29	20.66	192.75	19.47	136.33	10.49	207.33	58.44	206.74	79.98	2693.31	700.55	79.36%	20.64%
PERLND areas:																
perlnd 16 Till-forest			0.24		6.59		0.90		3.09		-		41.74		1.23%	
perlnd 26 Till-grass			118.67		49.55		16.31		156.15		135.43		1681.27		49.54%	
perlnd 34 Outwash-forest			13.46		50.09		34.82		2.25		2.02		154.97		4.57%	
perlnd 44 Outwash-grass			41.91		86.52		82.11		45.84		69.29		796.09		23.46%	
perlnd 54 Wetland			-		-		2.19		-		-		19.24		0.57%	
subtotal:			174.29		192.75		136.33		207.33		206.74		2693.31		79.36%	
IMPLND areas:																
EIA				20.66		19.47		10.49		58.44		79.98		700.55		20.64%
Basin total:			194.94		212.22		146.82		265.77		286.72		3393.86		100.00%	
Percent Impervious:				10.6%		9.2%		7.1%		22.0%		27.9%				

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Table B2-6. Walker Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)											
		% of total basin	M-20		MC-8		MC-9		MC-8B		Total		Percent of Total	
Land Use	Soil Type	equal to EIA	Pervious	Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
STIA	M	0%	-	-	-	-	1.39	-	0.69	-	2.09	-	0.89%	0.00%
	Qvr	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvt	0%	-	-	-	-	-	-	0.63	-	0.63	-	0.27%	0.00%
	Qw	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	TIA	100%	-	-	-	-	-	0.31	-	0.28	-	0.59		
COMM	Qvr	85%	7.04	39.91	-	-	-	-	-	-	7.04	39.91	3.01%	17.08%
	Qvrl	85%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvt	85%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
TRANS	M	0%	1.74	-	-	-	1.76	-	-	-	3.50	-	1.50%	0.00%
	Qvr	0%	10.76	-	1.19	-	0.33	-	-	-	12.28	-	5.26%	0.00%
	Qvrl	0%	0.95	-	-	-	-	-	-	-	0.95	-	0.41%	0.00%
	Qvt	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qw	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	TIA	100%	-	11.38	-	0.01	-	0.01	-	-	-	11.39		
MF	Qvr	47%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvrl	47%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
HD	Qvr	15%	3.66	0.65	5.02	0.89	-	-	2.90	0.51	11.58	2.04	4.96%	0.87%
	Qvrl	15%	0.16	0.03	-	-	-	-	-	-	0.16	0.03	0.07%	0.01%
	Qvt	15%	-	-	5.08	0.90	-	-	5.19	0.92	10.27	1.81	4.39%	0.78%
	Qw	15%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
LD	M	4%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qu	4%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvr	4%	20.81	0.87	-	-	-	-	-	-	20.81	0.87	8.91%	0.37%
	Qvrl	4%	0.00	0.00	-	-	-	-	-	-	0.00	0.00	0.00%	0.00%
	Qvt	4%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qw	4%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
OG	M	0%	-	-	-	-	6.17	-	1.53	-	7.70	-	3.30%	0.00%
	Qvr	0%	11.16	-	14.70	-	3.60	-	12.56	-	42.02	-	17.98%	0.00%
	Qvrl	0%	9.37	-	-	-	-	-	-	-	9.37	-	4.01%	0.00%
	Qvt	0%	0.31	-	0.11	-	-	-	11.16	-	11.58	-	4.96%	0.00%
	Qw	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
F	M	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qu	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvr	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvrl	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvt	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qw	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%

Table B2-6. Walker Creek subbasin characteristics - 1994 base condition (STIA basins).

Land Use			Sub-basin Areas (acres)											
		% of total basin	M-20		MC-8		MC-9		MC-8B		Total		Percent of Total	
Land Use	Soil Type	equal to EIA	Pervious	Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
--	Wetland	0%	33.43		2.91		• 0.08		0.61		37.04	-	15.85%	0.00%
	Lake		-		-		-		-		-		0.00%	0.00%
	Mcrk-df		-		-		-		-		-		0.00%	0.00%
	Other		-		-		-		-		-		0.00%	0.00%
Basin total:			99.40	52.83	29.02	1.79	13.34	0.32	35.27	1.71	177.03	56.65	75.76%	24.24%
PERLND areas:														
(16)	Till-Forest		-		-		-		-		-		0.00%	
(26)	Till-Grass		12.53		5.19		9.33		19.21		46.25		19.79%	
(34)	Outwash-Forest		-		-		-		-		-		0.00%	
(44)	Outwash-Grass		53.43		20.92		3.93		15.45		93.74		40.11%	
(54)	Wetland		33.43		2.91		0.08		0.61		37.04		15.85%	
	subtotal:		99.40		29.02		13.34		35.27		177.03		75.76%	
IMPLND areas:														
	EIA			52.83		1.79		0.32		1.71		56.65		24.24%
Basin total:			152.23		30.81		13.66		36.98		233.68		100.00%	
Percent Impervious:				34.7%		5.8%		2.3%		4.6%				

Table B2-7. Walker Creeks subbasin characteristics - 1994 base condition (non-STIA basins).

Land Use			Sub-basin Areas (acres)											
		% of total basin equal to EIA	Non-STIA Basins of M-1 to M-24											
			M-18		M-19		M-21		M-22		Total		Percent of Total	
Land Use	Soil Type		Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious	Pervious	Effective Impervious
Bare	M	85%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
Ground	Qb	85%	-	-	-	-	-	-	0.20	1.11	0.20	1.11	0.03%	0.16%
Asphalt	Qvi	85%	-	-	-	-	-	-	0.00	0.01	0.00	0.01	0.00%	0.00%
	Qvr	85%	-	-	2.12	12.02	2.55	14.45	-	-	4.67	26.47	0.69%	3.89%
	Qvrl	85%	-	-	0.03	0.14	-	-	-	-	0.03	0.14	0.00%	0.02%
	Qvt	85%	-	-	0.08	0.46	0.66	3.76	-	-	0.74	4.22	0.11%	0.62%
	Qw	85%	-	-	-	-	-	-	0.06	0.32	0.06	0.32	0.01%	0.05%
	Qyal	85%	-	-	-	-	-	-	0.02	0.13	0.02	0.13	0.00%	0.02%
Bare	M	85%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
Rock	Qvr	85%	-	-	0.02	0.10	0.09	0.52	-	-	0.11	0.62	0.02%	0.09%
Concrete	Qvrl	85%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvt	85%	-	-	-	-	0.03	0.15	-	-	0.03	0.15	0.00%	0.02%
Develop	M	85%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
High	Qb	85%	-	-	-	-	-	-	0.04	0.25	0.04	0.25	0.01%	0.04%
Intensity	Qpf	85%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvi	85%	-	-	-	-	-	-	0.02	0.11	0.02	0.11	0.00%	0.02%
	Qvr	85%	0.01	0.05	0.41	2.31	0.92	5.20	-	-	1.34	7.57	0.20%	1.11%
	Qvrl	85%	-	-	0.11	0.60	-	-	-	-	0.11	0.60	0.02%	0.09%
	Qvt	85%	-	-	0.27	1.52	1.15	6.51	-	-	1.42	8.03	0.21%	1.18%
	Qw	85%	-	-	-	-	-	-	0.02	0.13	0.02	0.13	0.00%	0.02%
	Qyal	85%	-	-	-	-	-	-	0.12	0.66	0.12	0.66	0.02%	0.10%
Develop	M	10%	-	-	0.71	0.08	-	-	-	-	0.71	0.08	0.10%	0.01%
Medium	Qb	10%	-	-	-	-	-	-	0.14	0.02	0.14	0.02	0.02%	0.00%
Intensity	Qpf	10%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvi	10%	-	-	-	-	1.47	0.16	4.17	0.46	5.65	0.63	0.83%	0.09%
	Qvr	10%	6.70	0.74	45.89	5.10	52.06	5.78	0.07	0.01	104.71	11.63	15.40%	1.71%
	Qvrl	10%	-	-	21.79	2.42	-	-	-	-	21.79	2.42	3.20%	0.36%
	Qvt	10%	2.21	0.25	16.06	1.78	75.17	8.35	-	-	93.43	10.38	13.74%	1.53%
	Qvu	10%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qw	10%	-	-	-	-	-	-	0.81	0.09	0.81	0.09	0.12%	0.01%
	Qyal	10%	-	-	-	-	0.02	0.00	1.31	0.15	1.33	0.15	0.20%	0.02%
Develop.	M	4%	-	-	1.23	0.05	-	-	-	-	1.23	0.05	0.18%	0.01%
Low	Qb	4%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
Intensity	Qpf	4%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qu	4%	-	-	0.10	0.00	-	-	-	-	0.10	0.00	0.01%	0.00%
	Qvi	4%	-	-	-	-	2.87	0.12	6.50	0.27	9.37	0.39	1.38%	0.06%
	Qvr	4%	41.48	1.73	44.89	1.87	57.86	2.41	0.71	0.03	144.93	6.04	21.31%	0.89%
	Qvrl	4%	-	-	37.05	1.54	-	-	-	-	37.05	1.54	5.45%	0.23%
	Qvt	4%	12.79	0.53	12.72	0.53	52.24	2.18	-	-	77.75	3.24	11.43%	0.48%
	Qvu	4%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qw	4%	-	-	-	-	-	-	0.42	0.02	0.42	0.02	0.06%	0.00%
	Qyal	4%	-	-	-	-	0.36	0.02	4.61	0.19	4.98	0.21	0.73%	0.03%

Table B2-7. Walker Creeks subbasin characteristics - 1994 base condition (non-STIA basins).

Land Use			Sub-basin Areas (acres)											
		% of total	Non-STIA Basins of M-1 to M-24											
		basin	M-18		M-19		M-21		M-22		Total		Percent of Total	
	Soil	equal to		Effective		Effective		Effective		Effective		Effective		Effective
Land Use	Type	EIA	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious
Grass	M	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qb	0%	-	-	-	-	-	-	0.01	-	0.01	-	0.00%	0.00%
	Qpf	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qvr	0%	1.03	-	2.13	-	5.18	-	0.08	-	8.43	-	1.24%	0.00%
	Qvrl	0%	-	-	1.70	-	-	-	-	-	1.70	-	0.25%	0.00%
	Qvt	0%	1.08	-	0.34	-	3.66	-	-	-	5.08	-	0.75%	0.00%
	Qw	0%	-	-	-	-	-	-	1.83	-	1.83	-	0.27%	0.00%
	Qyal	0%	-	-	-	-	-	-	1.49	-	1.49	-	0.22%	0.00%
Forest	M	0%	-	-	0.32	-	-	-	-	-	0.32	-	0.05%	0.00%
	Qpf	0%	-	-	-	-	-	-	-	-	-	-	0.00%	0.00%
	Qu	0%	-	-	0.24	-	-	-	-	-	0.24	-	0.04%	0.00%
	Qvi	0%	-	-	-	-	-	-	0.64	-	0.64	-	0.09%	0.00%
	Qvr	0%	20.95	-	8.15	-	5.96	-	1.32	-	36.37	-	5.35%	0.00%
	Qvrl	0%	-	-	12.09	-	-	-	-	-	12.09	-	1.78%	0.00%
	Qvt	0%	0.76	-	0.30	-	7.61	-	-	-	8.67	-	1.27%	0.00%
	Qw	0%	-	-	-	-	-	-	0.07	-	0.07	-	0.01%	0.00%
	Qyal	0%	-	-	-	-	0.13	-	2.35	-	2.47	-	0.36%	0.00%
	Wetland		-		-		-		-		-		0.00%	
	Lake		-		0.25		-		0.47		0.72		0.11%	
	Other		-		-		-		-		-		0.00%	
Basin total:			87.00	3.30	208.72	30.53	269.99	49.63	27.01	3.95	592.72	87.41	87.15%	12.85%
PERLND areas:														
perlnd 16	Till-forest		0.76		12.72		7.61		-		21.08		3.10%	
perlnd 26	Till-grass		16.08		92.07		132.91		-		241.06		35.44%	
perlnd 34	Outwash-forest		20.95		8.39		6.09		4.30		39.72		5.84%	
perlnd 44	Outwash-grass		49.22		95.55		123.39		19.49		287.65		42.29%	
perlnd 54	Wetland		-		-		-		3.21		3.21		0.47%	
	subtotal:		87.00		208.72		269.99		27.01		592.72		87.15%	
IMPLND areas:														
	EIA			3.30		30.53		49.63		3.95		87.41		12.85%
Basin total:			90.30		239.25		319.62		30.96		680.13		100.00%	
Percent Impervious:				3.7%		12.8%		15.5%		12.8%				

AR 010974

3. MILLER CREEK

3.1 WATERSHED BOUNDARIES

Separate field investigations by Dave Harms and Ron Simmons of Parametrix identified areas where subbasin boundaries required modification. The boundary for subbasin M11 was moved to the north to include a portion of M24 and additional area previously considered to be out of the Miller Creek basin. A new subbasin (M23) was created to include area previously outside of the drainage basin to the west. City of Burien drainage basin mapping supports creation of subbasin M23 for this model. Subbasin M23 discharges through the Hermes depression. Another new subbasin (M24) was created, primarily as a result of subdividing M2, to separate two conveyance systems. M4 was subdivided into subbasins M4 and M4A. M4A consists primarily of airport buyout areas, where the team estimated the percent effective impervious area from aerial photography to be approximately 7 percent.

3.2 GROUNDWATER ROUTING

Groundwater plays a key role in properly calibrating the Miller Creek watershed. Using the standard assumption that all groundwater generated within the Miller Creek watershed surface water boundaries drains to Miller Creek upstream of the gage site, simulated streamflows at the mouth of Miller Creek are nearly double that of observed streamflows. This result indicated that the Miller Creek watershed contributes to recharging a deeper underlying aquifer. The exact relationship between this deep aquifer and Miller Creek is unknown. However, a groundwater contour map (Figure B2-2) was prepared as part of a groundwater study performed by S.S. Papadopulos and Associates, Inc. using nearly 700 well logs. This map was used by the team as the basis for the groundwater routing in the calibration of the Miller Creek watershed. Figures B2-3a and B2-3b show detailed routing schematics, which include the routing of all surface water, interflow, and groundwater.

3.3 FTABLES

All the stage-storage-discharge relationships from the previous model were reviewed. As a result, FTABLEs 1, 4, 10, 11, 12, 13, 14, 15, 16, 17, 34, 35, 50, 53, and 54 were modified.

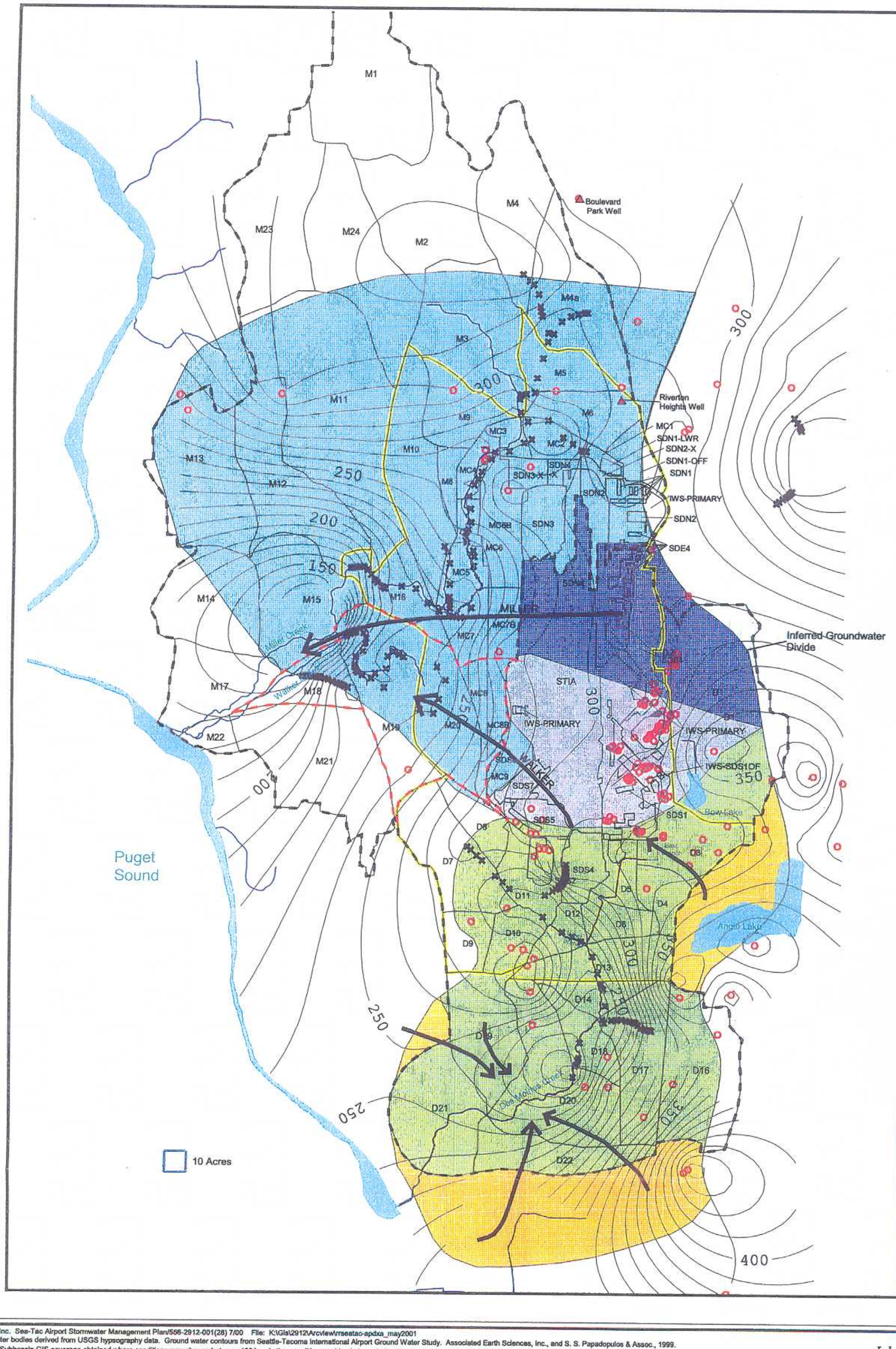
In addition to the above changes, four new FTABLES were added to the model:

1 Subbasin M3 detention facility. RCHRES number 33.

2 Vacca Farm. RCHRES number 135.

3 Hermes depression. RCHRES number 23.

4 Downstream of Hermes depression. RCHRES number 24.



Parametrix, Inc. Sea-Tac Airport Stormwater Management Plan/556-2912-001(28) 7/00 File: K:\Gis\2912\Arcview\rrseatac-apdxa_may2001
Source: Water bodies derived from USGS hypsography data. Ground water contours from Seattle-Tacoma International Airport Ground Water Study. Associated Earth Sciences, Inc., and S. S. Papadopulos & Assoc., 1999.
Note: STIA Subbassin GIS coverage obtained where conditions may change between 1994 and other conditions; subbasin boundaries shown outside of STIA area are for illustration and reference only.

N

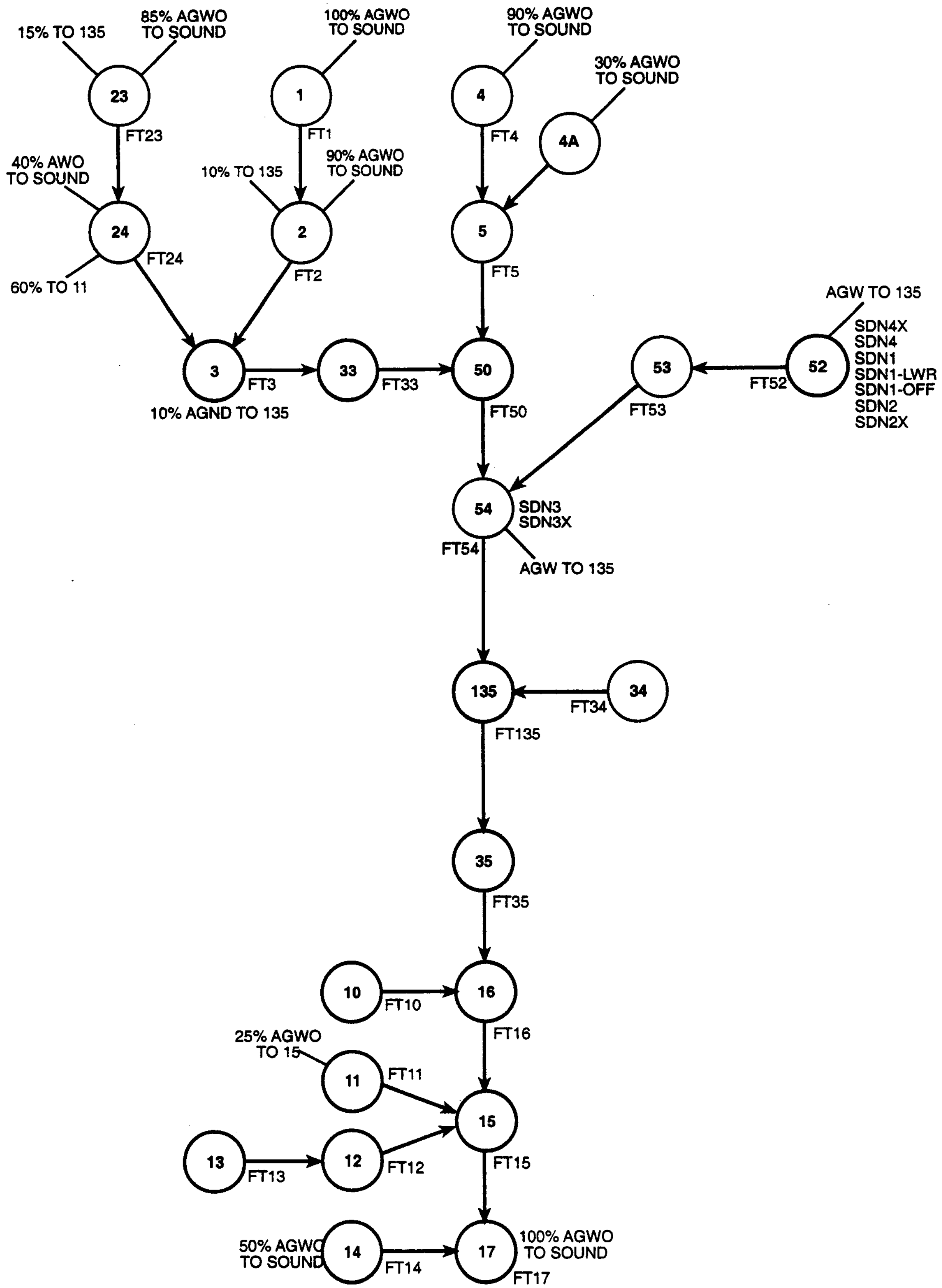
1000 0 1000 2000 Feet

1:36,000

- Existing (1994) Drainage Subbasins
- STIA Area (see note)
- Watershed Boundary
- Subwatershed Boundaries
- Rivers
- Roads
- Water Bodies
- Noncontiguous Miller Creek groundwater area
- Noncontiguous Walker Creek groundwater area
- Contiguous Miller/Walker groundwater area
- Noncontiguous Des Moines Creek groundwater area
- Contiguous Des Moines Creek groundwater area
- Ground water elevation contour (10 ft. interval) for shallow (C1) aquifer
- Data Point (e.g. monitoring well)
- Wells
- XXX Locations where ground water elevation intersects stream channel
- General ground water flow direction

July 2001
556-2912-001 (28)

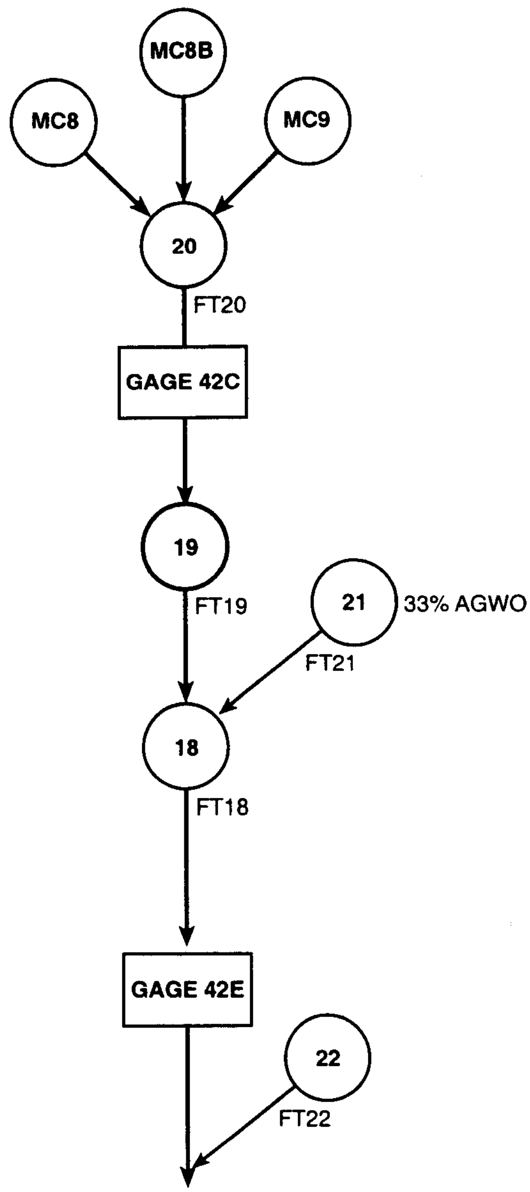
Figure B2-2 Groundwater Flow Direction and Boundaries



Parametrix, Inc. Port of Seattle/556-2912-001(028) 8/00 (K)

Figure B2-3a
HSPF Model Schematic
Miller Creek

AR 010977



July 2001
556-2912-001 (28)

Figure B2-3b
HSPF Model Schematic
Walker Creek

3.4 ROUTING

The following changes were made to the Miller Creek model to reflect updated information about the watershed drainage characteristics:

- MC9 was routed to Lora Lake.
- MC4 & MC6 were routed downstream to Reach 35.
- MC6B was routed to Reach 35.
- MC7B was routed to Reach 35.
- M8 was routed to Reach 35.
- M6 was routed directly to Lake Reba.
- M9 was routed directly to Lora Lake.
- Reaches 51 and 52 were combined to form Reach 52, with FTABLE 52.
- MC3 was routed to Reach 54.
- M3 detention storage was modified based on field visit.
- Reach 50 was routed directly to reach 54 (MCDF).
- A new reach was added upstream of Reach 50.

3.5 LAKES

Arbor, Tub, and Lora Lakes are all underlain by outwash soils. Field inspection indicated that these lakes can drop several feet below the outlets during the summer dry period. This cannot be accomplished by evaporation alone. As a result, a small amount of seepage (0.11 cfs) from each of the lakes was modeled.

3.6 HERMES POND

Hermes Pond is a natural depression that has been modified to serve as a stormwater detention facility. All of subbasin 23 drains to this depression and there is no natural outlet. As a result, two pumps have been installed in an attempt to keep the depression from flooding. The maximum capacity of the outlet pipe is 0.5 cfs. Using this set of assumptions, the simulated elevation of the depression is much higher than the observed maximum flood stage. As with the lakes, Hermes depression is underlain by outwash soils. Using seepage in the range of 0.05 to 0.4 cfs resulted in a corresponding maximum flood stage near that which has been observed.

3.7 CALIBRATION PERLND PARAMETERS

Seven PERLND parameters were adjusted in the following manner:

- The LZSN value for all soils was doubled from 4.5 to 9.0 for till soils and from 5.0 to 10.0 for outwash soils. This was done to increase the ability of the soil to store moisture. The basis for this change is related to the thick layers of permeable soil overlaying the till layer for much of the till soils.
- INFILT was multiplied by four for all till soils in an effort to infiltrate more runoff.
- INFEXP was set to 2.0 for all soils.
- DEEPFR was set to 0.33 for all soil types. This represents the loss of groundwater from the Miller Creek watershed to a deeper aquifer.
- UZSN was doubled for all soils. This increases evaporation from the soil surface and decreases summer and fall peaks. This adjustment improved the overall simulation performance during these time frames.
- INTFW was set to nine for till soils. This reduces the amount of surface runoff, again reducing peak flows.
- IRC has been set to 0.7 for all till soils.

AR 010980

4. MILLER CREEK CALIBRATION RESULTS

4.1 MILLER CREEK STREAMFLOW AT THE MOUTH

Calibration was performed for water-years 1993 through 1996. Total simulated runoff volume for the calibration period was within 0.75 inch of the total observed volume (Table B2-8). Simulated runoff volumes for water-years 1994 and 1996 are within 0.60 inch of observed runoff volumes. Simulated runoff volumes for water-years 1993 and 1995 are within 2.45 inches of observed runoff volumes. However, the streamflow gage was down for 4 months during water-year 1995. Examination of the recorded data after a gage malfunction in December and January of water-year 1995 indicates possible disruption in the reliability of the recorded data for the months of January through May. The gage again malfunctioned starting in June of 1995 and lasting until the middle of October 1995. These chronic problems during water-year 1995 call into question the overall reliability of the gaged streamflow data for this water-year. Figures B2-4 through B2-7 show the annual simulated and observed streamflow for water-years 1993 through 1996 at the mouth of Miller Creek.

4.2 MILLER CREEK STREAMFLOW DOWNSTREAM OF THE REGIONAL DETENTION FACILITY.

Calibration was performed for water-years 1993 through 1996. Total simulated runoff volume for the calibration period is within 0.9 inch of the total observed volume. Simulated runoff volumes for three of the four water-years are higher than observed runoff volumes. The largest over-simulation error is 0.56 inch, which occurs in water-year 1993. All other water-years are within 0.44 inch of observed volumes. Figures B2-8 through B2-11 show the annual simulated and observed streamflow for water-years 1993 through 1996 downstream of the Miller Creek Regional Detention Facility (RDF).

4.3 PEAK FLOW EVENTS

Five peak flow events have been examined during the calibration process and are listed below:

- January 20, 1993 through January 31, 1993
- March 16, 1993 through March 31, 1993
- February 16, 1994 through March 15, 1994
- November 21, 1995 through December 21, 1995
- January 1, 1996 through January 31, 1996

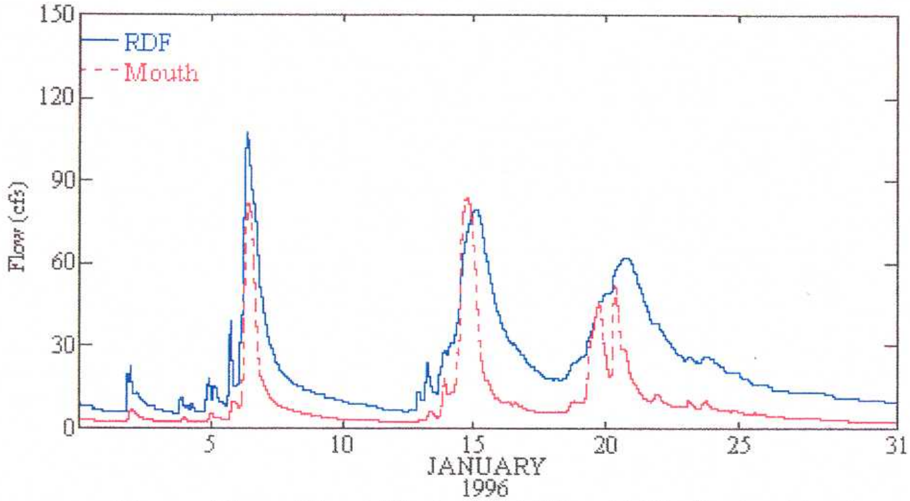
Calibration plots from these events are listed in Figures B2-12 through B2-21.

No events from water-year 1995 were used as a result of the documented malfunctions of the stream gage during this time period. Although the February 1996 flood event is the largest of the calibration period, it was not used because of the manipulation of the outlet gate from the RDF during this event.

Simulated streamflows at both the mouth of Miller Creek and downstream of the RDF generally match the timing, shape, and magnitude of the observed streamflows. Some events such as the January 1993 event match very well, while others such as the January 1996 event do not. However, close examination of the January 1996 event shows some potential errors in the observed data. Figure B2-22 shows the observed streamflow for Miller Creek at both the downstream end of the RDF and at the mouth. This figure clearly indicates that observed streamflows at the RDF are higher than at the mouth. This is obviously not possible, so as a result, the team concluded that some error in the observed data is likely. A comparison of observed flows at the RDF and at the mouth reveals that peak flows at the mouth are generally three or four times higher than peak flows at the RDF. If the ratio drops to below two, then the observed streamflow can be called into question.

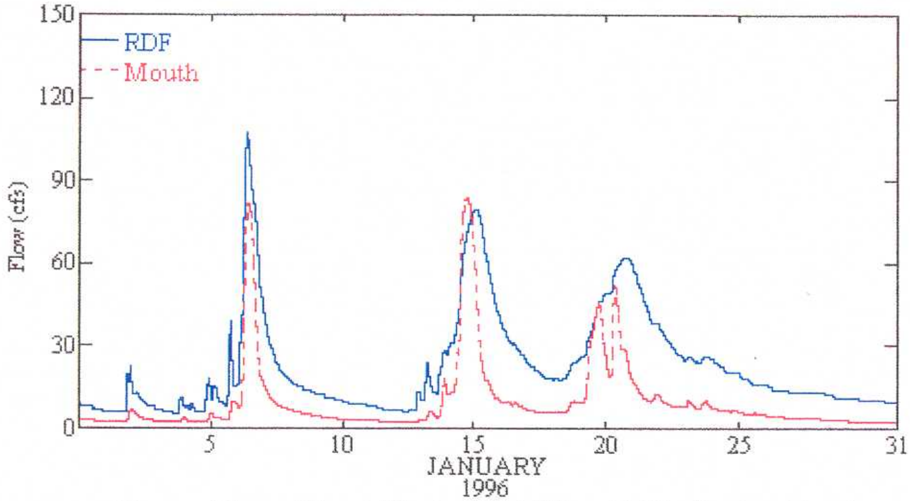
Table B2-8. Miller Creek runoff volumes: calibration period water-years 1993 through 1996.

Water-Year	Observed Streamflow Volumes Regional Detention Facility (inches)	Observed Streamflow Volumes Mouth (inches)	Simulated Streamflow Volumes Regional Detention Facility (inches)	Simulated Streamflow Volumes Mouth (inches)	Simulated Minus Observed Regional Detention Facility (inches)	Simulated Minus Observed Mouth (inches)
1993	5.41	8.53	5.97	10.53	0.56	2.00
1994	3.66	7.79	3.43	7.22	-0.23	-0.57
1995	6.60	12.02	6.85	9.68	0.25	-2.34
1996	13.64	20.94	14.25	21.65	0.61	0.71
Total	29.31	49.28	30.50	49.08	1.19	-0.20



Observed Stream Flow: Miller Creek at RDF and Miller Creek at Mouth

Figure B2-22



Observed Stream Flow: Miller Creek at RDF and Miller Creek at Mouth

Figure B2-22

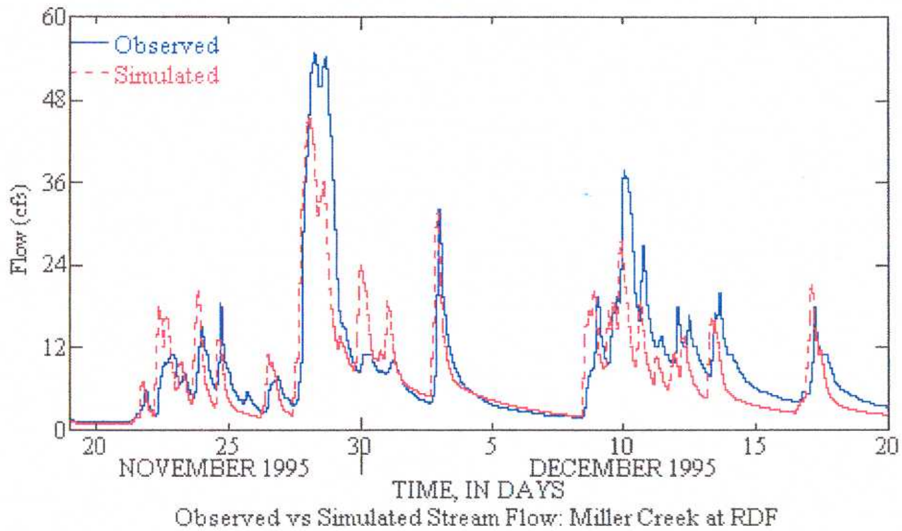
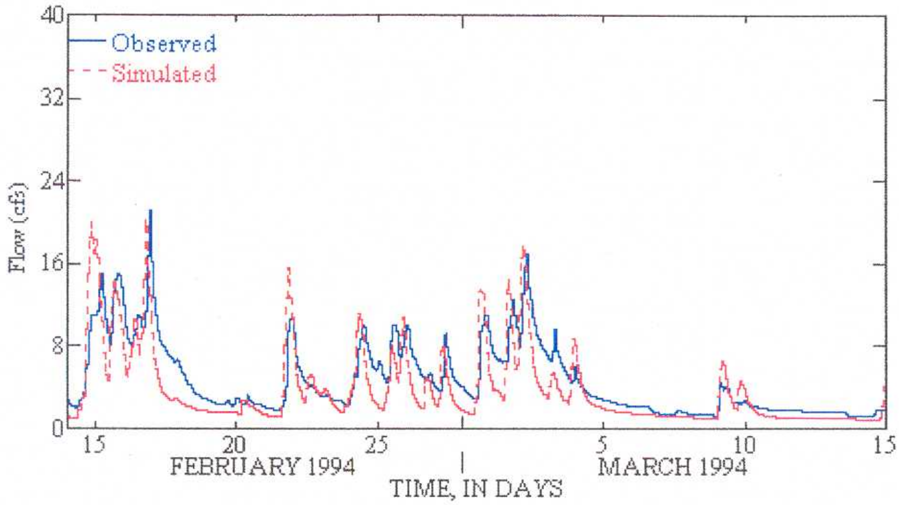
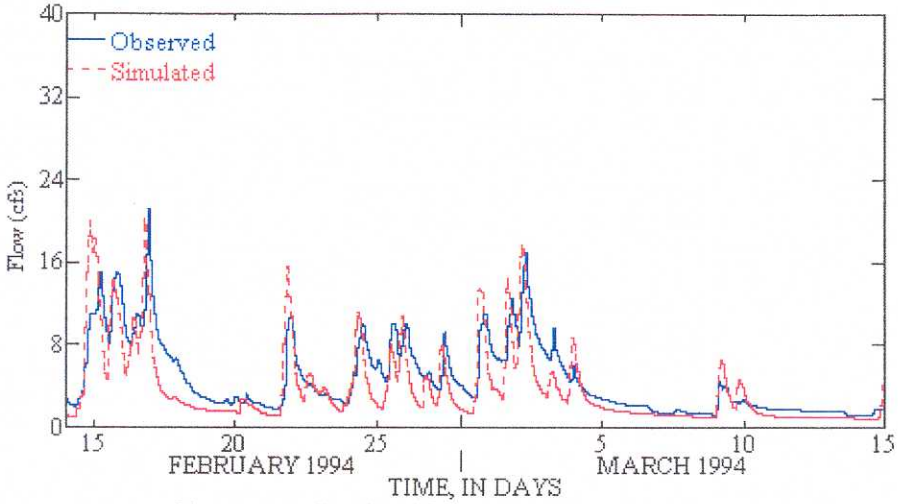

Observed
Simulated
60
48
36
24
12
0
Flow (cfs)
20
25
30
5
10
15
20
NOVEMBER 1995
DECEMBER 1995
TIME, IN DAYS
Observed vs Simulated Stream Flow: Miller Creek at RDF

Figure B2-20



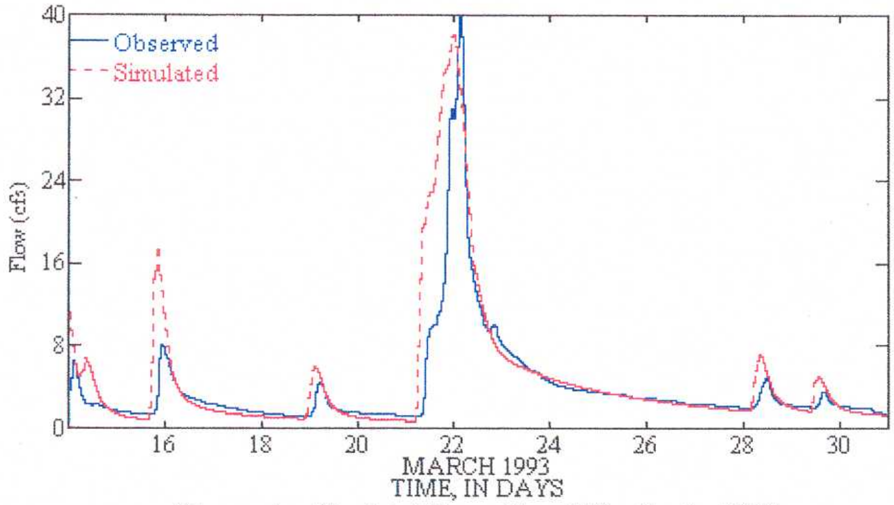
Observed vs Simulated Stream Flow: Miller Creek at RDF

Figure B2-19



Observed vs Simulated Stream Flow: Miller Creek at RDF

Figure B2-19



Observed vs Simulated Stream Flow: Miller Creek at RDF

Figure B2-18

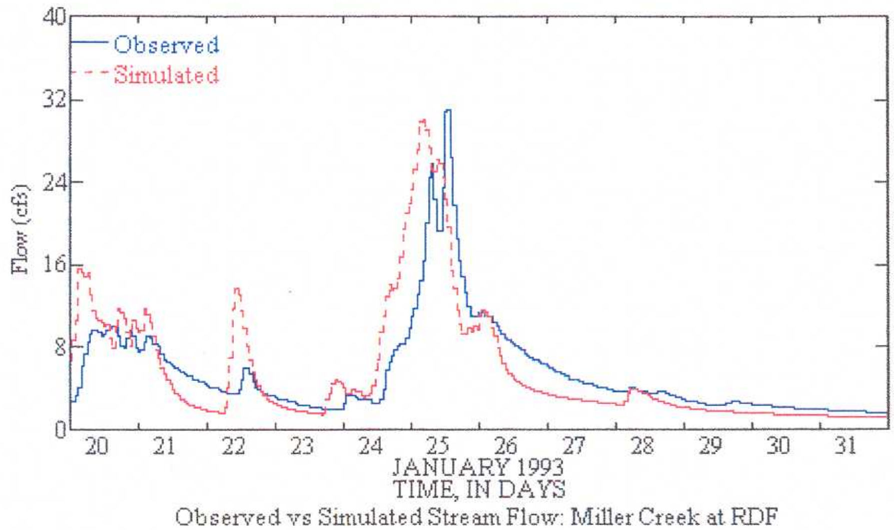
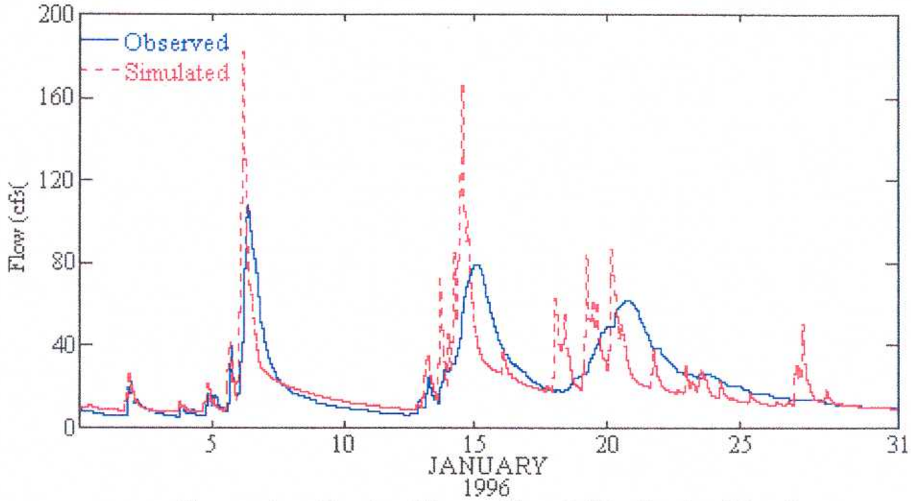
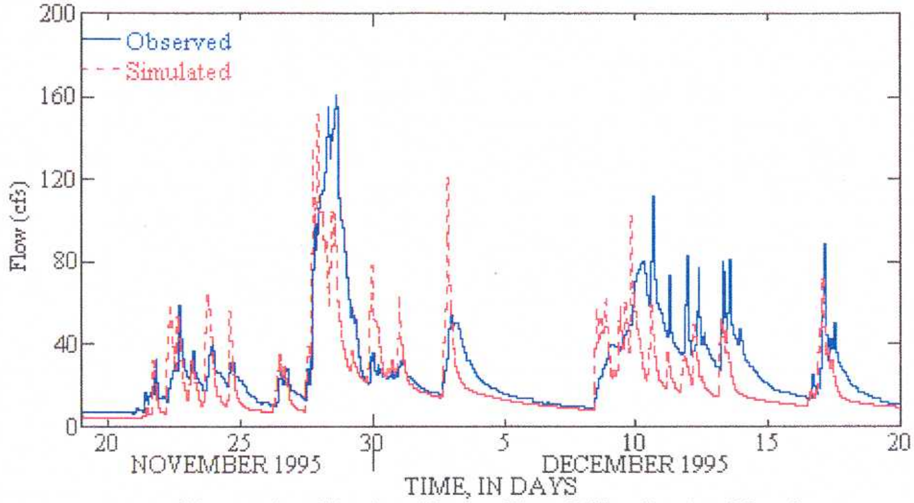

Observed
Simulated
40
32
24
16
8
0
Flow (cfs)
20
21
22
23
24
25
26
27
28
29
30
31
JANUARY 1993
TIME, IN DAYS
Observed vs Simulated Stream Flow: Miller Creek at RDF

Figure B2-17



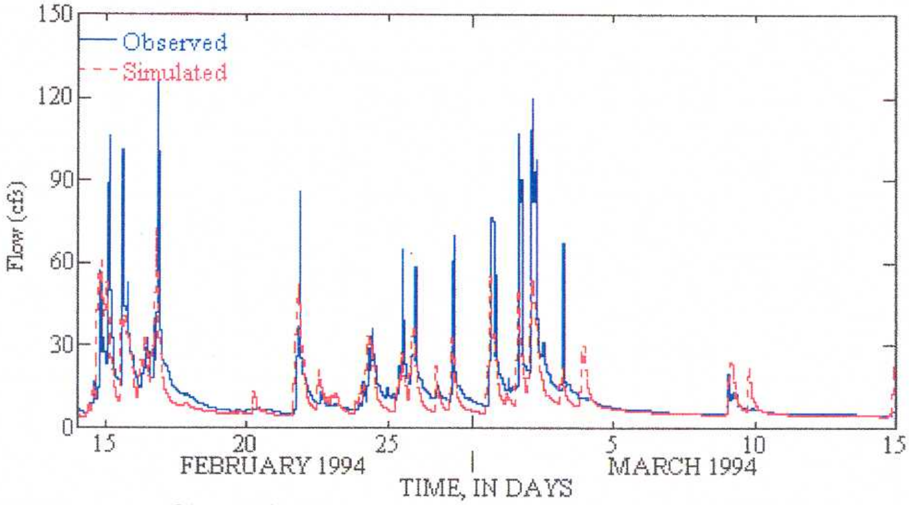
Observed vs Simulated Stream Flow: Miller Creek at Mouth

Figure B2-16



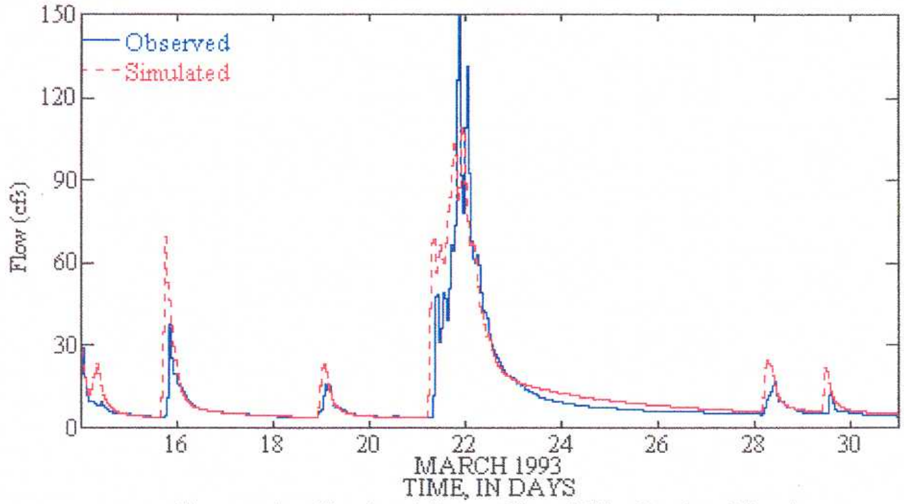
Observed vs Simulated Stream Flow: Miller Creek at Mouth

Figure B2-15



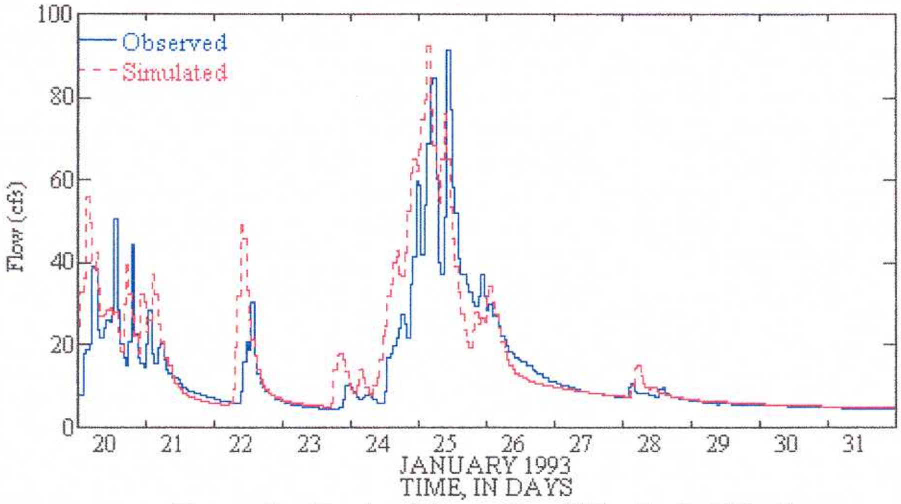
Observed vs Simulated Stream Flow: Miller Creek at Mouth

Figure B2-14



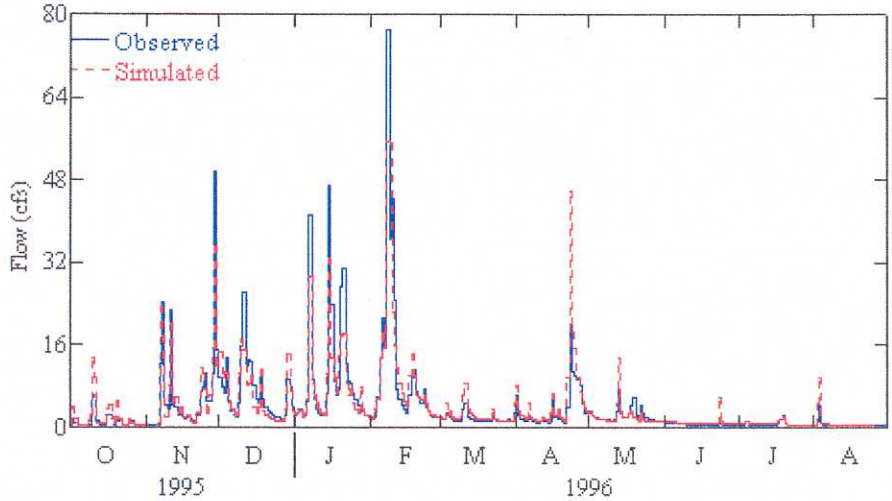
Observed vs Simulated Stream Flow: Miller Creek at Mouth

Figure B2-13



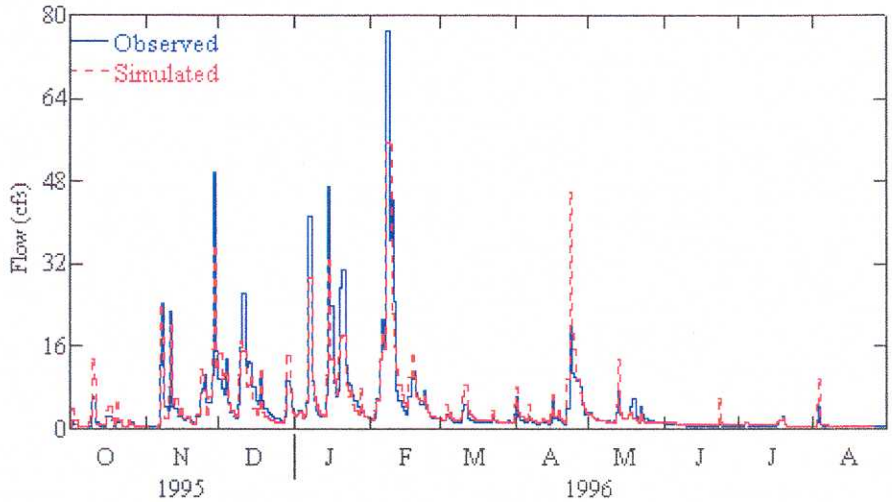
Observed vs Simulated Stream Flow: Miller Creek at Mouth

Figure B2-12



Observed vs. Simulated Stream Flow: Miller Creek at RDF

Figure B2-11



Observed vs. Simulated Stream Flow: Miller Creek at RDF

Figure B2-11

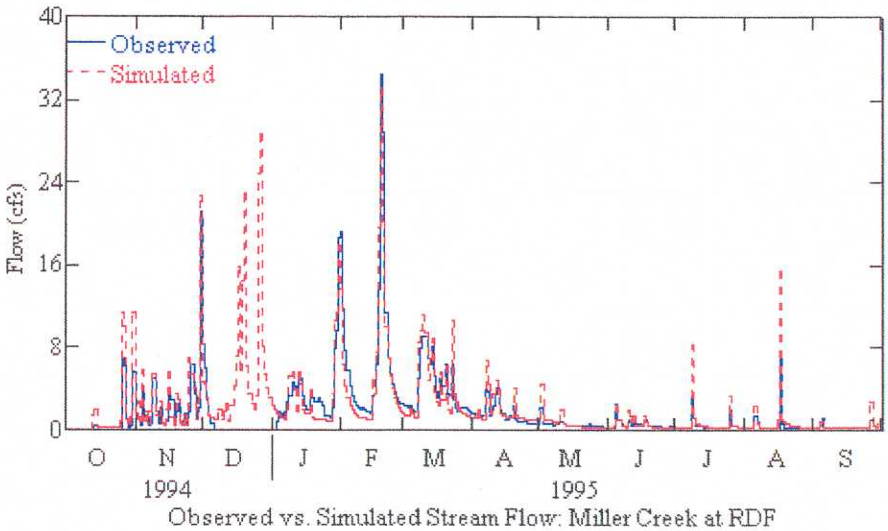
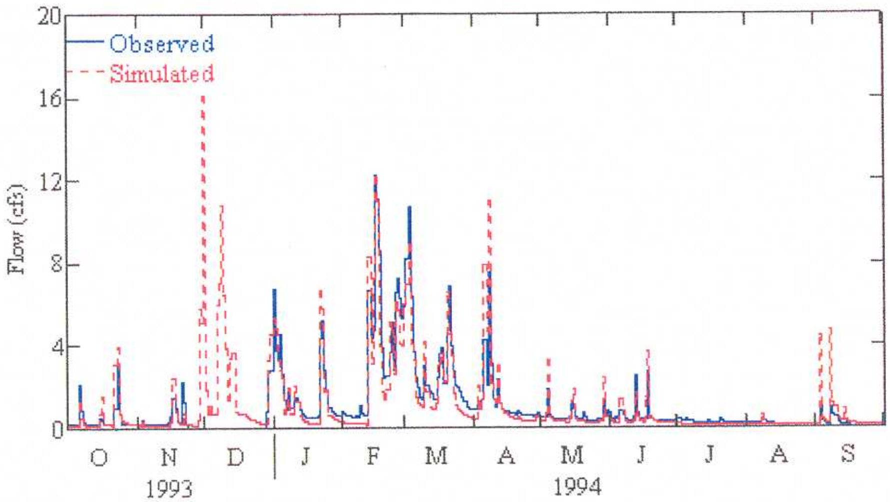
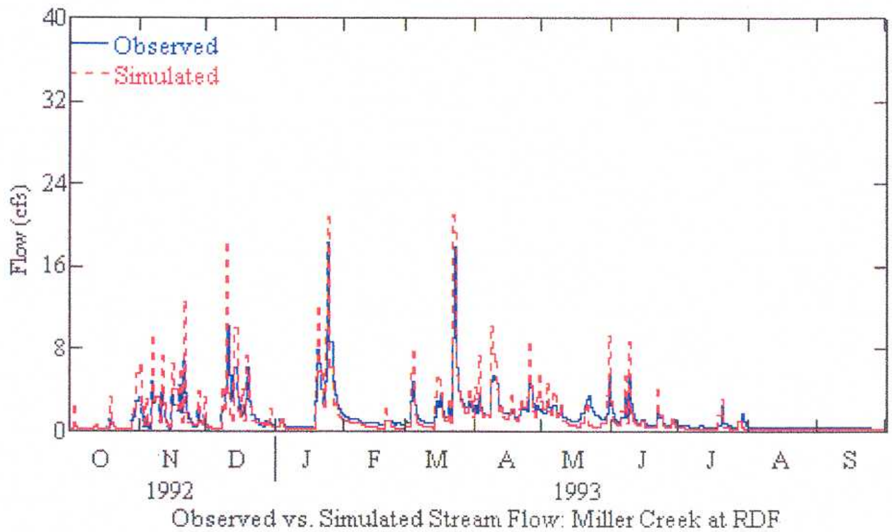

Observed
Simulated
Flow (cfs)
40
32
24
16
8
0
O
N
D
J
F
M
A
M
J
J
A
S
1994
1995
Observed vs. Simulated Stream Flow: Miller Creek at RDF

Figure B2-10



Observed vs. Simulated Stream Flow: Miller Creek at RDF

Figure B2-9



40
32
24
16
8
0
Flow (cfs)
Observed
Simulated
O
N
D
J
F
M
A
M
J
J
A
S
1992
1993
Observed vs. Simulated Stream Flow: Miller Creek at RDF

Figure B2-8

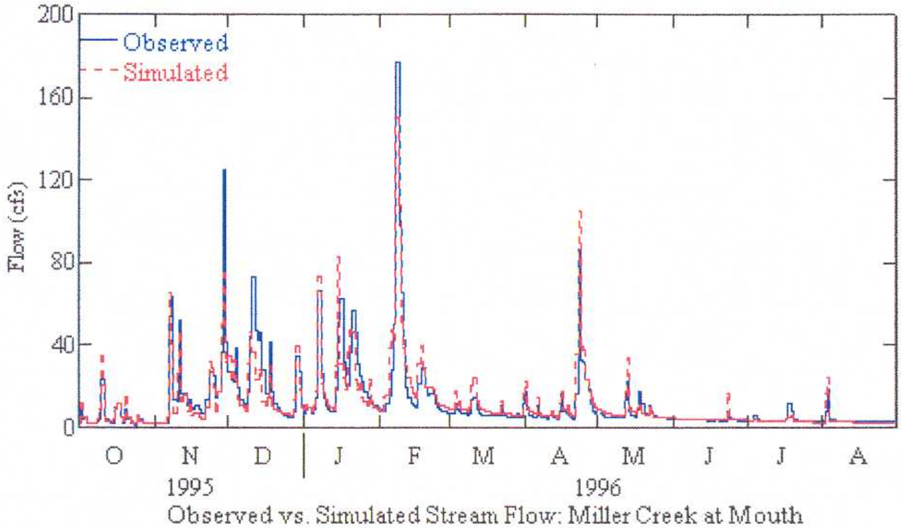
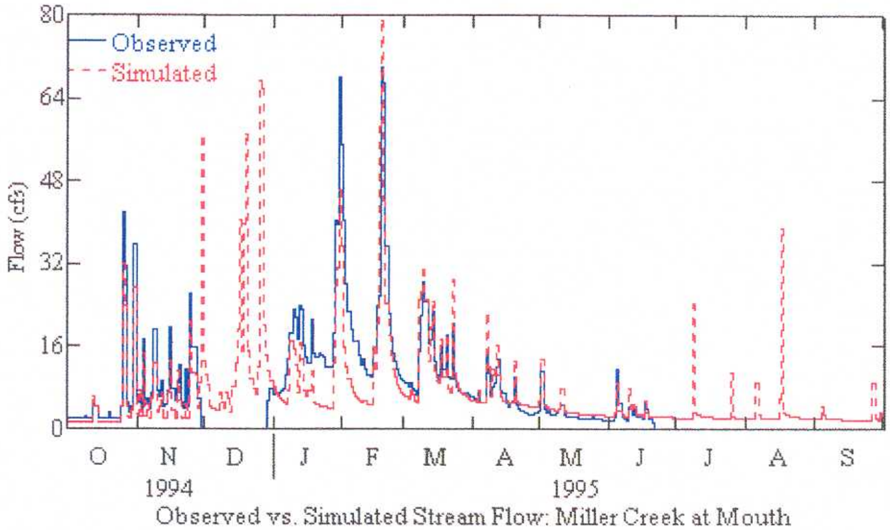

Observed
Simulated
Flow (cfs)
200
160
120
80
40
0
O
N
D
J
F
M
A
M
J
J
A
1995
1996
Observed vs. Simulated Stream Flow: Miller Creek at Mouth

Figure B2-7



80
64
48
32
16
0
Observed
Simulated
Flow (cfs)
O
N
D
J
F
M
A
M
J
J
A
S
1994
1995
Observed vs. Simulated Stream Flow: Miller Creek at Mouth

Figure B2-6

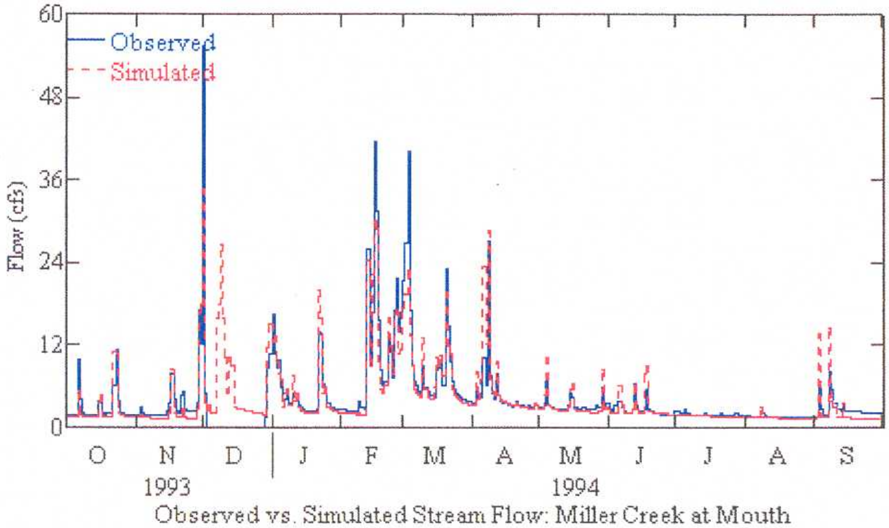
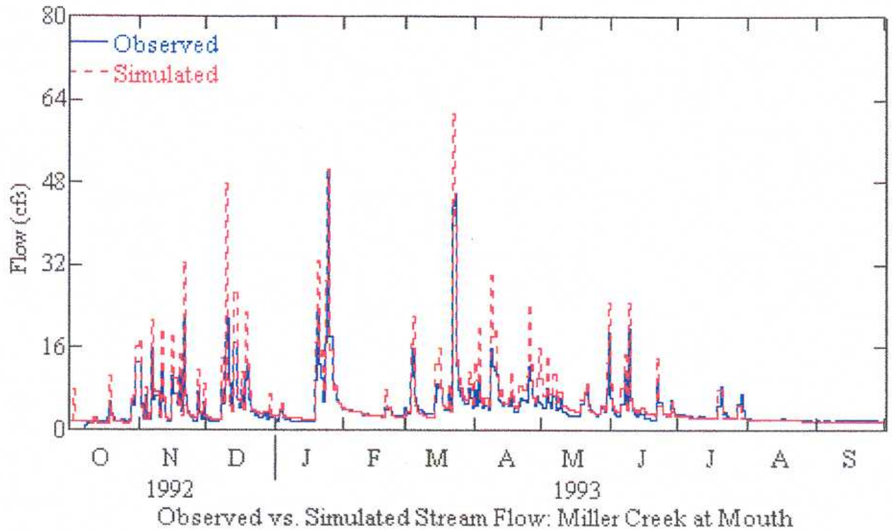

60
48
36
24
12
0
Observed
Simulated
Flow (cfs)
O
N
D
J
F
M
A
M
J
J
A
S
1993
1994
Observed vs. Simulated Stream Flow: Miller Creek at Mouth

Figure B2-5



80
64
48
32
16
0
Observed
Simulated
Flow (cfs)
O
N
D
J
F
M
A
M
J
J
A
S
1992
1993
Observed vs. Simulated Stream Flow: Miller Creek at Mouth

Figure B2-4

5. WALKER CREEK

5.1 WATERSHED BOUNDARIES

The Walker Creek watershed boundary has been verified and will be used without any alterations. However, based on topographical mapping, one-third of the groundwater from subbasin M21 has been routed upstream of the Walker Creek gage (Figure B2-23).

5.2 GROUNDWATER ROUTING

As with the Miller Creek watershed, groundwater plays a key role in properly calibrating the Walker Creek watershed. Using the standard assumption that all groundwater generated within the Walker Creek surface water boundaries drains to Walker Creek upstream of the gage site, simulated streamflows at the mouth of Walker Creek are approximately only half that of observed streamflows. This clearly indicates that Walker Creek is receiving groundwater from outside the surface water boundaries. Groundwater mapping (see Figure B2-2) indicates that approximately 630 acres of the Des Moines Creek watershed contribute groundwater to the Walker Creek watershed. As a result, 630 acres of till-grass soil has been added to the Walker Creek model. This PERLND uses an INFILT of 0.12, while the rest of the parameters correspond to regional values. Only the groundwater from this PERLND contributes to the Walker Creek watershed.

5.3 WALKER CREEK WETLAND

The Walker Creek wetland controls all of the runoff from subbasins MC-8, MC-8B, MC-9, and 20. There is a semi-blocked culvert that carries flows under Des Moines Way. Exact flow capacity of the culvert is unknown; however, using streamflow gage 42c, a rough approximation of the capacity is that of a 36-inch culvert.

5.4 FTABLES

All the stage-storage-discharge relationships from the previous model were reviewed. As a result, FTABLEs 18, 19, and 20 were modified.

FTABLE 20 represents a large wetland at the headwaters of Walker Creek. The stage-storage-discharge relationship for this wetland is based on previous modeling efforts and is believed to be accurate.

5.5 CALIBRATION PERLND PARAMETERS

Four PERLND parameters were adjusted in an effort to obtain an acceptable calibration:

- INFEXP was set to 2.0 for all soils.
- AGWRC was set to 0.996.

- INTFW was set to two for till soils. This moves most of the surface runoff away from interflow.
- IRC was set to 0.15 for all soils. This allows the interflow to respond rapidly, causing higher peak flows.

5.6 WALKER CREEK CALIBRATION RESULTS

Calibration was performed for water-years 1993 through 1996. Total simulated runoff volume at the mouth of Walker Creek for the calibration period is within 3.28 inches of the total observed volume (Table B2-9). Simulated runoff volumes for water-years 1994, 1995, and 1996 are within 0.7 inch of observed runoff volumes. The simulated runoff volume for water-year 1993 is below the observed runoff volume by 2.86 inches, which represents most of the volume deficiency. However, the streamflow gage installed in September 1992 malfunctioned at different times during water-years 1993 and 1994. This led the team to question the accuracy of the observed data for water-year 1993. Figures B2-24 through B2-27 show the annual simulated and observed streamflow for water-years 1993 through 1996 at the mouth of Walker Creek. Total simulated runoff volume at the upper gage of Walker Creek for the calibration period is within 1.36 inches of the total observed volume (Table B2-9). Figures B2-28 through B2-31 show the annual simulated and observed streamflow for water-years 1993 through 1996 at the upper Walker Creek gage.

5.7 PEAK FLOW EVENTS

Five peak flow events have been examined during the calibration process and are listed below:

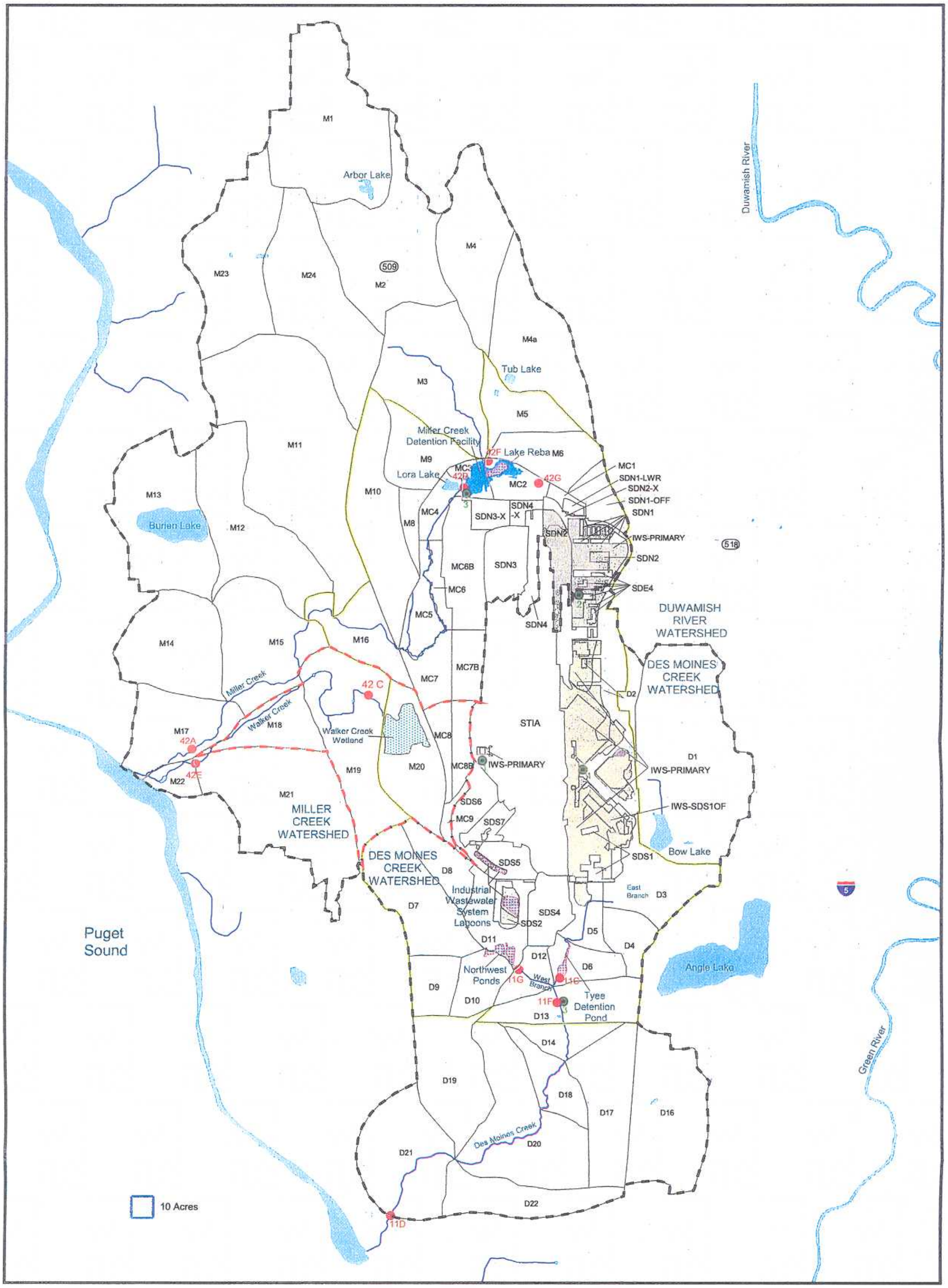
- February 5, 1996 through February 10, 1996
- February 13, 1995 through February 28, 1995
- December 13, 1994 through December 31, 1994
- April 2, 1996 through April 30, 1996
- November 2, 1995 through November 30, 1995

Calibration plots from these events are listed in Figures B2-32 through B2-41.

No events from water-year 1993 were used as a result of the documented malfunctions of the stream gage during this time period.

Simulated streamflows at the mouth of Walker Creek generally match the timing and shape of the observed streamflows. However, the peak flows for water-years 1993 and 1994 are generally too low at both the upper gage and at the mouth. Peak streamflows for water-years 1995 and 1996 are much closer to observed flows for both gage locations.

In addition to the recorded streamflow data at the upper Walker Creek gage 42c, hand-measured data points were recorded for this same location. These data points were compared to the simulated streamflow data and the recorded streamflow data for each of the days that data exists (Table B2-10). Since hand-recorded streamflow data can occur at any time during the day, it should not be expected that these data points should match exactly. A comparison of the daily average flow and the daily maximum flow against the hand-measured streamflow shows that for summer low flow conditions the numbers are nearly identical, but for winter peak flow events the numbers vary greatly. Overall, the hand-measured streamflows, the recorded or (gaged) streamflows, and the simulated streamflows exhibit a fairly good match, indicating that the model has replicated general streamflow characteristics.



Parametrix, Inc. Sea-Tac Airport Stormwater Management Plan/556-2912-001(28) 6/00 File: K:\Gis\2912\Arcview\rrseatac-apdxa_may2001.apr
Source: Roads based on King County data. Water bodies derived from USGS hypsography data. Detention boundaries are approximate.
Note: Subbasin boundaries shown outside of STIA area are for illustration and reference only.
STIA subbasins assume existing (1994) conditions.

July 2001
556-2912-001 (28)

N

1000 0 1000 2000 Feet

1:36,000

Roads

Existing (1994) Drainage Subbasins

STIA Area (see note)

Constructed Water Features

IWS Drainage Area

Subwatershed Boundary

Watershed Boundary

Rivers

Water Bodies

Detention Facilities (existing)

Precipitation Gaging Stations:
Type 1 - National Weather Service (Gage relocated 1996)
Type 2 - POS Rainfall Monitoring
Type 3 - King County Rainfall Monitoring

Streamflow
King County Gaging Stations:
42A - Miller Ck @ SW 175th Pl & 12th Ave SW
42B - Miller Ck @ Lake Reba/RDF Outlet
42C - Walker Ck @ 171st Pl
42E - Walker Ck @ 12th Ave SW
42F - Miller Ck @ SR518
42G - Miller Ck @ East Branch
11D - Des Moines Ck near mouth
11F - Des Moines Ck @ Golf Course
11C - Des Moines Ck @ Tyee Pond
11G - Des Moines Ck @ NW Ponds

Figure B2-23
Walker Creek
Subbasin Boundary

AR 011008

Table B2-9. Walker Creek runoff volumes: calibration period water-years 1993 through 1996.

Walker Creek at mouth runoff volumes: calibration period water-years 1993 through 1996.

Water-Year	Observed Mouth (inches)	Simulated Mouth (inches)	Simulated minus Observed Mouth (inches)
1993	15.64	12.78	-2.86
1994	11.41	10.7	-0.71
1995	17.54	17.59	0.05
1996	24.04	24.28	0.24
Total	**68.63**	**65.35**	**-3.28**

Walker Creek upper gage runoff volumes: calibration period water-years 1993 through 1996.

Water-Year	Observed Mouth (inches)	Simulated Mouth (inches)	Simulated minus Observed Mouth (inches)
1993	9.64	8.16	-1.48
1994	8.38	6.75	-1.63
1995	9.01	9.43	0.42
1996	11.09	12.42	1.33
Total	**38.12**	**36.76**	**-1.36**

AR 011009

Table B2-10. Spot field-measured flows for Walker Creek gage 42c (upper Walker Creek gage).

Field Measured Data		Observed Gage 42C		Simulated Data	
Date	Flow (cfs)	Daily Average (cfs)	Hourly Max For Day (cfs)	Daily Average (cfs)	Hourly Max For Day (cfs)
09/06/90	0.93	N/A	N/A	N/A	N/A
10/07/90	0.94	1.04	1.14	0.70	0.71
11/06/90	1.23	1.27	1.30	0.86	0.86
11/09/90	19.15	11.94	23.00	9.32	17.76
02/05/91	2.69	3.93	10.80	2.99	5.15
03/26/91	1.47	1.49	1.60	2.21	2.25
04/04/92	24.71	22.35	26.00	16.26	21.21
05/17/91	1.36	1.30	1.40	1.55	1.62
09/05/91	1.32	1.34	1.40	0.95	0.96
10/14/91	1.37	1.40	1.40	0.77	0.77
11/14/91	1.57	1.55	1.60	0.8	0.81
11/19/91	6.74	3.78	7.10	2.61	3.83
12/05/91	11.51	5.89	11.00	4.71	7.15
01/29/92	10.76	6.77	14.00	4.51	8.61
01/30/92	4.25	5.71	9.50	4.93	7.23
03/19/92	1.46	1.55	1.60	1.76	1.79
04/16/92	2.39	2.09	4.90	3.37	10.65
05/22/92	1.38	1.20	1.20	1.2	1.21
08/05/92	1.14	1.30	1.30	0.81	0.81
09/10/92	1.31	1.24	1.40	0.73	0.73
11/17/92	1.04	1.92	3.00	1.44	3.28
02/10/93	1.21	1.29	1.30	1.44	1.47
03/16/93	1.25	1.97	5.10	2.37	6.88
04/16/93	1.25	1.62	1.70	1.88	2.49
09/16/93	0.76	0.90	0.90	0.74	0.74
10/26/93	0.97	1.20	1.20	0.7	0.70
11/30/93	1.52	1.96	2.92	1.84	7.48
01/19/94	0.98	1.30	1.30	1.06	1.07
02/14/94	1.82	3.11	4.48	1.59	2.39
04/21/94	1.35	0.93	0.93	1.5	1.56
07/18/94	0.68	1.00	1.00	0.79	0.79
08/25/94	0.88	0.82	0.82	0.67	0.68
09/22/94	0.84	0.87	0.89	0.65	0.66
10/20/94	0.94	0.88	0.89	0.63	0.66

AR 011010

Table B2-10. Spot field-measured flows for Walker Creek gage 42c (upper Walker Creek gage) (continued).

Field Measured Data		Observed Gage 42C		Simulated Data	
Date	Flow (cfs)	Daily Average (cfs)	Hourly Max For Day (cfs)	Daily Average (cfs)	Hourly Max For Day (cfs)
01/11/95	2.36	2.41	3.00	2.61	3.40
02/09/95	1.34	1.43	1.60	2	2.03
05/25/95	1.32	1.30	1.30	1.16	1.17
07/10/95	1.43	1.36	2.40	1.04	1.19
08/08/95	1.16	1.16	1.25	0.86	0.86
09/13/95	0.81	0.72	0.72	0.79	0.79
10/20/95	3.17	1.50	3.03	1.77	4.21
01/05/96	1.21	1.22	1.30	2.68	3.58
04/10/96	1.21	1.23	1.30	1.86	1.88

AR 011011

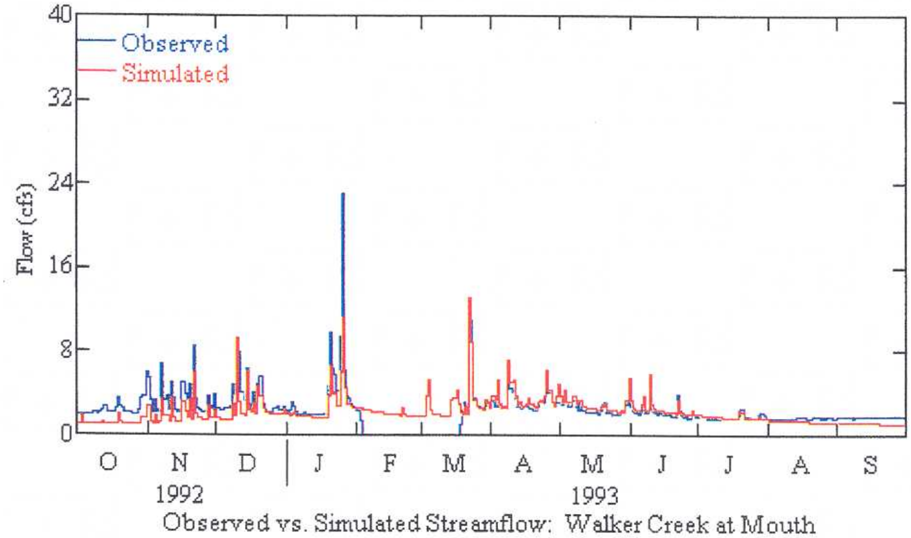


Figure B2-24

AR 011012

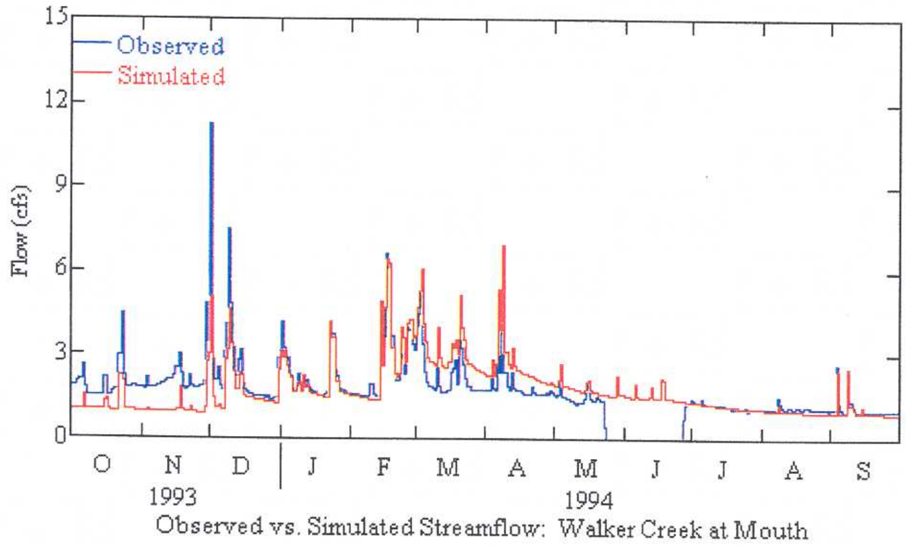
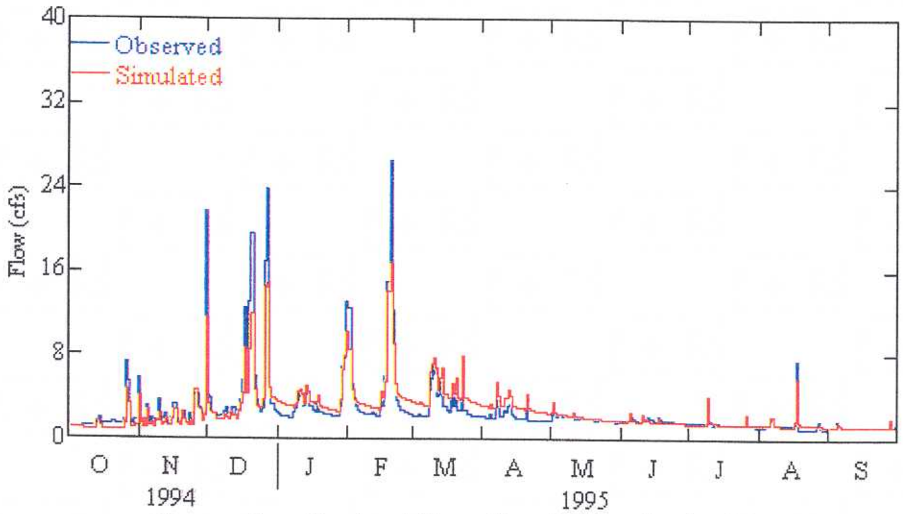


Figure B2-25

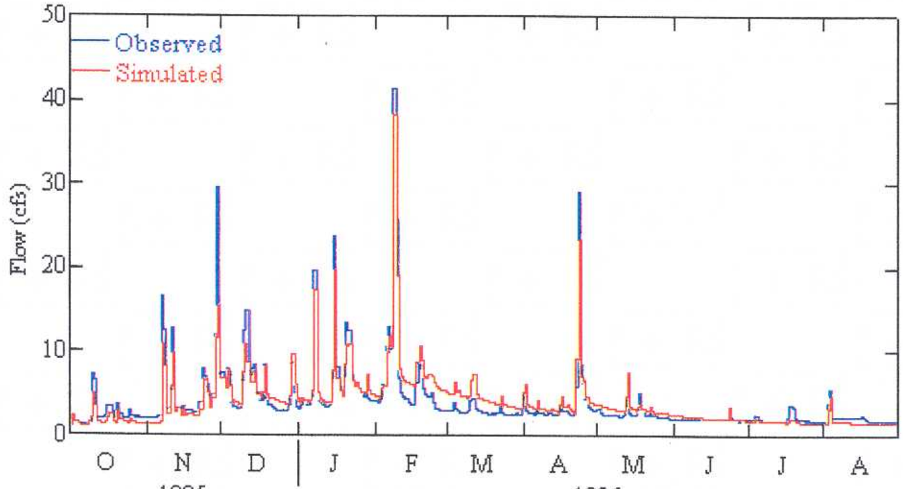
AR 011013



Observed vs. Simulated Streamflow: Walker Creek at Mouth

Figure B2-26

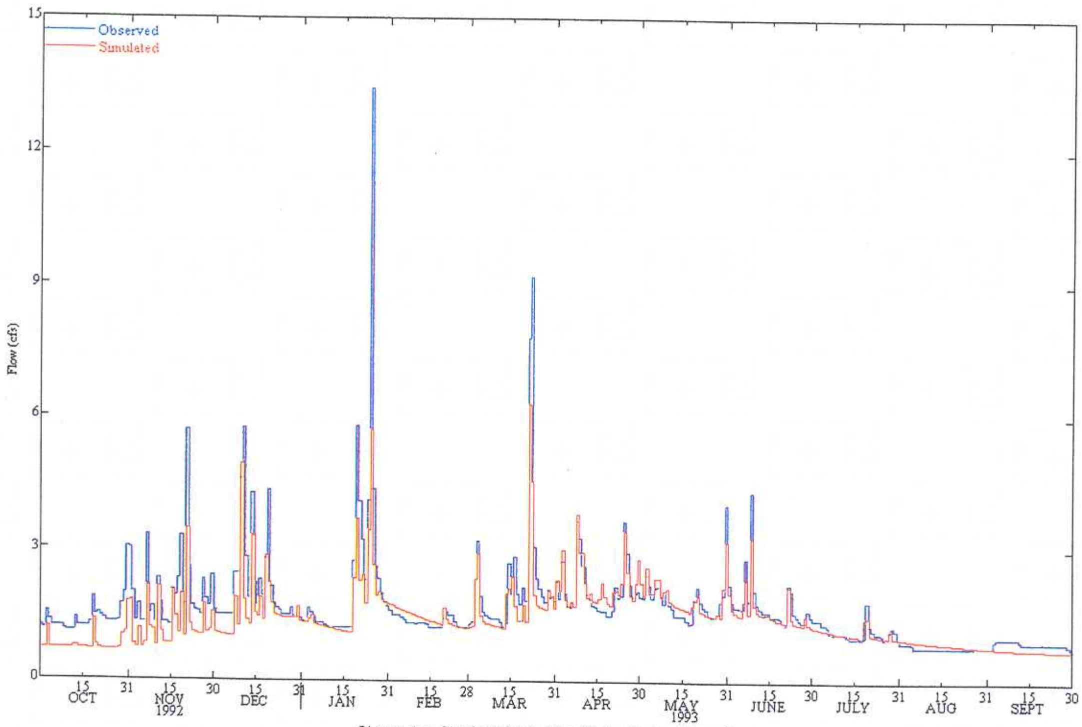
AR 011014



Observed vs. Simulated Streamflow: Walker Creek at Mouth

Figure B2-27

AR 011015



Observed vs. Simulated Streamflow: Walker Creek at Upper Gage

Figure B2-28

AR 011016

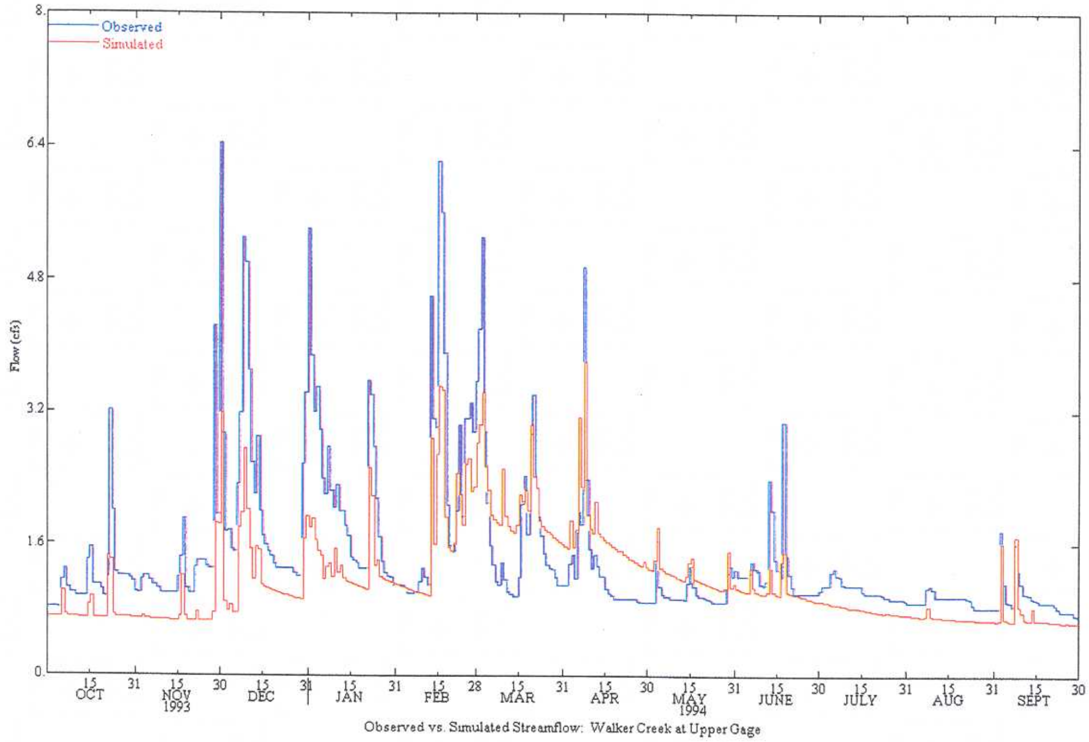


Figure B2-29

AR 011017

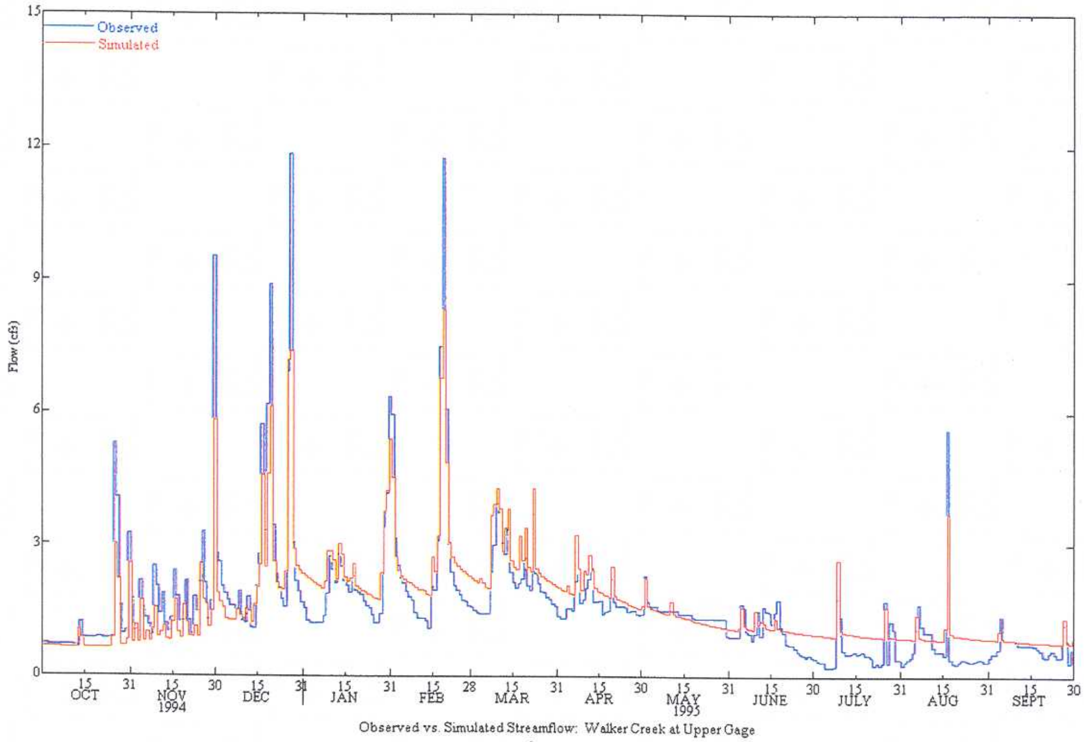


Figure B2-30

AR 011018

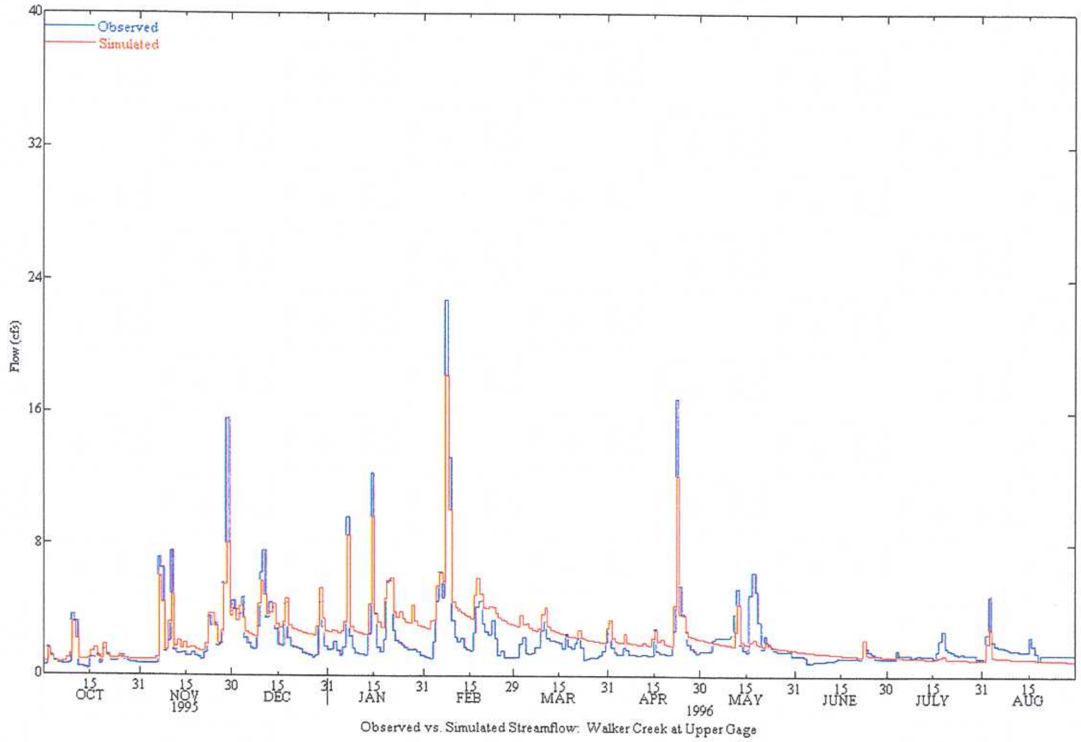
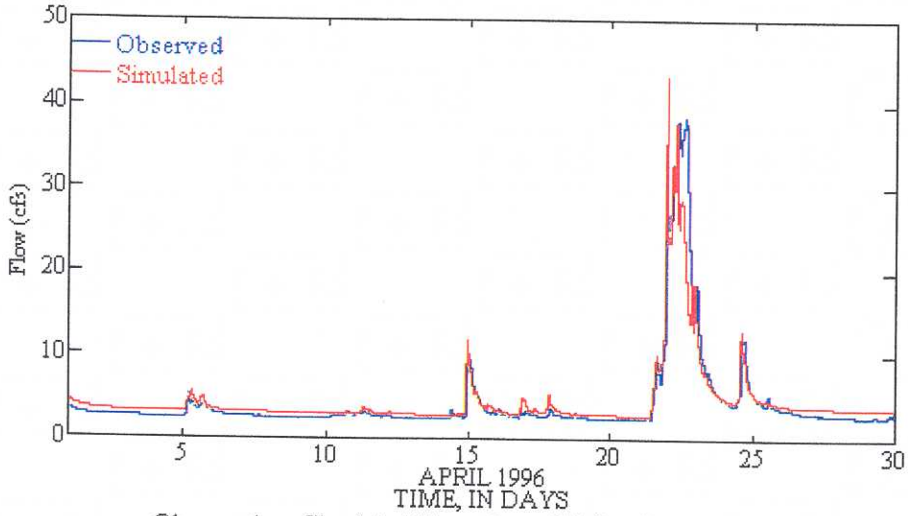


Figure B2-31

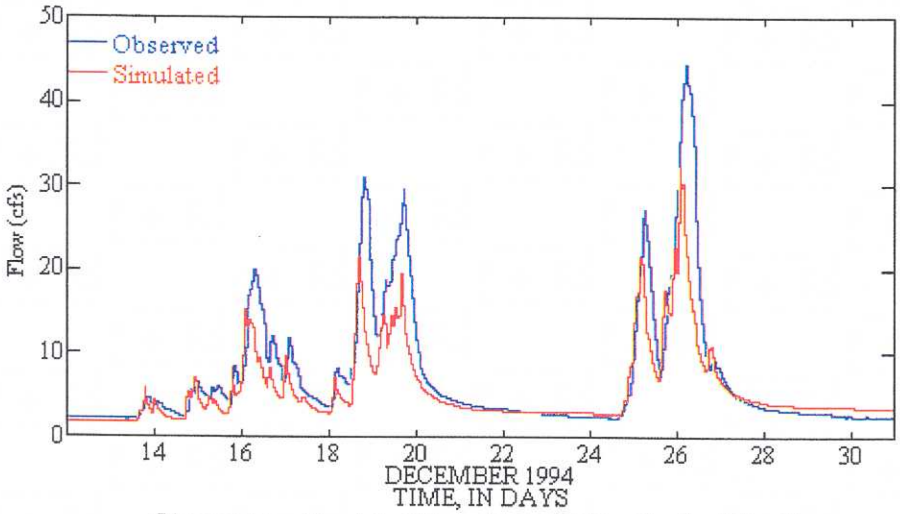
AR 011019



Observed vs. Simulated Streamflow: Walker Creek at Mouth

Figure B2-32

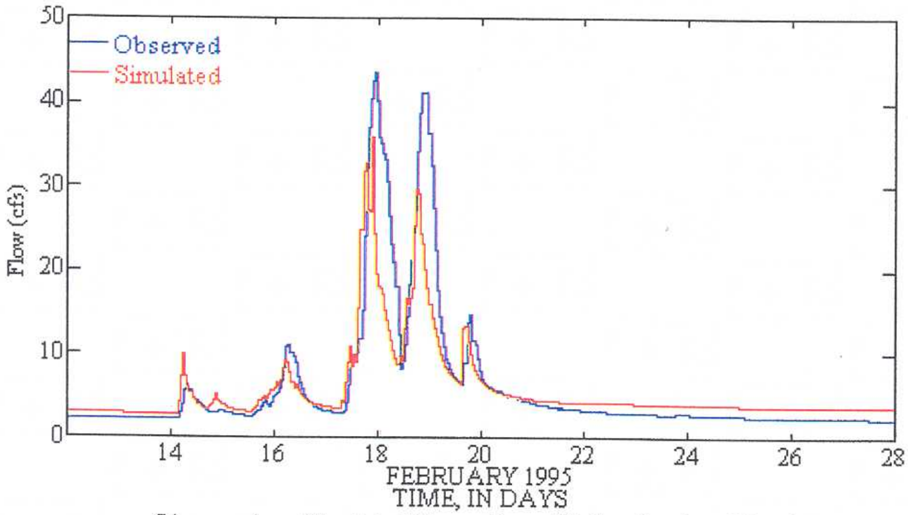
AR 011020



Observed vs. Simulated Streamflow: Walker Creek at Mouth

Figure B2-33

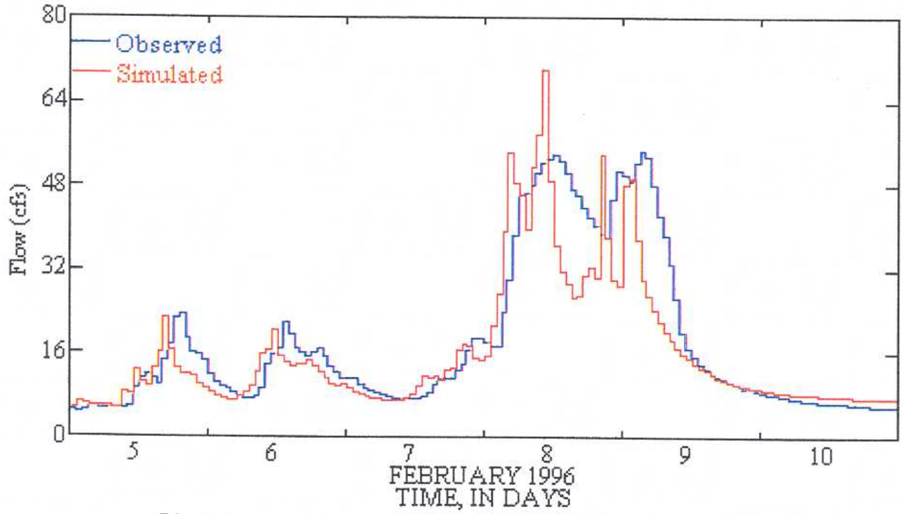
AR 011021



Observed vs. Simulated Streamflow: Walker Creek at Mouth

Figure B2-34

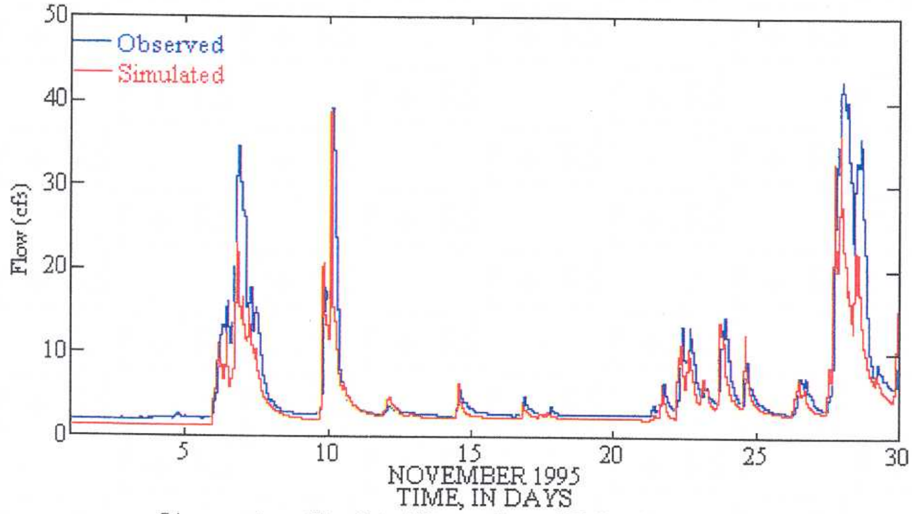
AR 011022



Observed vs. Simulated Streamflow: Walker Creek at Mouth

Figure B2-35

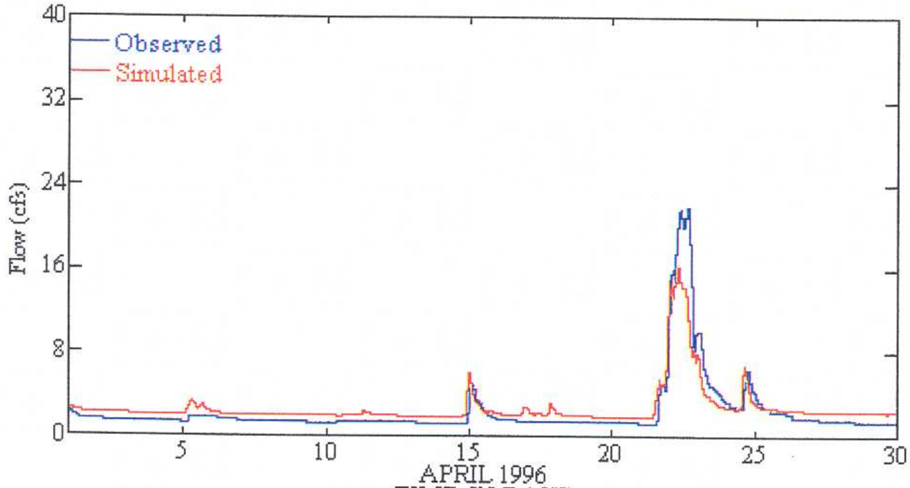
AR 011023



Observed vs. Simulated Streamflow: Walker Creek at Mouth

Figure B2-36

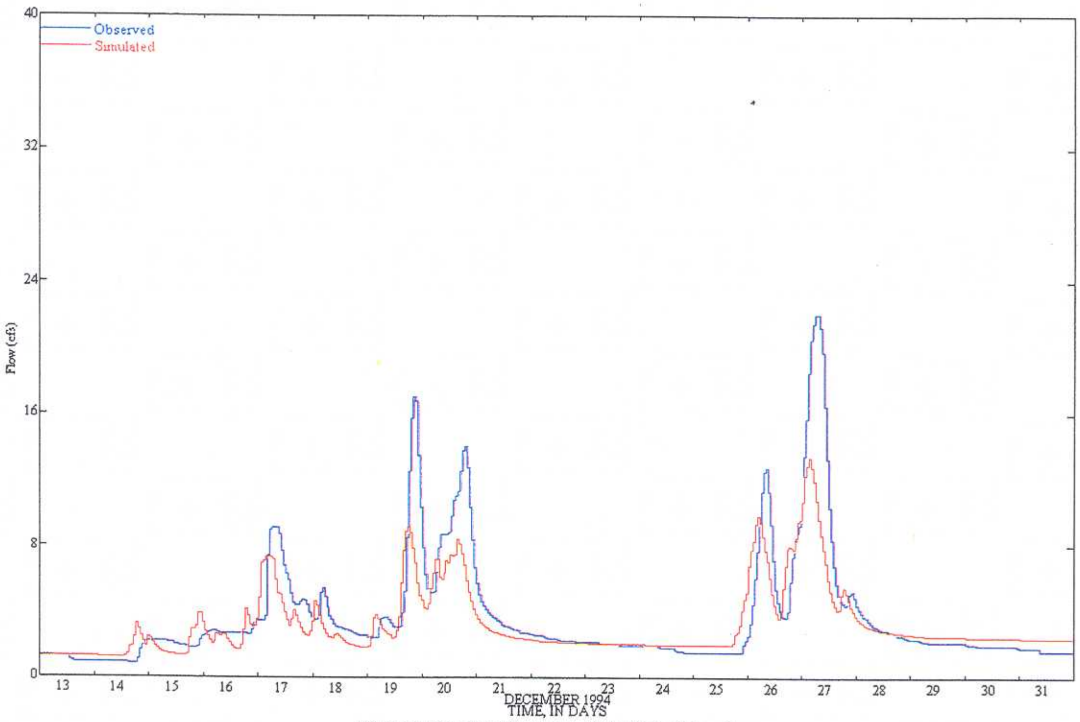
AR 011024



Observed vs. Simulated Streamflow: Walker Creek at Upper Gage

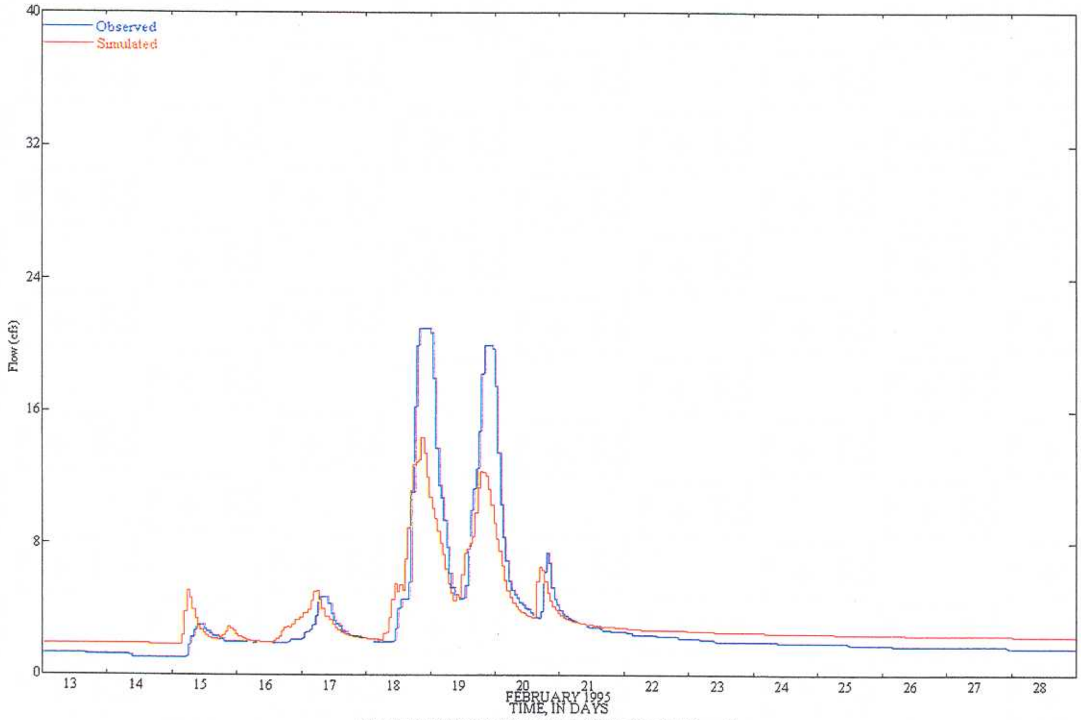
Figure B2-37

AR 011025



Observed vs. Simulated Streamflow: Walker Creek at Upper Gage

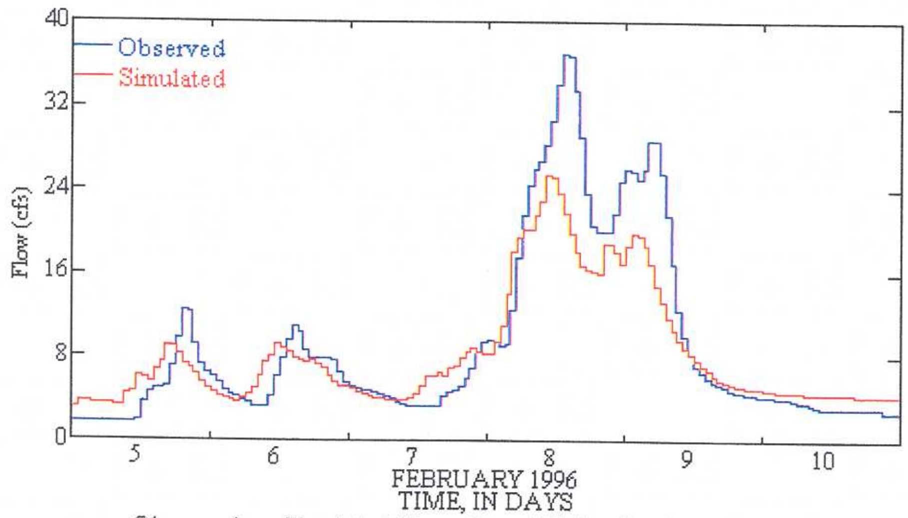
Figure B2-38



Observed vs. Simulated Streamflow: Walker Creek at Upper Gage

Figure B2-39

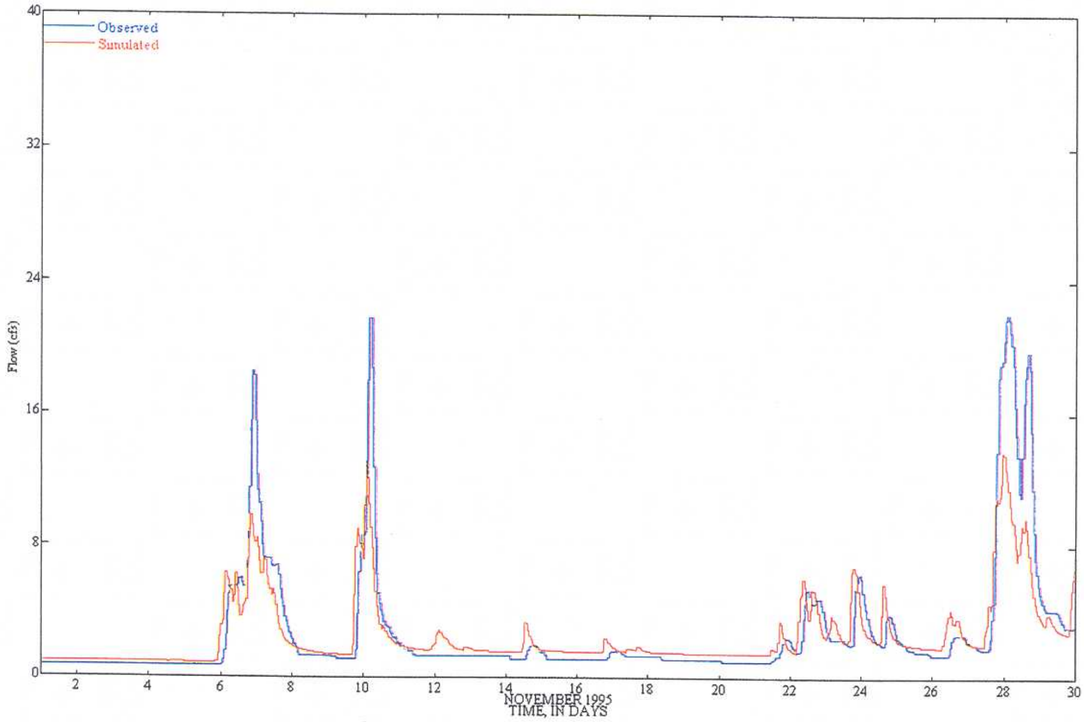
AR 011027



Observed vs. Simulated Streamflow: Walker Creek at Upper Gage

Figure B2-40

AR 011028



Observed vs. Simulated Streamflow: Walker Creek at Upper Gage

Figure B2-41

AR 011029

6. SUMMARY

This computer calibration effort resulted in calibrated models for both the Miller and Walker Creek watersheds. The final calibrations include all of the best available data. Each stage-storage-discharge relationship was derived from field data or topographical mapping. The land use data were updated based on the King County land use coverage. The watershed boundaries were altered to include an additional 300 or so acres to the northwest as a result of field investigations.

Simulated streamflow volumes over the calibration period are within 10 percent of recorded volumes. There was some difficulty matching the magnitude of recorded streamflow peaks. A total of 65 calibration runs were performed for Miller Creek and 21 calibration runs were performed for Walker Creek in an effort to match the magnitude of the recorded streamflow peaks. The best possible match for the given data has been achieved. Investigation of the recorded streamflow data at both gage sites for Miller Creek and both gage sites at Walker Creek demonstrates some possible errors as a result of gage malfunctions and shifting control situations. The team believes these errors may contribute to the inability for simulated streamflows to match observed streamflows.

Most importantly, both calibration HSPF models behave in a consistent manner, which will enable them to be used to study the impacts of differing land use conditions that are proposed for both these watersheds.

MILLER CREEK HSPF CALIBRATION
MODEL INPUT FILE

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RUN
GLOBAL
  ***  FILE: mill65.inp REVISED Aug 2000  Joe Brascher(atc)
  *** for parameterix
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF MILLER CREEK
  ***  - POST-MILLER CK DETENTION FACITY 10/92-6/93
  *** m23 AND M24 new area west of m2.  Flows to rdf
  MILLER CREEK BASIN HSPF MODEL
  START       1989 01  1  0  0  END    1996  8 30 24  0
  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

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MESSU      24   D:\PARA\SEATAC\MILLER\MILL.MES
WDM        25   D:\PARA\SEATAC\MILLER\MILL.WDM
           61   D:\PARA\SEATAC\MILLER\PER.L61
           62   D:\PARA\SEATAC\MILLER\RCH.L62
END FILES

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      PERLND     16
      PERLND     18
      PERLND     24
      PERLND     26
      PERLND     28
      PERLND     34
      PERLND     44
      PERLND     54
      IMPLND     14
      RCHRES      1
      RCHRES     23
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      RCHRES      2
      RCHRES      3
      RCHRES     33
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      RCHRES     10
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      RCHRES     13
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      RCHRES     15
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      RCHRES     17
    END INGRP
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  GEN-INFO
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    # -  #                              User  t-series Engl Metr                 ***
                                              in   out                           ***
   14       TFF- TILL FOR FLT       1     1     1    1    61     0
   16       TFM- TILL FOR MOD       1     1     1    1    61     0
   18       TFS- TILL FOR STP       1     1     1    1    61     0
   24       TGF- TILL GR FLT        1     1     1    1    61     0
   26       TGM- TILL GR MOD        1     1     1    1    61     0
   28       TGS- TILL GR STP        1     1     1    1    61     0
   34       OF - OUTWASH FOR        1     1     1    1    61     0
   44       OG - OUTWASH GR         1     1     1    1    61     0
 ***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
   45       AIRPORT FILL            1     1     1    1    61     0
   54       SA - WETLANDS           1     1     1    1    61     0
   64       RES- GROUNDWATER        1     1     1    1    61     0
  END GEN-INFO
  ACTIVITY
    <PLS > ************* Active Sections *****************************
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   14  200    0    0    1    0    0    0    0    0    0    0    0    0
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   14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
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```

```
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  18                  9.0000     0.3200     200.00     0.2000     0.5000     0.9960
  24                  9.0000     0.1200     400.00     0.0500     0.5000     0.9960
  26                  9.0000     0.1200     400.00     0.1000     0.5000     0.9960
  28                  9.0000     0.1200     200.00     0.2000     0.5000     0.9960
  34                 10.0000     2.0000     400.00     0.0500     0.3000     0.9960
  44                 10.0000     0.8000     400.00     0.0500     0.3000     0.9960
  45                  7.5000     0.0200     300.00     0.0700     0.0000     0.9000
  54                  8.0000     2.0000     100.00     0.0010     0.5000     0.9960
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  16                             2.0000     2.0000       0.33       0.00        0.0
  18                             2.0000     2.0000       0.33       0.00        0.0
  24                             2.0000     2.0000       0.33       0.00         0.
  26                             2.0000     2.0000       0.33         0.         0.
  28                             2.0000     2.0000       0.33         0.         0.
  34                             2.0000     2.0000       0.33       0.00        0.0
  44                             2.0000     2.0000       0.33         0.         0.
  54                             10.000     2.0000       0.33         0.        0.7
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 PWAT-PARM4
   <PLS >                                                           ***
   # -  #      CEPSC      UZSN       NSUR      INTFW        IRC     LZETP***
  14          0.2000     1.5000     0.3500     9.000     0.7000     0.7000
  16          0.2000     0.7500     0.3500     9.000     0.7000     0.7000
  18          0.2000     0.4500     0.3500     9.000     0.3000     0.7000
  24          0.1000     0.7500     0.2500     9.000     0.7000     0.2500
  26          0.1000     0.3750     0.2500     9.000     0.7000     0.2500
  28          0.1000     0.2250     0.2500     9.000     0.3000     0.2500
  34          0.2000     0.7500     0.3500     0.000     0.7000     0.7000
  44          0.1000     0.7500     0.2500     0.000     0.7000     0.2500
  54          0.1000     2.2500     0.5000     1.000     0.7000     0.8000
 END PWAT-PARM4
 PWAT-STATE1
   <PLS >  PWATER state variables***
   # -  #***     CEPS       SURS        UZS       IFWS        LZS       AGWS       GWVS
  14            0.078         0.     0.2500       0.10      2.000      2.000      0.000
  16            0.078         0.     0.2500       0.10      2.000      2.000      0.000
  18            0.078         0.     0.2500       0.10      2.000      2.000      0.000
  24            0.051         0.     0.2500       0.10      2.000      2.000      0.000
  26            0.051         0.     0.2500       0.10      2.000      2.000      0.000
  28            0.051         0.     0.2500       0.10      2.000      2.000      0.000
  34            0.078         0.     0.2500       0.10      2.000      2.000      0.000
  44            0.051         0.     0.2500       0.10      2.000      2.000      0.000
  45            0.051         0.     0.2500       0.10      2.000      2.000      0.000
  54            0.051         0.     0.2500       0.10      2.000      2.000      0.000
  64            0.051         0.     0.2500       0.10      2.000      2.000      0.000
 END PWAT-STATE1
END PERLND
IMPLND
 GEN-INFO
   <ILS >      Name              Unit-systems   Printer                          ***
   # -  #                      User  t-series Engl Metr                          ***
                                      in  out                                    ***
```

```
   14      IMPERVIOUS             1    1    1   60    0
  END GEN-INFO
  ACTIVITY
    <ILS > ************* Active Sections ****
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL  ***
   14         0    0    1    0    0    0
  END ACTIVITY
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
   14         0    0    6    0    0    0    1    9
  END PRINT-INFO
  IWAT-PARM1
    <ILS >             Flags            ***                              ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***                              ***
   14         0    0    0    0    0
  END IWAT-PARM1
  IWAT-PARM2
    <ILS >                                                               ***
    # -  #      LSUR     SLSUR      NSUR     RETSC                       ***
   14         100.00    0.0100    0.1000    0.1000
  END IWAT-PARM2
  IWAT-PARM3
    <ILS >                                                               ***
    # -  #    PETMAX    PETMIN                                           ***
   14
  END IWAT-PARM3
  IWAT-STATE1
    <ILS >  IWATER state variables                                       ***
    # -  #      RETS      SURS                                           ***
   14       1.0000E-3 1.0000E-3
  END IWAT-STATE1
END IMPLND
                                                                         ***
EXT SOURCES
                                                                         ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes.
                                                                         ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM      2 PREC     ENGLZERO  1.00         PERLND  14 200 EXTNL  PREC
WDM      2 PREC     ENGLZERO  1.00         IMPLND  14     EXTNL  PREC
WDM   1010 EVAP     ENGLZERO  0.8          PERLND  14  18 EXTNL  PETINP
WDM   1010 EVAP     ENGLZERO  0.8          PERLND  24  28 EXTNL  PETINP
WDM   1010 EVAP     ENGLZERO  0.8          PERLND  34  54 EXTNL  PETINP
WDM   1010 EVAP     ENGLZERO  0.8          PERLND  64     EXTNL  PETINP
WDM   1010 EVAP     ENGLZERO  0.8          IMPLND  14     EXTNL  PETINP
*** PRECIP/EVAP TO LAKES
WDM      2 PREC     ENGLZERO               RCHRES   1     EXTNL  PREC
WDM   1010 EVAP     ENGLZERO    0.8        RCHRES   1     EXTNL  POTEV
WDM      2 PREC     ENGLZERO               RCHRES   4     EXTNL  PREC
WDM   1010 EVAP     ENGLZERO    0.8        RCHRES   4     EXTNL  POTEV
WDM   1010 EVAP     ENGLZERO    0.8        RCHRES   1     EXTNL  POTEV
WDM      2 PREC     ENGLZERO               RCHRES   1     EXTNL  PREC
WDM   1010 EVAP     ENGLZERO    0.8        RCHRES   4     EXTNL  POTEV
WDM      2 PREC     ENGLZERO               RCHRES   4     EXTNL  PREC
```

```
WDM       2 PREC     ENGLZERO              RCHRES  11     EXTNL  PREC
WDM    1010 EVAP     ENGLZERO    0.8       RCHRES  11     EXTNL  POTEV
WDM       2 PREC     ENGLZERO              RCHRES  13     EXTNL  PREC
WDM    1010 EVAP     ENGLZERO    0.8       RCHRES  13     EXTNL  POTEV
WDM       2 PREC     ENGLZERO              RCHRES  23     EXTNL  PREC
WDM    1010 EVAP     ENGLZERO    0.8       RCHRES  23     EXTNL  POTEV
WDM       2 PREC     ENGLZERO              RCHRES  34     EXTNL  PREC
WDM    1010 EVAP     ENGLZERO    0.8       RCHRES  34     EXTNL  POTEV
WDM       2 PREC     ENGLZERO              RCHRES  53     EXTNL  PREC
WDM    1010 EVAP     ENGLZERO    0.8       RCHRES  53     EXTNL  POTEV
WDM       2 PREC     ENGLZERO              RCHRES  54     EXTNL  PREC
WDM    1010 EVAP     ENGLZERO    0.8       RCHRES  54     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
*** UPPER MILLER CREEK GROUNDWATER PUMPING
COPY *** 1 OUTPUT MEAN   1    12.1         WDM     18 FLOW     ENGL      REPL
*** GAUGE POINTS (17=MOUTH, 54=MILLER RDF, 50=SR 518, 18=WALKER CK)
RCHRES  17 HYDR   RO                       WDM     33 FLOW     ENGL      REPL
RCHRES  54 HYDR   RO                       WDM     34 FLOW     ENGL      REPL
RCHRES  50 HYDR   RO        ***            WDM     35 FLOW     ENGL      REPL
RCHRES  18 HYDR   RO        ***            WDM     36 FLOW     ENGL      REPL
*** MISC (20=WALKER WETLAND, 55=SR509, 56=1ST AVE, 1=ARBOR LAKE)
RCHRES  23 HYDR   STAGE  ***               WDM     91 STAG     ENGL      REPL
RCHRES  20 HYDR   RO     ***               WDM     37 FLOW     ENGL      REPL
RCHRES  55 HYDR   RO     ***               WDM     38 FLOW     ENGL      REPL
RCHRES  62 HYDR   RO     ***               WDM     39 FLOW     ENGL      REPL
RCHRES   1 HYDR   RO     ***               WDM     80 FLOW     ENGL      REPL
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
 ***MOUTH
RCHRES  54 HYDR   RO     1 1 0.000419      WDM     60 SIMQ     ENGL      REPL
RCHRES  17 HYDR   RO     1 1 0.000213      WDM     70 SIMQ     ENGL      REPL
END EXT TARGETS
                                                                              ***

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK    ***
<Name>   #                  <-factor->     <Name>   #   Tbl#    ***
  *** SUB-CATCHMENT 1 all agwo goes to sound
PERLND  16                        3.41     RCHRES   1      6
PERLND  26                      232.36     RCHRES   1      6
PERLND  34                        3.07     RCHRES   1      6
PERLND  44                       38.03     RCHRES   1      6
PERLND  54                        3.87     RCHRES   1      6
IMPLND  14                       56.14     RCHRES   1      2
 *** SUB-CATCHMENT 2 10% of area GW goes to vaca 90% goes to sound
PERLND  16                        5.56     RCHRES   2      6
PERLND  26                      200.05     RCHRES   2      6
PERLND  34                        0.46     RCHRES   2      6
PERLND  44                       38.71     RCHRES   2      6
PERLND  16                        0.56     RCHRES 135      7
PERLND  26                       20.01     RCHRES 135      7
PERLND  34                        0.05     RCHRES 135      7
PERLND  44                        3.87     RCHRES 135      7
```

```
IMPLND  14                        42.22      RCHRES   2        2
 *** SUB-CATCHMENT 23 New subbasin 15 % OF GW GOES TO VACCA 85% TO SOUND
PERLND  16                         3.09      RCHRES  23        6
PERLND  26                       156.15      RCHRES  23        6
PERLND  34                         2.25      RCHRES  23        6
PERLND  44                        45.84      RCHRES  23        6
PERLND  16                         0.46      RCHRES 135        7
PERLND  26                        23.42      RCHRES 135        7
PERLND  34                         0.34      RCHRES 135        7
PERLND  44                         6.88      RCHRES 135        7
IMPLND  14                        58.44      RCHRES  23        2
 *** SUB-CATCHMENT 24 New subbasin 60 % OF GW GOES TO 11 40% TO SOUND
PERLND  26                       135.43      RCHRES  24        6
PERLND  34                         2.02      RCHRES  24        6
PERLND  44                        69.29      RCHRES  24        6
PERLND  26                        81.26      RCHRES  11        7
PERLND  34                         1.21      RCHRES  11        7
PERLND  44                        41.57      RCHRES  11        7
IMPLND  14                        79.98      RCHRES  24        2
  *** SUB-CATCHMENT 3 agwo goes to vaca(135)
PERLND  16                         8.26      RCHRES   3        6
PERLND  26                       108.38      RCHRES   3        6
PERLND  34                        16.02      RCHRES   3        6
PERLND  44                       102.89      RCHRES   3        6
PERLND  54                         0.04      RCHRES   3        6
PERLND  16                         8.26      RCHRES 135        7
PERLND  26                       108.38      RCHRES 135        7
PERLND  34                        16.02      RCHRES 135        7
PERLND  44                       102.89      RCHRES 135        7
PERLND  54                         0.04      RCHRES 135        7
IMPLND  14                        27.30      RCHRES   3        2
  *** SUB-CATCHMENT 4 10% of agwo goes to rchres 90% goes to sound
PERLND  16                         2.95      RCHRES   4        6
PERLND  26                        85.95      RCHRES   4        6
PERLND  34                         3.75      RCHRES   4        6
PERLND  44                        92.06      RCHRES   4        6
PERLND  16                         0.30      RCHRES   4        7
PERLND  26                         8.60      RCHRES   4        7
PERLND  34                         0.38      RCHRES   4        7
PERLND  44                         9.21      RCHRES   4        7
IMPLND  14                        18.43      RCHRES   4        2
  *** SUB-CATCHMENT 4a 70% of agwo goes to rchres 30% goes to sound
PERLND  16                         8.66      RCHRES   4        6
PERLND  26                        61.64      RCHRES   4        6
PERLND  34                        22.06      RCHRES   4        6
PERLND  44                        78.09      RCHRES   4        6
PERLND  54                        12.50      RCHRES   4        6
PERLND  16                         6.06      RCHRES   4        7
PERLND  26                        43.15      RCHRES   4        7
PERLND  34                        15.44      RCHRES   4        7
PERLND  44                        54.66      RCHRES   4        7
PERLND  54                         8.75      RCHRES   4        7
IMPLND  14                        29.14      RCHRES   4        2
  *** SUB-CATCHMENT 5
PERLND  26                        10.29      RCHRES   5        1
PERLND  44                        50.04      RCHRES   5        1
PERLND  54                        10.74      RCHRES   5        1
```

IMPLND	14	16.31	RCHRES	5	2
*** SUB-CATCHMENT 6					
PERLND	16	10.66	RCHRES	53	1
PERLND	26	41.08	RCHRES	53	1
PERLND	34	21.75	RCHRES	53	1
PERLND	44	13.39	RCHRES	53	1
PERLND	54	0.82	RCHRES	53	1
IMPLND	14	7.14	RCHRES	53	2
*** SUB-CATCHMENT 8					
PERLND	44	22.21	RCHRES	35	1
IMPLND	14	6.60	RCHRES	35	2
*** SUB-CATCHMENT 9					
PERLND	16	4.94	RCHRES	34	1
PERLND	26	14.32	RCHRES	34	1
PERLND	34	0.05	RCHRES	34	1
PERLND	44	56.70	RCHRES	34	1
PERLND	54	0.01	RCHRES	34	1
IMPLND	14	22.46	RCHRES	34	2
*** SUB-CATCHMENT 10					
PERLND	16	4.15	RCHRES	10	1
PERLND	26	31.94	RCHRES	10	1
PERLND	44	95.23	RCHRES	10	1
IMPLND	14	71.97	RCHRES	10	2
*** SUB-CATCHMENT 11 25% OF AGWO GOES TO 15					
PERLND	16	0.89	RCHRES	11	6
PERLND	26	217.92	RCHRES	11	6
PERLND	34	1.32	RCHRES	11	6
PERLND	44	65.65	RCHRES	11	6
PERLND	16	0.67	RCHRES	11	7
PERLND	26	163.44	RCHRES	11	7
PERLND	34	0.99	RCHRES	11	7
PERLND	44	49.24	RCHRES	11	7
PERLND	16	0.22	RCHRES	15	7
PERLND	26	54.48	RCHRES	15	7
PERLND	34	0.33	RCHRES	15	7
PERLND	44	16.41	RCHRES	15	7
IMPLND	14	230.80	RCHRES	11	2
*** SUB-CATCHMENT 12					
PERLND	16	0.39	RCHRES	12	1
PERLND	26	101.18	RCHRES	12	1
PERLND	34	5.64	RCHRES	12	1
PERLND	44	54.98	RCHRES	12	1
PERLND	54	0.64	RCHRES	12	1
IMPLND	14	79.83	RCHRES	12	2
*** SUB-CATCHMENT 13					
PERLND	16	0.79	RCHRES	13	1
PERLND	26	197.68	RCHRES	13	1
IMPLND	14	27.66	RCHRES	13	2
*** SUB-CATCHMENT 14 50% OF AGWO GOES TO SOUND					
PERLND	16	0.24	RCHRES	14	6
PERLND	26	118.67	RCHRES	14	6
PERLND	34	13.46	RCHRES	14	6
PERLND	44	41.91	RCHRES	14	6
PERLND	16	0.12	RCHRES	14	7
PERLND	26	59.34	RCHRES	14	7
PERLND	34	6.73	RCHRES	14	7
PERLND	44	20.95	RCHRES	14	7

IMPLND 14	20.66	RCHRES	14	2
*** SUB-CATCHMENT 15				
PERLND 16	6.59	RCHRES	15	1
PERLND 26	49.55	RCHRES	15	1
PERLND 34	50.09	RCHRES	15	1
PERLND 44	86.52	RCHRES	15	1
IMPLND 14	19.47	RCHRES	15	2
*** SUB-CATCHMENT 16				
PERLND 16	10.93	RCHRES	16	1
PERLND 26	30.30	RCHRES	16	1
PERLND 34	20.03	RCHRES	16	1
PERLND 44	31.42	RCHRES	16	1
IMPLND 14	15.54	RCHRES	16	2
*** SUB-CATCHMENT 17 AGWO GOES TO SOUND				
PERLND 16	0.90	RCHRES	17	6
PERLND 26	16.31	RCHRES	17	6
PERLND 34	34.82	RCHRES	17	6
PERLND 44	82.11	RCHRES	17	6
PERLND 54	2.19	RCHRES	17	6
IMPLND 14	10.49	RCHRES	17	2
*** SUB-CATCHMENT MC-1				
PERLND 26	0.17	RCHRES	52	1
PERLND 44	8.21	RCHRES	52	1
PERLND 54	0.27	RCHRES	52	1
IMPLND 14	0.09	RCHRES	52	2
*** SUB-CATCHMENT MC-2				
PERLND 16	0.08	RCHRES	53	1
PERLND 26	0.64	RCHRES	53	1
PERLND 34	6.72	RCHRES	53	1
PERLND 44	10.43	RCHRES	53	1
PERLND 54	15.25	RCHRES	53	1
IMPLND 14	0.27	RCHRES	53	2
*** SUB-CATCHMENT MC-3				
PERLND 34	5.44	RCHRES	54	1
PERLND 44	5.03	RCHRES	54	1
PERLND 54	2.28	RCHRES	54	1
IMPLND 14	0.11	RCHRES	54	2
*** SUB-CATCHMENT MC-4				
PERLND 44	17.32	RCHRES	135	1
PERLND 54	14.41	RCHRES	135	1
IMPLND 14	1.77	RCHRES	135	2
*** SUB-CATCHMENT MC-5				
PERLND 26	13.49	RCHRES	35	1
PERLND 44	31.06	RCHRES	35	1
PERLND 54	5.95	RCHRES	35	1
IMPLND 14	2.50	RCHRES	35	2
*** SUB-CATCHMENT MC-6				
PERLND 44	17.75	RCHRES	35	1
PERLND 54	6.54	RCHRES	35	1
IMPLND 14	0.95	RCHRES	35	2
*** SUB-CATCHMENT MC-6B				
PERLND 26	34.94	RCHRES	35	1
PERLND 34	7.81	RCHRES	35	1
PERLND 44	52.91	RCHRES	35	1
PERLND 54	4.61	RCHRES	35	1
IMPLND 14	3.14	RCHRES	35	2
*** SUB-CATCHMENT MC-7				

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PERLND  26                          12.66     RCHRES  16       1
PERLND  44                          33.53     RCHRES  16       1
PERLND  54                           4.16     RCHRES  16       1
IMPLND  14                           3.88     RCHRES  16       2
  *** SUB-CATCHMENT MC-7B
PERLND  26                          36.16     RCHRES  16       1
PERLND  44                           8.46     RCHRES  16       1
PERLND  54                           1.92     RCHRES  16       1
IMPLND  14                           2.12     RCHRES  16       2
***all sdn basin agwo goes to 35
  *** SUB-CATCHMENT SDN-1
PERLND  26                           3.23     RCHRES  52       6
PERLND  44                           2.11     RCHRES  52       6
PERLND  54                           0.20     RCHRES  52       6
PERLND  26                           3.23     RCHRES 135       7
PERLND  44                           2.11     RCHRES 135       7
PERLND  54                           0.20     RCHRES 135       7
IMPLND  14                           8.29     RCHRES  52       2

  *** SUB-CATCHMENT SDN-1-LWR
PERLND  44                           4.97     RCHRES  52       6
PERLND  54                           0.07     RCHRES  52       6
PERLND  44                           4.97     RCHRES 135       7
PERLND  54                           0.07     RCHRES 135       7
IMPLND  14                           0.38     RCHRES  52       2

  *** SUB-CATCHMENT SDN-1-OFF
PERLND  26                          29.12     RCHRES  52       6
PERLND  44                           3.62     RCHRES  52       6
PERLND  54                           1.67     RCHRES  52       6
PERLND  26                          29.12     RCHRES 135       7
PERLND  44                           3.62     RCHRES 135       7
PERLND  54                           1.67     RCHRES 135       7
IMPLND  14                          11.50     RCHRES  52       2

  *** SUB-CATCHMENT SDN-2
PERLND  26                          10.41     RCHRES  52       6
PERLND  44                           3.04     RCHRES  52       6
PERLND  26                          10.41     RCHRES 135       7
PERLND  44                           3.04     RCHRES 135       7
IMPLND  14                          33.22     RCHRES  52       2

  *** SUB-CATCHMENT SDN-2X
PERLND  26                           1.37     RCHRES  52       6
PERLND  44                           5.84     RCHRES  52       6
PERLND  26                           1.37     RCHRES 135       7
PERLND  44                           5.84     RCHRES 135       7
IMPLND  14                           0.28     RCHRES  52       2

  *** SUB-CATCHMENT SDN-3
PERLND  26                          49.79     RCHRES  54       6
PERLND  26                          49.79     RCHRES 135       7
IMPLND  14                          15.82     RCHRES  54       2

  *** SUB-CATCHMENT SDN-3X
PERLND  16                           0.65     RCHRES  54       6
PERLND  26                           5.17     RCHRES  54       6
```

```
PERLND  34                        13.64     RCHRES  54          6
PERLND  44                         5.34     RCHRES  54          6
PERLND  54                         0.57     RCHRES  54          6
PERLND  16                         0.65     RCHRES 135          7
PERLND  26                         5.17     RCHRES 135          7
PERLND  34                        13.64     RCHRES 135          7
PERLND  44                         5.34     RCHRES 135          7
PERLND  54                         0.57     RCHRES 135          7

  *** SUB-CATCHMENT SDN-4
PERLND  26                        24.43     RCHRES  52          6
PERLND  44                         3.19     RCHRES  52          6
PERLND  26                        24.43     RCHRES 135          7
PERLND  44                         3.19     RCHRES 135          7
IMPLND  14                         2.61     RCHRES  52          2

  *** SUB-CATCHMENT SDN-4X
PERLND  26                         1.57     RCHRES  52          6
PERLND  34                         1.16     RCHRES  52          6
PERLND  44                        10.01     RCHRES  52          6
PERLND  26                         1.57     RCHRES 135          7
PERLND  34                         1.16     RCHRES 135          7
PERLND  44                        10.01     RCHRES 135          7

***ROUTING FOR MILLER CREEK
*** M1 TO M2 TO M3 TO STORAGE 50.  M4 TO M5 TO STORAGE 50
RCHRES   1                                  RCHRES   2          4
RCHRES  23                                  RCHRES  24          4
RCHRES  24                                  RCHRES   3          3
RCHRES   2                                  RCHRES   3          3
RCHRES   3                                  RCHRES  33          3
RCHRES  33                                  RCHRES  50          3
RCHRES   4                                  RCHRES   5          4
RCHRES   5                                  RCHRES  50          3
*** NEW STREAM REACH 52 TO LAKE REBA 53 TO RDF 54
RCHRES  52                                  RCHRES  53          3
RCHRES  53                                  RCHRES  54          3
RCHRES  50                                  RCHRES  54          3
*** RDF 54 TO 35
RCHRES  54                                  RCHRES 135          3
RCHRES  34                                  RCHRES 135          4
RCHRES  34                                  RCHRES 135          5
RCHRES 135                                  RCHRES  35          3
RCHRES  10                                  RCHRES  16          3
RCHRES  35                                  RCHRES  16          3
RCHRES  11                                  RCHRES  15          3
RCHRES  13                                  RCHRES  12          4
RCHRES  13                                  RCHRES  12          5
RCHRES  12                                  RCHRES  15          3
RCHRES  16                                  RCHRES  15          3
RCHRES  14                                  RCHRES  17          3
RCHRES  15                                  RCHRES  17          3
END SCHEMATIC

NETWORK
                                                                          ***
***        <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>         <-MEMBER->
```

```
<NAME>   # <NAME>   TEM STRG<-FACTOR->STRG <NAME>   #   # <-GRP> <NAME> # # ***
                                                                             ***
END NETWORK
                                                                             ***
RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
    1     Arbor Lake  M 1         2     1    1    1    62    0    0
    2     Arbor Ck -03710 M 2     1     1    1    1    62    0    0
    3     Arbor Ck   M 3          1     1    1    1    62    0    0
    4     Tub Lake   M 4          2     1    1    1    62    0    0
    5     Miller Ck SR518 M5      1     1    1    1    62    0    0
   10     Trib (0371G)   M 10     1     1    1    1    62    0    0
   11     M11 Ambaum Detention    1     1    1    1    62    0    0
   12     Trib(0354)  M 12        1     1    1    1    62    0    0
   13     Burien Lake M 13        2     1    1    1    62    0    0
   14     Trib (0353) M 14        1     1    1    1    62    0    0
   15     M/S U/S OF 17           1     1    1    1    62    0    0
   16     U/S OF 15 M/S           1     1    1    1    62    0    0
   17     GAGE                    1     1    1    1    62    0    0
   23     BASIN M23               2     1    1    1    62    0    0
   24     BASIN M24               1     1    1    1    62    0    0
   33     detention m3            1     1    1    1    62    0    0
   34     LORA LAKE               2     1    1    1    62    0    0
   35     D/S OF VACA FARM        1     1    1    1    62    0    0
   38     MC basins               1     1    1    1    62    0    0
   50     sr 518                  1     1    1    1    62    0    0
   52     U/S OF LAKE REBA        1     1    1    1    62    0    0
   53     Reba outflow            1     1    1    1    62    0    0
   54     Miller RDF outflow      1     1    1    1    62    0    0
  135     VACA FARMS              1     1    1    1    62    0    0
  END GEN-INFO
  ACTIVITY
    RCHRES *************** Active Sections *****************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG                 ***
    1  999    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    RCHRES *************** Printout Flags ***************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
    1  999    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible   exit *** possible  exit     possible  exit
             *  *  *  *    *  *  *  *  *        *  *  *  *  *        ***
    1        0  1  0  0    4  5  0  0  0        0  0  0  0  0      2  2  2  2  2
    2        0  0  0  0    4  0  0  0  0        0  0  0  0  0      2  2  2  2  2
    3        0  0  0  0    4  0  0  0  0        0  0  0  0  0      2  2  2  2  2
    4        0  1  0  0    4  5  0  0  0        0  0  0  0  0      2  2  2  2  2
    5   12   0  0  0  0    4  0  0  0  0        0  0  0  0  0      2  2  2  2  2
   13        0  1  0  0    4  5  0  0  0        0  0  0  0  0      2  2  2  2  2
   14   22   0  0  0  0    4  0  0  0  0        0  0  0  0  0      2  2  2  2  2
   23        0  1  0  0    4  5  0  0  0        0  0  0  0  0      2  2  2  2  2
```

```
  24   33    0   0   0   0     4   0   0   0   0          0   0   0   0   0          2   2   2   2   2
  34         0   1   0   0     4   5   0   0   0          0   0   0   0   0          2   2   2   2   2
  35  999    0   0   0   0     4   0   0   0   0          0   0   0   0   0          2   2   2   2   2
END HYDR-PARM1
HYDR-PARM2
  RCHRES                                                                                     ***
  # -  #     FTABNO        LEN      DELTH      STCOR        KS       DB50                    ***
<------><--------><--------><--------><--------><--------><-------->                         ***
  1              1   0.010                                 0.3
  2              2   0.776                                 0.3
  3              3   0.980                                 0.3
  4              4   0.010                                 0.3
  5              5   0.380                                 0.3
 10             10   0.380                                 0.3
 11             11   0.010                                 0.3
 12             12   1.000                                 0.3
 13             13   0.015                                 0.3
 14             14   0.450                                 0.3
 15             15   0.735                                 0.3
 16             16   0.587                                 0.3
 17             17   0.379                                 0.3
 23             23   0.379                300.0            0.3
 24             24   0.379                                 0.3
 33             33   0.200                                 0.3
 34             34   0.852                                 0.3
 35             35   0.663                                 0.3
 38             38   0.010                                 0.3
 50             50   0.010                                 0.3
 52             52   0.010                                 0.3
 53             53   0.010                                 0.3
 54             54   0.010                                 0.3
135            135   0.350                                 0.3
END HYDR-PARM2
HYDR-INIT
  RCHRES  Initial conditions for each HYDR section                                           ***
  # -  # ***   VOL     Initial  value  of COLIND    Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
<------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  1     2.0              4.0  5.0
  2     0.0              4.0
  3     0.0              4.0  5.0
  4     2.0              4.0
  5     0.0              4.0
 10     0.0              4.0
 11     0.0              4.0
 12     0.0              4.0
 13     10.0             4.0  5.0
 14     0.0              4.0
 15     0.0              4.0
 16     0.0              4.0
 17     0.0              4.0
 23     6.0              4.0  5.0
 24     0.0              4.0
 33     0.0              4.0
 34     9.0              4.0  5.0
 35     0.1              4.0
 38     0.1              4.0
```

```
   50      0.0                 4.0
   52      0.0                 4.0
   53      0.1                 4.0
   54      2.25                4.0
  135      0.00                4.0
  END HYDR-INIT
END RCHRES

FTABLES
***UPPER BASIN
***===========

  FTABLE      1
 ROWS COLS ***
   11     5
     DEPTH        AREA     VOLUME    OUTFLOW OUTFLOW2***
     0.00         3.00      0.00       0.00     0.00
     2.50         3.00      7.50       0.00     0.11
     3.00         3.00      9.00       1.80     0.11
     3.50         3.30     10.58       5.00     0.11
     4.00         3.60     12.30      10.90     0.11
     4.50         3.90     14.18      17.50     0.11
     5.00         4.10     16.18      26.20     0.11
     5.50         4.30     18.28      32.50     0.11
     6.00         4.50     20.48      35.90     0.11
     7.00         5.00     25.23      38.10     0.11
     8.00         5.50     30.48      46.40     0.11
  END FTABLE  1

  FTABLE      2
 ROWS COLS ***
    9     4
     DEPTH        AREA     VOLUME    OUTFLOW      ***
     0.000      0.0000     0.0000       0.00
     0.100      0.2571     0.0129       0.16
     0.500      0.3873     0.1417       6.53
     1.000      0.5501     0.3761      25.95
     1.500      0.7128     0.6918      59.86
     2.000      0.8756     1.0889     110.67
     3.000      1.2011     2.1273     272.24
     3.500      1.3639     2.7685     387.38
     4.000      1.5266     3.4912     528.19
  END FTABLE  2

  FTABLE      3
 ROWS COLS ***
   12     4
     DEPTH        AREA     VOLUME    OUTFLOW      ***
     0.000      0.0000     0.0000       0.00
     0.100      0.9669     0.0483       0.13
     0.500      1.0637     0.4545       4.92
     1.000      1.1846     1.0165      17.12
     1.500      1.3055     1.6390      34.92
     2.000      1.4264     2.3220      57.95
     2.500      1.5473     3.0654      86.14
     3.000      1.6682     3.8693     119.53
     3.500      1.7891     4.7336     158.24
```

```
    4.000     1.9100     5.6584     202.41
    4.500     2.0294     6.6310     251.52
    5.000     2.1488     7.6624     306.28
 END FTABLE  3

 FTABLE      4
ROWS COLS ***
   7    5
    DEPTH       AREA     VOLUME     OUTFLOW  OUTFLOW2***
      0.00    3.00      0.00       0.00        0.00
      2.50    4.50      9.38       0.00        0.11
      3.00    6.00      12.00      6.00        0.11
      4.00    10.00     20.00      13.00       0.11
      5.00    15.00     32.50      20.00       0.11
      6.00    20.00     50.00      26.00       0.11
      7.00    25.00     72.50      168.00      0.11
 END FTABLE  4

 FTABLE      5
ROWS COLS ***
  10    4
    DEPTH       AREA     VOLUME     OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.1010     0.0051       0.03
    0.500     0.1754     0.0603       1.46
    1.000     0.2684     0.1713       6.16
    1.500     0.3614     0.3288      14.89
    2.000     0.4544     0.5327      28.48
    2.500     0.5474     0.7832      47.70
    3.000     0.6404     1.0801      73.29
    3.500     0.7334     1.4236     105.94
    4.000     0.8264     1.8136     146.33
 END FTABLE  5

 FTABLE     10
ROWS COLS ***
   9    4
    DEPTH       AREA     VOLUME     OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.1010     0.0051       0.06
    0.500     0.1660     0.0585       2.27
    1.000     0.2472     0.1618       9.32
    1.500     0.3285     0.3057      22.08
    2.000     0.4097     0.4902      41.66
    2.500     0.4909     0.7154      69.09
    3.000     0.5722     0.9811     105.37
    4.000     0.6887     1.6116     209.70
 END FTABLE 10

 POST AMBAUM DETENTION ***
 FTABLE     11
ROWS COLS ***
  11    4
    DEPTH       AREA     VOLUME     OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    1.000     0.1000     0.2300       3.90
    2.000     0.2000     0.6000       6.30
```

```
    3.000     0.3000     0.9700       8.10
    4.000     0.4000     1.3400      11.10
    5.000     0.5000     1.8200      16.00
    6.000     0.6000     2.2700      19.10
    7.000     0.7000     2.8300      21.60
    8.000     0.8000     3.3700      30.80
    9.000     0.9000     4.0000      38.10
   10.000     1.0000     4.6500      74.10
   10.500     1.1000     5.2000     133.00
   11.000     1.1500     5.3000     500.00
 END FTABLE 11

 FTABLE      12
ROWS COLS ***
   6    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.6327     0.0316       0.15
    0.500     0.7960     0.3174       5.87
    1.000     1.0002     0.7664      21.53
    1.500     1.2043     1.3176      46.43
    2.000     1.4085     1.9708      81.20
    3.000     1.8168     3.5834     183.79
    4.000     2.2251     5.6044     336.22
    5.000     2.6335     8.0337     545.30
    6.000     3.0418    10.8713     817.51
 END FTABLE 12

 FTABLE      13
ROWS COLS ***
   7    5
    DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
    0.000     40.000     0.0000       0.00      0.00
    1.000     41.400     40.000       0.00      0.11
    1.500     42.000     60.000      10.00      0.11
    2.000     42.700     80.000      16.00      0.11
    2.500     43.300     100.00      20.00      0.11
    3.000     44.000     120.00      28.00      0.11
    5.000     45.000     210.00      45.00      0.11
 END FTABLE 13

 FTABLE      14
ROWS COLS ***
   6    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.3361     0.0168       0.24
    0.500     0.3809     0.1602       9.04
    1.000     0.4370     0.3647      31.61
    1.500     0.4930     0.5972      65.00
    2.000     0.5491     0.8577     108.85
    2.500     0.6051     1.1462     163.33
    3.000     0.6612     1.4628     228.78
 END FTABLE 14

 FTABLE      15
ROWS COLS ***
```

```
  4    4
   DEPTH       AREA     VOLUME    OUTFLOW   ***
    0.00      0.10       0.00       0.00
    1.00      1.00       0.55      91.00
    2.00      1.10       1.60     268.00
    3.00      1.20       2.75     493.00
 END FTABLE 15

 FTABLE     16
ROWS COLS ***
  4    4
   DEPTH       AREA     VOLUME    OUTFLOW   ***
    0.00      0.10       0.00       0.00
    1.00      1.00       0.55      74.00
    2.00      1.10       1.60     219.00
    3.00      1.20       2.75     403.00
 END FTABLE 16

 FTABLE     17
ROWS COLS ***
  5    4
   DEPTH       AREA     VOLUME    OUTFLOW   ***
    0.00      0.10       0.00       0.00
    1.00      1.00       0.55      59.00
    2.00      1.10       1.60     173.00
    3.00      1.20       2.75     318.00
    4.00      1.30       4.00     484.00
 END FTABLE 17

 FTABLE     23
ROWS COLS ***   HERMES
  9    5
   DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW    ***
    0.00      0.00       0.00       0.00    0.00            0.00
    5.00      0.50       1.91       0.00    0.00          305.00
   11.00      0.79       5.79       0.00    0.00          311.00
   15.00      1.13       9.64       0.50    0.01          315.00
   19.00      1.72      15.34       0.50    0.05          319.00
   29.00      2.86      38.25       0.50    0.10          329.00
   39.00      4.40      74.55       0.50    0.20          339.00
   50.00      6.22     132.98       0.50    0.30          350.00
   60.00     10.00    1212.98       0.50    0.40          360.00
 END FTABLE 23

 FTABLE     24
ROWS COLS ***
  9    4
   DEPTH       AREA     VOLUME    OUTFLOW   ***
   0.000    0.0000     0.0000       0.00
   0.100    0.2571     0.0129       0.16
   0.500    0.3873     0.1417       6.53
   1.000    0.5501     0.3761      25.95
   1.500    0.7128     0.6918      59.86
   2.000    0.8756     1.0889     110.67
   3.000    1.2011     2.1273     272.24
   3.500    1.3639     2.7685     387.38
   4.000    1.5266     3.4912     528.19
```

```
 END FTABLE 24

 FTABLE     33
ROWS COLS ***
  11    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.00      1.00      0.00       0.00
     0.50      1.20      0.55       2.00
     1.00      1.40      1.20       6.00
     1.50      1.60      1.95       9.00
     2.00      1.80      2.80      13.00
     2.50      2.00      3.75      16.50
     3.00      2.20      4.80      20.00
     3.50      2.40      5.95      23.00
     4.00      2.60      7.20      26.00
     5.00      2.80      9.90     104.00
     6.00      3.00     12.80     246.00
 END FTABLE 33

 FTABLE     34
ROWS COLS *** REVISED 11/19/97 BASED ON HEC-RAS MODEL
   6    5
    DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
     0.00       3.00      0.00       0.00     0.00
     3.00       3.05      9.08       0.00     0.11
     4.00       3.10     12.15       0.00     0.11
     5.00       3.15     15.28       0.00     0.11
     6.00       3.20     18.45       72.0     0.11
     7.00       3.25     21.68      225.0     0.11
 END FTABLE 34

 FTABLE     35
ROWS COLS *** REVISED 11/19/97 BASED ON HECRAS MODEL
   5    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.00      0.10      0.00       0.00
     1.00      1.10      0.60      38.00
     2.00      1.20      1.75     108.00
     3.00      1.30      3.00     194.00
     4.00      1.40      4.35     290.00
 END FTABLE 35

 FTABLE     38
ROWS COLS ***
   7    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000    0.0000       0.00
    1.000     0.4000    0.4000       2.00
    1.500     0.5000    1.0000       4.00
    2.000     0.9000    1.3000      11.00
    2.500     1.3000    1.6000      15.00
    3.000     1.6000    2.0000      18.00
    3.500     1.9000    2.5000      20.80
 END FTABLE 38

 FTABLE     45
ROWS COLS ***
```

```
NORTH EMPLOYEE PARKING LOT VAULT (AS-BUILT)***
  12    4
    DEPTH      AREA     VOLUME   OUTFLOW   ***
    0.000    0.2200    0.0000      0.00
    2.000    0.2200    0.4500      1.20
    4.000    0.2200    0.9000      1.70
    6.000    0.2200    1.3400      2.10
    8.000    0.2200    1.7900      2.40
   10.000    0.2200    2.2400      2.70
   12.240    0.2200    2.7400      3.00
   14.000    0.2200    3.1400      6.90
   15.440    0.2200    3.4600      8.30
   16.000    0.2200    3.5800     10.30
   18.000    0.2200    4.0300     13.60
   20.000    0.2200    4.4800     30.79
 END FTABLE 45

 FTABLE     50
ROWS COLS ***
  10    4
    DEPTH      AREA     VOLUME   OUTFLOW   ***
     0.00      1.00      0.00      0.00
     0.50      1.10      0.53      5.00
     1.00      1.20      1.10     15.00
     1.50      1.30      1.73     25.00
     2.00      1.40      2.40     35.00
     2.50      1.50      3.13     52.00
     3.00      1.60      3.90     70.00
     3.50      1.70      4.73     87.00
     4.00      1.80      5.60    105.00
     6.00      1.90      9.30    165.00
 END FTABLE 50

 FTABLE     52
ROWS COLS ***
   6    4
    DEPTH      AREA     VOLUME   OUTFLOW   ***
    0.000    0.0000    0.0000      0.00
    0.100    0.3680    0.0184      0.25
    0.500    0.3717    0.1664      9.39
    1.000    0.3763    0.3534     31.06
    2.000    0.3819    0.7325     94.37
    3.000    0.3874    1.1171    174.33
 END FTABLE 52

 FTABLE     53
OLD LAKE REBA                                ***
MAX DEPTH = 4.9 FEET                         ***
30" CMP, 40 CFS DISCHARGE AT MAX DEPTH       ***
ROWS COLS ***
   7    4
    DEPTH      AREA     VOLUME   OUTFLOW   ***
    0.000    2.4000    0.0000      0.00
    1.000    2.5800    2.5000     18.00
    2.000    2.9400    5.3000     26.00
    3.000    3.4100    8.4000     31.00
    4.000    3.8800    12.100     36.00
```

```
   4.900    4.3000    15.800     40.00
   6.000    4.3000    15.810    500.00
 END FTABLE 53

 FTABLE     54
EXISTING MILLER CREEK DETENTION FACILITY*** REVISED STORAGE/Q DATA
GATE SETTING: 2.0 FEET***
ROWS COLS ***
  12    4
   DEPTH       AREA    VOLUME   OUTFLOW   ***
   0.000       0.00      0.00      0.00
   1.300       0.01      0.01     10.00
   2.000       0.01      0.02     20.00
   2.900       0.70      0.40     30.00
   4.000       1.50      1.50     40.00
   5.400       3.50      4.90     50.00
   7.000       8.60     13.30     60.00
   8.800      15.60     34.80     70.00
  10.000      19.90     57.30     76.00
  10.500      21.50     68.00     92.00
  11.000      23.10     78.80    179.00
  11.500      24.70     88.60    303.00
 END FTABLE 54

 PRE AMBAUM DETENTION ***
 FTABLE    111
ROWS COLS ***
  12    4
   DEPTH       AREA    VOLUME   OUTFLOW   ***
   0.000    0.0000    0.0000      0.00
   0.500    0.2160    0.0750      5.30
   1.000    0.2730    0.1990     21.10
   1.500    0.2890    0.3410     43.90
   2.000    0.2900    0.4830     68.80
   2.500    0.2910    0.6070     89.10
   3.000    0.2950    0.6820     90.00
   3.500    0.3000    2.1000    100.00
   4.000    0.3050    2.5000    105.00
   4.500    0.3100    3.0000    110.00
   5.000    0.3200    3.5000    120.00
   5.500    0.3300    4.0000    130.00
 END FTABLE111

 FTABLE    135
ROWS COLS *** VACA FARM
   6    4
   DEPTH       AREA    VOLUME   OUTFLOW   ***
    0.00      0.10      0.00      0.00
    1.00      0.10      0.10      4.00
    2.00      0.11      0.21      8.00
    2.50      1.00      0.48     13.00
    3.50      6.50      4.23     86.00
    4.50     13.00     13.98    235.00
 END FTABLE135
```

```
END FTABLES


MASS-LINK
<Volume>    <-Grp> <-Member-><--Mult-->       <Target>        <-Grp> <-Member->***
<Name>             <Name> # #<-factor->       <Name>                 <Name> # #***
  MASS-LINK        1
  conversion from acre-inches to acre-ft (1/12)                ***
PERLND      PWATER PERO       0.0833333       RCHRES          INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
IMPLND      IWATER SURO       0.0833333       RCHRES          INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
RCHRES      ROFLOW                            RCHRES          INFLOW
  END MASS-LINK    3

  MASS-LINK        4
RCHRES      OFLOW  OVOL   1                   RCHRES          INFLOW IVOL
  END MASS-LINK    4

  MASS-LINK        5
RCHRES      OFLOW  OVOL   2                   RCHRES          INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        6
PERLND      PWATER SURO       0.0833333       RCHRES          INFLOW IVOL
PERLND      PWATER IFWO       0.0833333       RCHRES          INFLOW IVOL
  END MASS-LINK    6

  MASS-LINK        7
PERLND      PWATER AGWO       0.0833333       RCHRES          INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        8
PERLND      PWATER PERO       0.0833333       COPY            INPUT  MEAN
  END MASS-LINK    8
  MASS-LINK        12
PERLND      PWATER AGWO       0.0833333       COPY            INPUT  MEAN
  END MASS-LINK    12

  MASS-LINK        9
IMPLND      IWATER SURO       0.0833333       COPY            INPUT  MEAN
  END MASS-LINK    9

  MASS-LINK        10
COPY        OUTPUT MEAN                       RCHRES          INFLOW IVOL
  END MASS-LINK    10

END MASS-LINK
END RUN
```

WALKER CREEK HSPF CALIBRATION
MODEL INPUT FILE

This page included for guidance only.
(Not to be included in document.)

```
RUN
GLOBAL
  ***  FILE: WALKER21.inp REVISED March 2001  Joe Brascher ATC
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF WALKER CREEK (Calibration)
  ***  DEVELOPED BY PARAMETRIX (JRD) 2000 BASED ON 1999 SMP MODEL (KWR)
  WALKER CREEK BASIN HSPF MODEL
  START       1989 01  1  0  0  END    1996  8 30 24  0
  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname------------------------------------------->
MESSU      24   D:\PARA\SEATAC\MILLER\WALKER.MES
WDM        25   D:\PARA\SEATAC\MILLER\MILL.WDM
           61   D:\PARA\SEATAC\MILLER\wPER.L61
           62   D:\PARA\SEATAC\MILLER\wRCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      14
      PERLND      16
      PERLND      18
      PERLND      24
      PERLND      26
      PERLND      28
      PERLND      34
      PERLND      44
      PERLND      45
      PERLND      54
      PERLND      64
      PERLND      65
      IMPLND      14
      RCHRES      20
      RCHRES      19
      RCHRES      18
    END INGRP
END OPN SEQUENCE
                                                                          ***
COPY
  TIMESERIES
  Copy-opn                                                                ***
    # -  #  NPT  NMN                                                      ***
    1    5         1
  END TIMESERIES
END COPY

PERLND
  GEN-INFO
    <PLS >       Name           NBLKS   Unit-systems   Printer            ***
    # -  #                             User  t-series Engl Metr           ***
                                             in   out                     ***
   14      TFF- TILL FOR FLT       1     1     1    1   61    0
   16      TFM- TILL FOR MOD       1     1     1    1   61    0
   18      TFS- TILL FOR STP       1     1     1    1   61    0
   24      TGF- TILL GR FLT        1     1     1    1   61    0
```

```
  26       TGM- TILL GR MOD        1    1    1    1   61     0
  28       TGS- TILL GR STP        1    1    1    1   61     0
  34       OF - OUTWASH FOR        1    1    1    1   61     0
  44       OG - OUTWASH GR         1    1    1    1   61     0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
  45       AIRPORT FILL            1    1    1    1   61     0
  54       SA - WETLANDS           1    1    1    1   61     0
  64       TGM DES MOINES          1    1    1    1   61     0
  65       OG  DES MOINES          1    1    1    1   61     0
 END GEN-INFO
 ACTIVITY
   <PLS > ************* Active Sections *****************************
   # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC        ***
  14  200    0    0    1    0    0    0    0    0    0    0    0    0
 END ACTIVITY
 PRINT-INFO
   <PLS > ***************** Print-flags ************************* PIVL  PYR
   # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
  14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
 END PRINT-INFO
 PWAT-PARM1
   <PLS > ***************** Flags *******************
   # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                     ***
  14         0    0    0    0    0    0    0    0    0
  16         0    0    0    0    0    0    0    0    0
  18         0    0    0    0    0    0    0    0    0
  24         0    0    0    0    0    0    0    0    0
  26         0    0    0    0    0    0    0    0    0
  28         0    0    0    0    0    0    0    0    0
  34         0    0    0    0    0    0    0    0    0
  44         0    0    0    0    0    0    0    0    0
  45         0    0    0    0    0    0    0    0    0
  54         0    0    0    0    0    0    0    0    0
  64         0    0    0    0    0    0    0    0    0
 END PWAT-PARM1
 PWAT-PARM2
   <PLS > ***
   # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  14                   4.5000    0.0800    400.00    0.0500    0.5000    0.9960
  16                   4.5000    0.0800    400.00    0.1000    0.5000    0.9960
  18                   4.5000    0.0800    200.00    0.2000    0.5000    0.9960
  24                   4.5000    0.0300    400.00    0.0500    0.5000    0.9960
  26                   4.5000    0.0300    400.00    0.1000    0.5000    0.9960
  28                   4.5000    0.0300    200.00    0.2000    0.5000    0.9960
  34                   5.0000    2.0000    400.00    0.0500    0.3000    0.9960
  44                   5.0000    0.8000    400.00    0.0500    0.3000    0.9960
  45                   7.5000    0.0200    300.00    0.0700    0.0000    0.9960
  54                   4.0000    2.0000    100.00    0.0010    0.5000    0.9960
  64                   4.5000    0.1200    400.00    0.1000    0.5000    0.9990
  65                   5.0000    0.8000    400.00    0.0500    0.5000    0.9960
 END PWAT-PARM2
 PWAT-PARM3
   <PLS >***
   # -  #*** PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  14                             2.0000    2.0000      0.00      0.00       0.0
  16                             2.0000    2.0000      0.00      0.00       0.0
  18                             2.0000    2.0000      0.00      0.00       0.0
```

```
  24                          2.0000    2.0000      0.00      0.00        0.
  26                          2.0000    2.0000      0.00        0.        0.
  28                          2.0000    2.0000      0.00        0.        0.
  34                          2.0000    2.0000      0.00      0.00       0.0
  44                          2.0000    2.0000      0.00        0.        0.
  45                          2.0000    2.0000      0.00        0.        0.
  54                          10.000    2.0000      0.00        0.       0.7
  64                          2.0000    2.0000      0.00        0.       0.0
 END PWAT-PARM3
 PWAT-PARM4
   <PLS >                                                             ***
   # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
  14         0.2000    1.0000    0.3500     2.000    0.1500    0.7000
  16         0.2000    0.5000    0.3500     2.000    0.1500    0.7000
  18         0.2000    0.3000    0.3500     2.000    0.1500    0.7000
  24         0.1000    0.5000    0.2500     2.000    0.1500    0.2500
  26         0.1000    0.2500    0.2500     2.000    0.1500    0.2500
  28         0.1000    0.1500    0.2500     2.000    0.1500    0.2500
  34         0.2000    0.5000    0.3500     0.000    0.5000    0.7000
  44         0.1000    0.5000    0.2500     0.000    0.5000    0.2500
  45         0.1000    0.2800    0.2500     0.000    0.5000    0.2500
  54         0.1000    3.0000    0.5000     1.000    0.7000    0.8000
  64         0.1000    0.2500    0.2500     3.000    0.5000    0.2500
  65         0.1000    0.5000    0.2500     0.000    0.5000    0.2500
 END PWAT-PARM4
 PWAT-STATE1
   <PLS >  PWATER state variables***
   # -  #***   CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
  14          0.078        0.    0.2500      0.10     2.500      2.00     0.000
  16          0.078        0.    0.2500      0.10     2.500      2.00     0.000
  18          0.078        0.    0.2500      0.10     2.500      2.00     0.000
  24          0.051        0.    0.2500      0.10     2.500      2.00     0.000
  26          0.051        0.    0.2500      0.10     2.500      2.00     0.000
  28          0.051        0.    0.2500      0.10     2.500      2.00     0.000
  34          0.078        0.    0.2500      0.10     0.000      2.00     0.000
  44          0.051        0.    0.2500      0.10     0.000      2.00     0.000
  45          0.051        0.    0.2500      0.10     0.000      2.00     0.000
  54          0.051        0.    0.2500      0.10     2.000      2.00     0.000
  64          0.051        0.    0.2500      0.10     2.000     20.00     0.000
  65          0.051        0.    0.2500      0.10     0.000     20.00     0.000
 END PWAT-STATE1
END PERLND
IMPLND
 GEN-INFO
   <ILS >      Name             Unit-systems   Printer                      ***
   # -  #                     User  t-series Engl Metr                      ***
                                    in  out                                 ***
  14       IMPERVIOUS            1    1    1   60    0
 END GEN-INFO
 ACTIVITY
   <ILS > ************* Active Sections ****
   # -  # ATMP SNOW IWAT  SLD  IWG IQAL  ***
  14         0    0    1    0    0    0
 END ACTIVITY
 PRINT-INFO
   <ILS > ******** Print-flags ******** PIVL  PYR
   # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
```

```
  14          0    0    6    0    0    0    1    9
 END PRINT-INFO
 IWAT-PARM1
   <ILS >            Flags           ***                                       ***
   # -  # CSNO RTOP  VRS  VNN RTLI   ***                                       ***
  14          0    0    0    0    0
 END IWAT-PARM1
 IWAT-PARM2
   <ILS >                                                                      ***
   # -  #      LSUR     SLSUR      NSUR     RETSC                              ***
  14         100.00    0.0100    0.1000    0.1000
 END IWAT-PARM2
 IWAT-PARM3
   <ILS >                                                                      ***
   # -  #    PETMAX    PETMIN                                                  ***
  14
 END IWAT-PARM3
 IWAT-STATE1
   <ILS >  IWATER state variables                                              ***
   # -  #      RETS      SURS                                                  ***
  14      1.0000E-3 1.0000E-3
 END IWAT-STATE1
END IMPLND
                                                                               ***
EXT SOURCES
                                                                               ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes.
                                                                               ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM      2 PREC     ENGLZERO  1.00         PERLND  14 200 EXTNL  PREC
WDM      2 PREC     ENGLZERO  1.00         IMPLND  14     EXTNL  PREC
WDM   1010 EVAP     ENGLZERO  0.8          PERLND  14  65 EXTNL  PETINP
WDM   1010 EVAP     ENGLZERO  0.8          IMPLND  14     EXTNL  PETINP
*** PRECIP/EVAP TO LAKES
WDM      2 PREC     ENGLZERO               RCHRES  20     EXTNL  PREC
WDM   1010 EVAP     ENGLZERO    0.8        RCHRES  20     EXTNL  POTEV

END EXT SOURCES
                                                                               ***
EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
*** GAUGE POINTS (17=MOUTH, 54=MILLER RDF, 50=SR 518, 18=WALKER CK)
RCHRES  18 HYDR   RO                       WDM     36 FLOW     ENGL      REPL
*** MISC (20=WALKER WETLAND, 55=SR509, 56=1ST AVE)
RCHRES  20 HYDR   RO                       WDM     37 FLOW     ENGL      REPL
RCHRES  20 HYDR   STAGE  1 1     ***       WDM   1037 STAG     ENGL      REPL
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
***WALKER NR MTH
RCHRES  18 HYDR   RO     1 1 0.000764      WDM     50 SIMQ     ENGL      REPL
RCHRES  20 HYDR   RO     1 1 0.006520      WDM   1051 SIMQ     ENGL      REPL
END EXT TARGETS
                                                                               ***
SCHEMATIC
```

```
<-Source->                   <--Area-->    <-Target->  MBLK    ***
<Name>   #                   <-factor->    <Name>   #  Tbl#    ***

***WALKER CREEK
  *** SUB-CATCHMENT  MC 8
PERLND  26                      5.19       RCHRES  20     1
PERLND  44                     20.92       RCHRES  20     1
PERLND  54                      2.91       RCHRES  20     1
IMPLND  14                      1.79       RCHRES  20     2
  *** SUB-CATCHMENT  MC 8B
PERLND  26                     19.21       RCHRES  20     1
PERLND  44                     15.45       RCHRES  20     1
PERLND  54                      0.61       RCHRES  20     1
IMPLND  14                      1.71       RCHRES  20     2
  *** SUB-CATCHMENT  MC 9
PERLND  26                      9.33       RCHRES  20     1
PERLND  44                      3.93       RCHRES  20     1
PERLND  54                      0.08       RCHRES  20     1
IMPLND  14                      0.32       RCHRES  20     2
  *** SUB-CATCHMENT 18
PERLND  16                      0.76       RCHRES  18     1
PERLND  26                     16.08       RCHRES  18     1
PERLND  34                     20.95       RCHRES  18     1
PERLND  44                     49.22       RCHRES  18     1
IMPLND  14                      3.30       RCHRES  18     2
  *** SUB-CATCHMENT 19
PERLND  16                     12.72       RCHRES  19     1
PERLND  26                     92.07       RCHRES  19     1
PERLND  34                      8.39       RCHRES  19     1
PERLND  44                     95.55       RCHRES  19     1
IMPLND  14                     30.53       RCHRES  19     2
  *** SUB-CATCHMENT 20
PERLND  26                     12.53       RCHRES  20     1
PERLND  44                     53.43       RCHRES  20     1
PERLND  54                     33.43       RCHRES  20     1
IMPLND  14                     52.83       RCHRES  20     2
*** DOWN STREAM OF WALKER CREEK GAGE
  *** SUB-CATCHMENT 21 33% OF GW GOES TO GAGE REST GOES TO SOUND
PERLND  16                      2.54       RCHRES  18     7
PERLND  26                     44.30       RCHRES  18     7
PERLND  34                      2.03       RCHRES  18     7
PERLND  44                     41.13       RCHRES  18     7
  *** SUB-CATCHMENT 22
PERLND  34                      4.30       RCHRES  22     1
PERLND  44                     19.49       RCHRES  22     1
PERLND  54                      3.21       RCHRES  22     1
IMPLND  14                      3.95       RCHRES  22     2

***GROUNDWATER FROM OUTSIDE OF WALKER CREEK

PERLND  64                    630.00       RCHRES  20     7
PERLND  65           ***      130.00       RCHRES  20     7


***STREAM ROUTING
RCHRES  20                                 RCHRES  19     3
RCHRES  19                                 RCHRES  18     3
```

```
END SCHEMATIC

NETWORK
                                                                             ***
***        <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>       <-MEMBER->
<NAME>   # <NAME>   TEM STRG<-FACTOR->STRG <NAME>    #    # <-GRP> <NAME> # # ***
                                                                             ***
END NETWORK
                                                                             ***
RCHRES
  GEN-INFO
    RCHRES       Name         Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                          in  out                            ***
   18     Trib (0371A) M 18        1    1    1    1   62    0    0
   19     Trib (0371A) M 19        1    1    1    1   62    0    0
   20     Trib   M 20              1    1    1    1   62    0    1
   21     Trib (0371H) M 21        1    1    1    1   62    0    0
   22     Trib (0371A) M 22        1    1    1    1   62    0    0

  END GEN-INFO
  ACTIVITY
    RCHRES *************** Active Sections *****************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG                  ***
    1   63    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    RCHRES *************** Printout Flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
    1   63    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1   99   0  1  0  0    4  0  0  0  0       0  0  0  0  0      2  2  2  2  2
  END HYDR-PARM1
  HYDR-PARM2
    RCHRES                                                                   ***
    # -  #    FTABNO      LEN     DELTH     STCOR        KS      DB50        ***
  <------><--------><--------><--------><--------><--------><-------->       ***
   18            18   0.800                                 0.3
   19            19   0.568                                 0.3
   20            20   0.379                                 0.3
   21            21   0.450                                 0.3
   22            22   0.300                                 0.3
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---> ***  <---><---><---><--->
   18     0.1             4.0
   19     0.1             4.0
```

```
   20     10.0              4.0
   21     0.1               4.0
   22     0.1               4.0
  END HYDR-INIT
END RCHRES

FTABLES

  FTABLE     18
 ROWS COLS ***
    3    4
     DEPTH       AREA     VOLUME    OUTFLOW   ***
      0.00       1.30       0.00       0.00
      1.00       1.30       1.30     166.00
      2.00       1.40       2.65     490.00
  END FTABLE 18

  FTABLE     19
 ROWS COLS ***
    3    4
     DEPTH       AREA     VOLUME    OUTFLOW   ***
      0.00       1.10       0.00       0.00
      1.00       1.10       1.10      65.00
      2.00       1.20       2.25     223.00
  END FTABLE 19

  FTABLE     20
*** WALKER CREEK WETLAND
 ROWS COLS ***
   10    4
     DEPTH       AREA     VOLUME    OUTFLOW   OUTFLOW ***
      0.00       0.00       0.00       0.00
      1.00       2.50       1.25       7.04
      2.00       5.00       5.00      17.84
      3.00      12.00      13.50      32.17
      4.00      19.00      29.00      45.13
      5.00      22.00      49.50      54.95
      6.00      23.00      72.00      61.62
      6.10      23.00      74.30      62.15
      7.00      23.50      95.25      67.00
      7.24      24.10     101.10     100.00
  END FTABLE 20

  FTABLE     21
 ROWS COLS ***
    8    4
     DEPTH       AREA     VOLUME    OUTFLOW   ***
     0.000     0.0000     0.0000       0.00
     0.100     0.2259     0.0113       0.11
     0.500     0.2707     0.1106       4.27
     1.000     0.3268     0.2600      15.13
     1.500     0.3828     0.4374      31.67
     2.000     0.4389     0.6428      54.02
     2.500     0.4949     0.8763      82.52
     3.000     0.5510     1.1377     117.55
  END FTABLE 21
```

```
  FTABLE     22
 ROWS COLS ***
    9    4
     DEPTH      AREA     VOLUME    OUTFLOW   ***
     0.000     0.0000    0.0000       0.00
     0.100     0.3680    0.0184       0.25
     0.500     0.3717    0.1664       9.39
     1.000     0.3763    0.3534      31.06
     2.000     0.3819    0.7325      94.37
     3.000     0.3874    1.1171     174.33
     4.000     0.3930    1.5073     265.38
     5.000     0.3985    1.9030     364.68
     6.000     0.4040    2.3043     470.60
  END FTABLE 22
END FTABLES
MASS-LINK
<Volume>    <-Grp> <-Member-><--Mult-->     <Target>         <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                  <Name> # #***
  MASS-LINK        1
  conversion from acre-inches to acre-ft (1/12)                ***
PERLND      PWATER PERO       0.0833333     RCHRES           INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
IMPLND      IWATER SURO       0.0833333     RCHRES           INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
RCHRES      ROFLOW                          RCHRES           INFLOW
  END MASS-LINK    3

  MASS-LINK        4
RCHRES      OFLOW  OVOL   1                 RCHRES           INFLOW IVOL
  END MASS-LINK    4

  MASS-LINK        5
RCHRES      OFLOW  OVOL   2                 RCHRES           INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        6
PERLND      PWATER SURO       0.0833333     RCHRES           INFLOW IVOL
PERLND      PWATER IFWO       0.0833333     RCHRES           INFLOW IVOL
  END MASS-LINK    6

  MASS-LINK        7
PERLND      PWATER AGWO       0.0833333     RCHRES           INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        8
PERLND      PWATER PERO       0.0833333     COPY             INPUT  MEAN
  END MASS-LINK    8
  MASS-LINK       12
PERLND      PWATER AGWO       0.0833333     COPY             INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK        9
IMPLND      IWATER SURO       0.0833333     COPY             INPUT  MEAN
```

```
  END MASS-LINK     9

  MASS-LINK        10
COPY         OUTPUT MEAN                                RCHRES          INFLOW IVOL
  END MASS-LINK    10

END MASS-LINK
END RUN
```

SMP Volume 4 Sections
D,E,F,H,M,Q,W and Z only

PREFACE

Comprehensive Stormwater Management Plan
Seattle-Tacoma International Airport
Master Plan Update Improvements

July 2001

This document contains replacement pages developed in response to comments received from the Washington State Department of Ecology (Ecology) on Volumes 1 through 4 of the December 2000 Comprehensive Stormwater Management Plan (SMP) for the Seattle-Tacoma International Airport Master Plan Update Improvements. A facilitated process was used to document specific revisions required by Ecology to the December 2000 SMP. Each SMP volume contains an itemized list of replacement pages, and the replacement pages are identified by a July 2001 footer.

SMP VOLUME 4

<u>JULY 2001 REPLACEMENT PAGES</u>

Preface (before pg. *i*)

List of Volume 4 Replacement Pages

APPENDIX D (*Entire Appendix replaced*):

- List of Pond Plan and Profiles;
- Exhibits C131; C132; C133; C133.1; C134; C134.1; C134.2; C134.3; C135; C135.1; C136; C136.1; C136.2; C137; C138; C139; C140: C141; C145; C146; C147; C148; C149; C150; C151; and D-2
- October 27, 2000 Vault Structural Feasibility Memo (1 pg.)
- April 23, 2001 Supplemental Vault Structural Feasibility Memo (3 pgs.)
- April 21, 2001 Geotechnical Assessment of Constructing Vaults in Fill (2 pgs.)
- April 26, 2001 Feasibility of Vault Maintenance Memo (3 pgs.)

APPENDIX F

- Pg. 1 of December 14, 2000 Infiltration Memo
- May 23, 2001 Infiltration Feasibility Memo for Pond F (10 pgs.)

APPENDIX G:

- Section 3.2 (pg. G-5)
- Table G-2 (pg. G-6)

APPENDIX H:

- Table H-6 (pg. H-10)

APPENDIX Q:

- Exhibits C113, C114; C116; C118; C127; C128; C129; and C130

APPENDIX R:

- R-4 Pond B Drawing (Sheet C40)

APPENDIX Y:

- *Entire Appendix replaced* (17 pgs.)

Note: Listed page totals do <u>not</u> include "guidance" pages (the guidance pages do not need to be inserted as replacement pages).

COMPREHENSIVE STORMWATER MANAGEMENT PLAN

VOLUME 4

APPENDICES C THROUGH Z

SEATTLE-TACOMA INTERNATIONAL AIRPORT MASTER PLAN UPDATE IMPROVEMENTS

FOR AGENCY REVIEW

Prepared for

PORT OF SEATTLE
Seattle-Tacoma International Airport
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Prepared by

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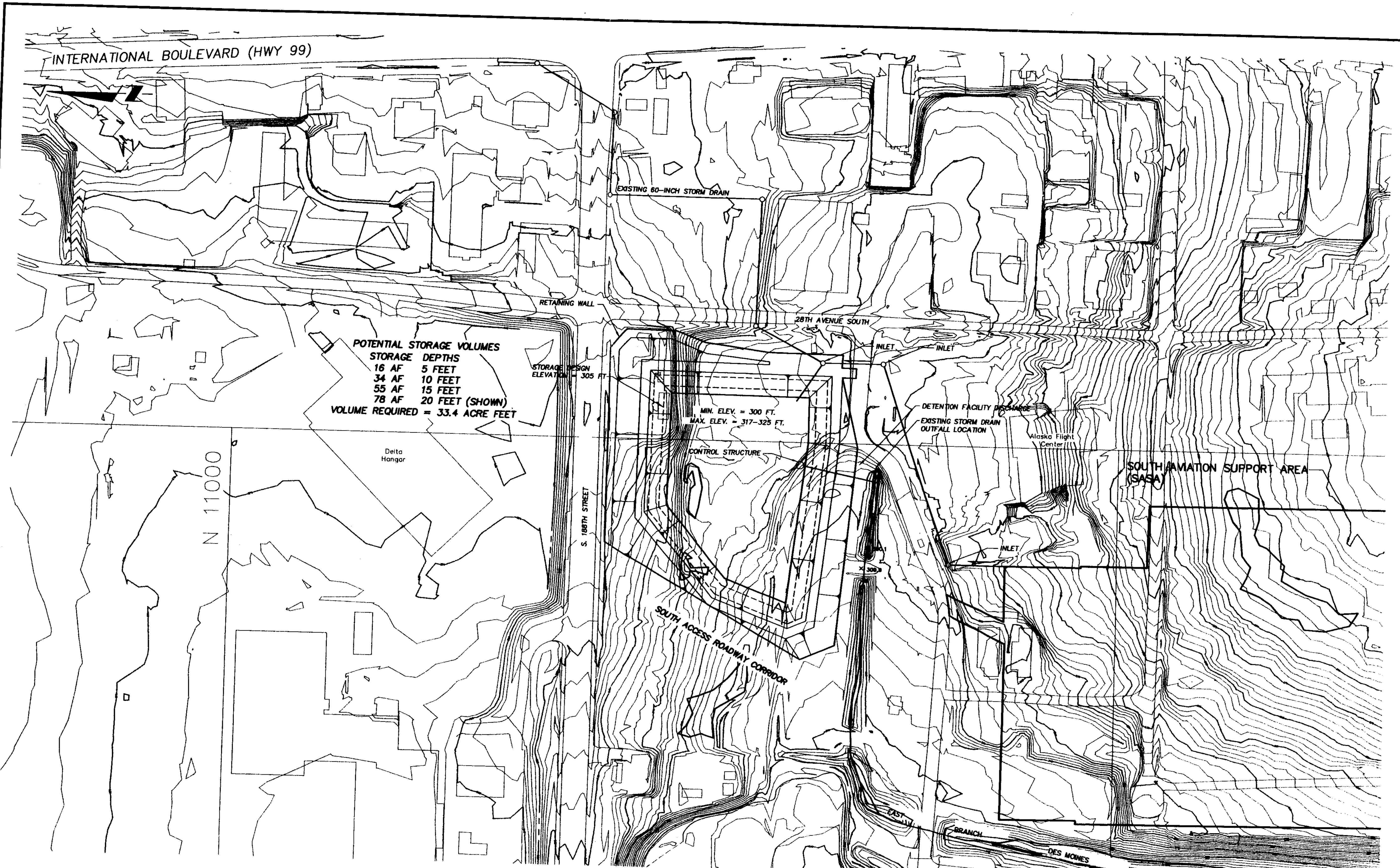
December 2000
556-2912-001 (28)

VOLUME 4



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NO.	REVISIONS	DATE	BY

DESIGNED K. RITLAND
DRAWN S. NEWELL
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APPROVED

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SEATAC, WASHINGTON
JOB NO. 55-2912-01-28 FILE NAME 5529120128-0109

FIGURE D-2
NEW STORMWATER DETENTION FACILITY
SAS DETENTION FACILITY

SHEET NO. D-2

AR 011066

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Memorandum

To Michael Cheyne, Program Manager Date 10/27/00

From Tom Cossette, P.E.

Subject Port of Seattle – Stormwater Master Plan (SMP)
Stormwater Detention Vaults – Structural Feasibility

The storage of storm water runoff as part of a comprehensive drainage system is critical to the viability of the proposed Master Plan Improvements at Sea-Tac. As structural engineers who have had experience with large water storage tanks and buried structures, HNTB structural engineering group was asked to assess the feasibility of constructing a number of large buried stormwater detention vaults necessary to meet the requirements of these improvements. The capacity of the vaults currently proposed range from 4.3 to 98.1 acre-feet.

For the purposes of feasibility analysis, geotechnical and soil data was assumed to be similar to that investigated elsewhere on the airport site for buried vault facilities. Based on currently available information and professional knowledge of structural considerations for above and below grade facilities, HNTB offers the following comments:

> There are contractors in this country that have built numerous buried water storage facilities under a variety of site-specific conditions. One such contractor, Preload Inc., Garden City, N.Y, has constructed thousands of prestressed concrete water tanks in the one to ten million gallon range, and advertises sizes to 40 million gallons (approx.123 acre-feet) and beyond. As evidenced by numerous above and below grade potable water storage tanks and industrial chemical storage tanks around the country, steel containment vessels have also been designed and constructed to meet similar applications. It was concluded that the sizes of the proposed vaults are apparently well within what contractors can build with proven construction means and methods.
>
> There are existing stormwater detention vaults on site, between S. 188th Way and Runway 34L, with a total capacity of 6.2 acre-feet. They are below grade caste-in-place reinforced concrete box structures, approximately 40 ft. wide x 20 ft. tall x 300 ft. long, with a single interior wall that divides the vault longitudinally into two 20 ft. wide cells. For purposes of evaluating structural feasibility, a simple analysis of replicating the existing structures to obtain the necessary volumes was evaluated. The analysis concluded that similar construction could be used for the proposed 98.1 acre-feet capacity vault. The resulting configuration could be a box structure approximately 260 ft. wide x 26 ft. tall x 680 ft. long, consisting of thirteen 20 ft. wide cells. Furthermore, while the ultimate size of the vault might be constrained by land use features or topography, it is not constrained (horizontally) by structural limitations.
>
> The invert depths and heights of soil cover on the proposed vaults are not excessive and the proposed locations of vaults do not require the capability to support large aircraft loads. No significant structural issues have been identified due to soil cover and surface loadings on the proposed vaults.

Based on structural considerations, stormwater detention vaults of the magnitude shown in the SMP are feasible and well within the engineering and constructability standards and practices used in industry for similar facilities.

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Supplemental Memorandum

To Michael Cheyne, Program Manager Date April 23, 2001

From Tom Cossette/Alan Black

Subject Port of Seattle – Stormwater Master Plan (SMP)
Stormwater Detention Vaults – Structural Feasibility

HNTB structural engineering group was asked to provide additional assessment for the feasibility of two non-standard vault design conditions that are shown in the Stormwater Master Plan Document: above ground detention/retention vaults and vaults within embankment areas.

Above Ground Vaults

There are three above ground vaults currently proposed in the Stormwater Master Plan Document.

Vault	Volume	Description of Condition
SDS3	12.9 Ac.Ft.	220' diameter x 18' deep portion above grade varies from 0' on one side to 10' on the opposite side
SDS7	21.4 Ac.Ft.	300' x 135' x 22' deep almost entirely above grade
SDN3	25.6 Ac.Ft.	300' x 187' x 25' deep. Mostly buried but the top 15 feet of one corner would be above grade

Based on currently available information and professional knowledge of structural considerations for these above grade facilities, HNTB offers the following comments:

SDS3 - Circular concrete tanks (vaults) are one of the most common types of water storage structures – whether above ground, partially buried, or fully buried. Preload Inc., Natgun Corp., and Crom Corp. are three examples of contractors who construct these tanks in various diameters and heights and in storage volume capacities that range from 0.6 to 120 Ac.Ft. Design and construction of circular concrete tanks is addressed by publications from the American Concrete Institute (ACI) and the Portland Cement Association (PCA).

SDS7 – This vault could be constructed as rectangular, but further investigation found that two circular vaults would be more cost effective to provide the required storage volume at this location. The two vaults can be hydraulically connected via large diameter pipe(s), either through the walls or through the floor. Penetrations through such structural elements can be accommodated by localized addition of steel reinforcing bars and/or member thickening. See SDS3 for discussion regarding circular tanks.

SDN3 – SeaTac has a an existing buried reinforced concrete stormwater detention vault on site, between S. 188th Way and Runway 34L, that is smaller but similar to this proposed vault. Design and construction of partially buried and buried rectangular concrete water storage vaults has a history and a future. A few comparable facilities elsewhere in the United States are described below.

HNTB is completing conceptual design for Lansing's Art and Education Center that is adjacent to a 30.6 Ac.Ft. partially buried water storage vault that was built in 1938. The water company owner is expecting that the vault will serve their needs for another 50 to 60 years.

A 20.7 Ac.Ft. buried reinforced concrete stormwater storage vault was constructed ten years ago as part of a new hold apron at Chicago's Midway Airport.

The Norumbega Reservoir, a 350 Ac.Ft. buried water storage vault, is currently being constructed by the Massachussetts Water Resources Authority.

One corner of this vault would be above grade. The differential earth and hydrostatic pressures generated by the sloping fill can be accommodated in the vault design. This generally takes the form of localized additions of steel reinforcing bars and/or member thickening.

Vaults within Embankment Areas

There are two vaults currently proposed to be within the airfield embankment.

Vault	Volume	Description of Condition
SDW1A	13.8 Ac.Ft.	200' x 100' x 30' deep below grade – set as close to edge of embankment as possible to minimize area for aircraft loading design
SDN3A	10.2 Ac.Ft.	Two 120' x 120' x 23' deep below grade vaults connected by a 48-in diameter equalizer pipe– set near the edge of embankment (or retaining wall) as possible to minimize area for aircraft loading design.

Based on currently available information and professional knowledge of structural considerations for these above grade facilities, HNTB offers the following comments:

SDW1A – Structural investigations of a particular conceptual layout for a rectangular vault was made for two contrasting siting conditions. The investigations included 2-dimensional frame analyses to arrive at preliminary foundation, wall, and top slab sizes. The assumed values for the geotechnical soil parameters (soil unit weight, lateral earth pressure, bearing capacity) used to complete the analyses are within a likely range for the soil units to be expected for this project, as presented in the Preliminary Geotchnical Assessment that accompanies this memo.

The first siting condition for which the concept layout was investigated was for the top of the vault to be flush with the 3rd runway apron and subject to direct aircraft loading (taxi weight of a 757-200). The second siting condition was for the vault located within the embankment slope such that 40 feet of the top surface would be exposed along the west edge. The dominant loading for this condition results from the approximately 38 feet deep triangular wedge of fill on top of the vault along east side and the accompanying highly differential lateral earth forces.

As a result of these specific structural investigations, HNTB engineers conclude that buried and partially buried rectangular vaults, of comparable order-of-magnitude size, are certainly feasible as a stormwater storage facility choice for this project.

SDN3A – These proposed vaults are of comparable size, and may be sited similar, to SDW1A for which specific structural investigations and affirmative feasibility conclusions were made, as discussed above.

PRELIMINARY GEOTECHNICAL ASSESSMENT OF CONSTRUCTING STORM WATER DETENTION VAULTS C_1, C_2 AND G_1, IN EMBANKMENT FILL

Hart Crowser evaluated stability of proposed stormwater vaults C_1, C_2 and G1, located as shown in the December 2000 Comprehensive Stormwater Management Plan, and including alternate locations on the top and bottom of the west facing embankment slope adjacent to Runway Stations 206+44 and near the toe of the embankment slope adjacent to Station 202+47.

1. Slope stability does not present a "critical flaw" for any of the proposed vault locations that we evaluated. Current feasibility level analyses were accomplished for both the 475- and 975-year seismic events. Ranges in factors of safety, with and without subgrade improvements, are slightly affected by vault location, but requirements for subgrade improvement (to provide slope stability) are more or less the same with and without vaults.

2. Embankment fill constructed to date has typically been compacted to minimum percentages of maximum, modified Proctor density of 90 to 92 percent, depending primarily on type of fill material. Actual densities achieved typically vary, but exceed specified minimums. Hart Crowser typically recommends that fill placed to support structures be compacted to at least 95 percent of maximum, modified Proctor density. Although some additional construction effort will be required, Third Runway construction experience to date indicates this can be accomplished within the area needed to support vaults.

3. Allowable bearing pressures for structures in the fill are anticipated to be around 4 kips per square foot and may be higher. This value is in addition to the weight of the fill itself, for embedded structures. Preliminary analyses indicated only nominal setback or embedment for foundations would be required relative to the sloping embankment surface to obtain the recommended allowable bearing. Additional setback or embedment may be appropriate to prevent any potential sloughing from exposing the footing.

4. Total and differential settlement of fill supporting the vaults will vary depending on location, size and sequence of construction. Potential differential settlement of pipes connected to the vault(s) and extending across fill zones compacted to different minimum densities may need to be addressed by settlement monitoring and construction

of piping after completion of primary fill settlement. Hart Crowser does not anticipate this will present any significant construction difficulty.

5. Nominal unit weight of the fill for conceptual design purposes is around 140 pounds per cubic foot (pcf). Lateral earth pressures acting on the vaults under static conditions are anticipated to be around 60 pcf (expressed as an equivalent fluid density) assuming backfill against non-yielding walls. Seismic surcharge on the embedded structures will be comparable to basement structures of comparable size, constructed per UBC.

6. Shallow piping (inlet or outlet) extending down the embankment face can be designed and constructed with conventional procedures, such as seepage collars. Published guidance used for outlet control structures on earth dams provides a good basis for design of the vaults and connecting piping for the Third Runway embankment.

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Memorandum

To Michael Cheyne, Program Manager

Date April 26, 2001

From Alan Black

Subject Port of Seattle – Stormwater Master Plan (SMP)
Stormwater Detention Vaults –Feasibility of Maintenance

The HNTB engineering group was asked to address January 2001 King County comments, Group 5 checklist item 2 requesting additional information on the maintenance feasibility of above ground and deeper than standard detention vaults that are shown in the Stormwater Master Plan.

King County standard detention vaults are described in the King County Surface Water Design Manual as facilities having the following characteristics:

- Maximum depth finished grade to the vault invert shall be 20 feet.
- Access ports located within 50 feet of any point in the vault with round solid locking lids, 3-foot square, locking diamond plate covers.
- Facilities with >1250 square feet (SF) shall include 5' x 10' removable panel
- Meet OSHA confined space requirements including ladders with hand holds provided at inlet and outlet pipe locations and clearly marked entrances to confined space areas.
- Internal walls shall be provided with openings sufficient for maintenance access and sized and situated for access to maintenance "v" in the vault floor.
- Ventilation pipes (12-inch diameter minimum) provided at all four corners to allow for artificial ventilation prior to entry of maintenance personnel.

Stormwater Master Plan Detention Vault Facilities

Vault Name	Exhibit	Depth*	Floor Area	Configuration
SDW2 Reserve Stormwater Release Vault	C131	16 ft	3600 SF	Below ground
SDS4	C139	20 ft	38,015 SF	Flush with ground at access road.
SDS7	C140	25 ft	47,250 SF	Above ground
SDS3	C141	41 ft	192,500 SF	Below ground
SDN3	C145	27 ft	56,100 SF	Mostly below ground
SDN2/SDN4	C146	23 ft	34,375 SF	Flush with ground at access road.
M6 (NEPL)	C147	28 ft	33,000 SF	Below ground
SDN1	C148	24 ft	21,905 SF	Mostly below ground
SDN6 (CARGO)	C149	18 ft	15,395 SF	Flush with ground
SDN3 (2 Vaults)	C150	25 ft	14,400 SF	Below ground
SDW1A	C151	38 ft	20,000 SF	Below ground

* An allowance of 2 feet has been used for the top slab thickness to estimate depth where defined by the top of structure. Maximum potential access depth is shown; actual depths vary.

C:\posvaultmaint-2.doc

Based on currently available information and discussion with Port of Seattle maintenance staff, HNTB offers the following comments:

There is one facility, SDS7 Basin Vault (sheet C140 in appendix D) shown as an above ground facility. The SDS7 Basin Vault would have a top elevation at approximately 325. The adjacent land varies between elevation 312 and 300. Two maintenance options are available: external stair, ladder, or access ramp roadway. The stair or ladder options would provide person access for regular inspections but a crane would be required to lift pump units or other equipment for less frequent cleaning operations. The lift height of 15 feet would allow use of smaller cherry-picker cranes. An access ramp is also feasible for this location. The King County standard 15 percent maximum slope would result in an 87-foot long ramp grade along the tank wall. Site constraints would likely require that this ramp would be constructed as a 15-foot wide asphalt roadway on a mechanically stabilized earth wall and barrier type wall coping. The drawings illustrate the ramp option since it would require the largest facility footprint (to facilitate assessment of greatest likely impact), but selection of which option is used will be done during final design.

All others that protrude above ground do so in only a portion of the top area. These will be designed for direct HS20 loading to allow full vehicular access to any part of the top to allow maintenance using the same methods typical of an underground tank. Those facilities are accessed from the side that is buried.

Most facilities exceed the King County maximum depth of 20 feet between top of finished grade and the invert of the vault in at least a portion of the facility. Though the KCSWDM does not specifically note the reason for this guideline, the maximum depth is likely the result of limitations for existent King County maintenance equipment. Since these facilities would be Port maintained facilities, the King County standard are not considered as design constraints for these facilities. The following special provisions are anticipated to address the maintenance of these facilities.

- The Port of Seattle currently uses a vactor truck, truck mounted cranes and block and tackle on tripod for vault cleaning work. The Port has noted that they do not see the depth of these facilities as a concern, but has noted that they may require some new or modified equipment to accommodate the facilities as shown. HNTB conducted a web search and verified that vactor trucks are available in a wide range of configurations and capacities. The largest "heavy industrial vacuum (Guzzler/Vactor) truck available through United Pumping was noted to be "capable of removing [water] from remote or inaccessible locations as far away from the machine as 1000 feet or more through suction lines 8" in diameter and smaller." This is consistent with the Port's intent to test alternate suction line configurations to address the proposed conditions, but also gives HNTB confidence that there is a vactor truck available if the Port's existing truck proves to be inadequate. A local utility cleaning service that uses vactor trucks indicated that they have gone to 100-foot depths with their equipment but they noted that pumping time increases with depth. The Port has the option to replace the function of the vactor truck with new or existing portable pumps that could be selected to perform better. The existing truck mounted crane or block and tackle could be used to lower a pump into position. The designer will continue to work with the Port through final design to allow them adequate time to plan and acquire equipment as needed.
- Vault access ports will meet or exceed King County standards.

- The Port has noted that we should use the current maximum of 41 feet as the depth limit in the event that further design/model developments identify a need for larger facilities.
- OSHA requires that ladders greater than 25 feet in height include intermediate landing for personnel access safety. This tends to add undesirable inconvenience for lowering items though the access ports on space constrained facilities. The large size of these facilities would allow space for landings or internal stairways for personnel access separate from the 5' x 10' equipment access doors or panels.
- The County's suggested provisions for ventilation might be inadequate for the large facilities shown. A qualified engineer will work with the Port to ensure that ventilation is adequate to meet OSHA confined space requirements. Self-contained supplied air is readily available to maintenance worker if needed.
- Pretreatment on the airfield including 60-foot filter strips, catchbasins, and frequent inspection/removal of foreign objects (including trash) for the airport operation area will significantly reduce maintenance requirements relative to typical King County facilities.
- Internal walls with openings sufficient for maintenance and access to maintenance "v" in the vault floor and to outlet structure or sediment trap sumps. These details are not shown on the drawings but will be addressed as part of the final design.

The Port's experience in owning, operating, and maintaining the two large existing detention vault facilities gives HNTB confidence that maintenance of the proposed facilities will be feasible. Final design will include consideration of OSHA confined space requirements, and special Port needs to establish personnel and equipment access appropriate for each vault location.

APPENDIX E

BMP SIZING ESTIMATIONS PER UNIT PGIS AREA

APPENDIX E

TABLE OF CONTENTS

LIST OF TABLES

AR 011077

1. STORM FLOW AND VOLUME CALCULATIONS

Bioswale and filter strip size were based on the water quality design flow rate, specified as the 6-month, 24-hour design storm. Wetpool and treatment wetland pool size were based on the mean annual storm runoff volume.

Water Quality Design Flow for Bioswales and Filter Strips

The following parameters were used in the StormSHED Hydrologic Modeling Program (Engenious Systems 1997):

Area: 1 acre
Curve Number: 98
Time of Concentration: 4 minutes

To estimate the 6-month storm flow rate, 64 percent of the 2-year, 24-hour precipitation of 2.0 inches was used. From StormSHED (output attached on following page), the 6-month peak flow rate was 0.32 cfs.

Runoff Volume from Mean Annual Storm for Wetvaults

Wetvault volume was based on the mean annual storm runoff volume. The mean annual storm volume for a 1-acre imperious area was calculated using the simplified method described in the King County Manual (King County 1998). Because the area to be treated is 100 percent impervious, the runoff formula from the King County Manual was simplified to:

Runoff Volume (ft^3), $V_r = 0.9 * A_i * (R/12)$

where: A_i = impervious area (ft^2)
R = mean annual storm precipitation (inches)

The mean annual storm precipitation of 0.47 inch was obtained from the isopluvial map provided in the King County Manual. The mean annual runoff was calculated to be:

$V_r = 0.9 * (43{,}560) * (0.47/12) = 1{,}535$ ft^3

AR 011078

Drainage Area: 1AC

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur	24.00 hrs			
	Area	CN	TC	
Pervious	0.0000 ac	98.00	0.00 hrs	
Impervious	1.0000 ac	98.00	0.07 hrs	
Total	1.0000 ac			

Supporting Data:

Impervious CN Data:

Impervious	98.00	1.0000 ac

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	Sheet	200.00 ft	1.00%	0.0100	3.26 min
Channel	Storm Drain	200.00 ft	1.00%	42.0000	0.79 min

1AC Event Summary:

BasinID ------	Peak Q (cfs)	Peak T (hrs)	Peak Vol (ac-ft)	Area ac	Method /Loss	Raintype	Event
1AC	0.32	7.83	0.0887	1.00	SBUH/SCS	kc24hr	0.64*2y

2. BMP SIZE CALCULATIONS

BMP sizing was based on the 1998 King County Manual. Sizing requirements for the King County and Ecology manuals are approximately equivalent; however, the King County Manual's simpler sizing procedures were better suited for these generic calculations.

2.1 FILTER STRIP SIZING

Filter strips were sized for a 300-ft-wide by 145-ft-long (1-acre) section of runway. Although the typical maximum flow path across runways and taxiways is 140 ft across the pavement and shoulder of straightaway taxiways, the flow path may reach up to 300 feet across runway/taxiway intersections.

Note: For filter strips, as with bioswales, the *length* dimension is parallel to the direction of flow. Therefore, for filter strips, length is measured perpendicular to the runway, taxiway, or roadway centerline. Runway and taxiway length is measured parallel to the centerline.

The following assumptions were used for the filter strip sizing:

WQ design flow, $Q = 0.32$ cfs
Manning's roughness, $n = 0.35$ (per King County Manual)
Strip Width, $W = 145$ ft
Slope, $s = 0.02$[1]

The calculations are shown below:

Flow depth, $d = \left[\frac{Q * n}{1.49 * W * s^{0.5}}\right]^{0.6} = \left[\frac{0.32 * 0.35}{1.49 * 145 * 0.02^{0.5}}\right]^{0.6} \approx 0.035\text{ ft}$

Flow velocity, $V = \frac{Q}{A} = \frac{Q}{W * d} = \frac{0.32}{145 * 0.035} = 0.064$ fps

Per the King County Manual, the flow must have a minimum 9-minute (540-second) residence time.

Strip Length, $L = 540 * V = 540 * 0.064 = 34.5$ ft

$\Rightarrow$ Area = $L * W = 145 * 34.5 \approx 5{,}000\text{ ft}^2$

2.2 BIOSWALE SIZING

The following assumptions were used for the bioswale sizing:

WQ design flow, $Q = 0.32$ cfs

---

[1] Nominal STIA design specifications call for a slope of 1.5 percent. This assumed slope results in a conservative size estimate.

Manning's roughness, $n = 0.2$ (per King County Manual)
Bottom width, $b = 6$ ft
Flow depth, $y = 2$ inches = 0.167 ft (regularly mowed)
H:V side slopes, $Z = 3$
Slope, $s = 0.02$

The calculations are shown below:

$$V = \frac{Q}{A} = \frac{Q}{by + Zy^2} = \frac{0.32}{(6*0.167)+(3*0.167^2)} = 0.30 \text{ fps}$$

Per the King County Manual, the flow must have a minimum 9-minute (540-second) residence time.

Swale Length, $L = 540 * V = 540 * 0.30 = 160$ ft

Swale Area $= L * W = 160 * 6 \approx 960$ ft^2

2.3 WETVAULT SIZING

The calculations for the wetvault sizing are shown below:

Basic wetpond size (per the King County Manual), therefore wetpool volume = 3 * (volume of mean annual 24-hour storm runoff)

Mean annual storm runoff volume = 1,535 ft^3

Wetpool volume = 3 * 1535 = 4,610 ft^3

2.4 SUMMARY

Unit sizes of BMPs per acre are shown in Table E-2.

Table E-2. BMP unit sizes per acre of PGIS.

BMP	Approximate required size per acre of PGIS
Filter Strip	5,000 ft^2
Bioswale[1]	960 ft^2
Wetvault	4,610 ft^3

1 Area given is for bottom of bioswale. Including side slopes, bioswale area at 1.0 ft depth would be 1915 ft^2. However, where the unit size (960 ft^2) was used to evaluate existing bioswales, the bottom width of the existing bioswales was used, consistent with the area calculation used to estimate 960 ft^2. Where this area figure is used to estimate future bioswale area, planners should be aware that an additional 6 ft of width is necessary (assuming Z = 3, 3 ft needed on each side of bottom).

AR 011081

3. REFERENCES

Ecology (Washington State Department of Ecology). 1992. Stormwater management manual for the Puget Sound basin, the technical manual. Washington Department of Ecology, Olympia, Washington.

Engenious Systems, Inc. 1997. WaterWorks hydrologic modeling program. Seattle, Washington.

King County Department of Natural Resources (King County DNR). 1998. King County surface water design manual. King County Department of Natural Resources, Water and Land Resources Division, Seattle, Washington.

AR 011082

APPENDIX F

FEASIBILITY OF STORMWATER INFILTRATION REPORT

Feasibility of Stormwater Infiltration
Third Runway Project
Sea-Tac International Airport
SeaTac, Washington

Prepared for
Port of Seattle

December 14, 2000
_J-4978-06_

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FIGURES

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EXPLORATION LOGS

FIGURES

FEASIBILITY OF STORMWATER INFILTRATION
THIRD RUNWAY PROJECT,
SEA-TAC INTERNATIONAL AIRPORT
SEATAC, WASHINGTON

SUMMARY

Infiltration tests have been performed for selected sites on the west side of the proposed runway embankment to evaluate the feasibility of infiltration as part of the Stormwater Management Plan (SMP) for the Sea-Tac Third Runway project. The testing performed to date shows infiltration is feasible in two of the areas tested (Areas 1 and 3). Preliminary design infiltration rates have been developed from the field tests using methods stipulated by King County (1998) as listed in Table 1. Based on these results, potential infiltration capacities (in cubic feet per second [cfs]) at the individual sites have been developed for nominal 8-foot-wide infiltration trenches totaling 400 feet in length:

- Infiltration Area 1 can accommodate stormwater disposal at an average rate of 0.30 cfs; and
- Infiltration Area 3 can accommodate stormwater disposal at an average rate of 0.20 cfs.

Additional trenches may be located in these areas to increase infiltration capacity, depending on site logistics.

These data are suitable for conceptual infiltration facility design. The infiltration capacity of any site will depend on the detailed design and layout (i.e., area and elevation) of the infiltration facility, and the degree of variability in soil conditions beneath the facility. Additional infiltration tests and soil borings will be needed to meet all the requirements of the King County Surface Water Design Manual (1998) and should be completed once provisional footprints of the facilities are established.

This report summarizes design requirements for infiltration facilities, field data collection performed by Hart Crowser, and results of our work to date for Infiltration Areas 1 and 3.

INTRODUCTION

As a result of increased stormwater storage capacity requirements in the SMP, Hart Crowser was tasked to investigate potential sites for infiltration of detained stormwater on the west side of the proposed Third Runway project area (see Figure 1 for general location). Based on the location of detention ponds C, D, and G, three sites were identified as potential sites for infiltration of water discharged from detention ponds and/or vaults on the airfield. Additionally, the footprint of detention ponds C, D, and G were also considered for potential infiltration capacity. Locations of the detention ponds and Infiltration Areas 1, 2, and 3 are shown on Figures 2 and 3.

Infiltration testing was conducted along with the collection of soils and groundwater data that are needed to establish if infiltration can be implemented in each area in accordance with the requirements of the King County Surface Water Design Manual (KCSWDM - King County, 1998). The overall requirements for infiltration facilities are summarized in the following section.

INFILTRATION FACILITY REQUIREMENTS

The following summary outlines the General Requirements (Section 5.4.1 of the KCSWDM) for infiltration facilities (ponds, tanks, and trenches) associated with the natural site conditions. Additional requirements identified below under "Other Engineering Considerations" need to be addressed by the engineering design team.

Soils

- The basic requirement is a minimum of 3 feet of permeable soil below the bottom of the facility and at least 3 feet between the bottom of the facility and the maximum wet-season water table.
- A minimum of two test pits or soil borings per 10,000 ft^2 of infiltration area are required to characterize the site.
- Test pits or borings should extend at least 5 feet below the bottom of the infiltration facility, and at least one test hole should reach the water table.

Measured Infiltration Rates

- The measured infiltration rate should be determined using either the double-ring infiltrometer test (ASTM Method D 3385, 2000) or the EPA falling head percolation test procedure (EPA, 1980).
- Sufficient tests should be performed to determine a representative infiltration rate but at least three tests shall be performed for each proposed infiltration facility.

Design Infiltration Rate

- The design infiltration rate should be calculated by Equation 5-9 of the KCSWDM, using the correction factors listed in that Section 5.4.1.

Off-site Groundwater Impacts

- The impacts of infiltration should be considered for the potential to provide increased water to landslide areas, increased groundwater resources available, increased water levels in closed depressions, and higher groundwater levels.

Groundwater Protection

Groundwater protection requirements call for implementing one of the following actions when infiltrating water from pollution-generating surfaces:

- Provide water quality treatment prior to infiltration; or
- Demonstrate that the soil beneath the infiltration facility has properties which reduce the risk of groundwater contamination from typical stormwater runoff.

Other Engineering Considerations

- 100-Year Overflow Conveyance
- Spill Control Devices
- Pre-settling
- Protection from Upstream Erosion
- Construction Guidelines.

This report by Hart Crowser provides a preliminary assessment of the soils, infiltration rates, and hydrology of each site to establish the feasibility of infiltration. Engineering aspects and site logistics will be addressed by the design team as part of final design.

APPROACH

The type of infiltration test chosen at each location was dependent on the depth of the target soil strata or pond elevation. Generally, for tests less than 4 to 5 feet below ground surface, test pits were dug and the double-ring infiltrometer method was used. This method involved repeatedly measuring a small (< 1/4 inch) change in water level in both the inner and outer rings while consistently maintaining a head between 5.5 and 6 inches in both rings until a relatively constant rate was obtained. Pre-soaking the test area is not required; however, to limit the amount of inconsistent readings at the beginning of the test, a pre-soaking period of approximately one hour was employed.

For testing depths below 5 feet, the EPA method was used in an augered hole with a 6-inch-diameter temporary casing inserted to prevent caving of the borehole walls. This method involved repeatedly measuring the water level drop from an initial head (6 inches above the base of the hole) over a given period until a relatively constant rate was obtained. At the end time interval the water level was adjusted back to the original head level prior to starting the next measurement. A minimum of four hours or overnight pre-soaking of the test zone was performed.

The seasonal high groundwater level was estimated by measuring current groundwater levels in existing or recently installed monitoring wells at each site and comparing these with longer records from existing nearby wells in similar hydrogeologic settings. Additionally, soil profile characteristics such as low chroma mottling were also reviewed to assess the seasonal high groundwater levels.

RESULTS

We have completed infiltration tests and soil borings at one pond location and three potential infiltration areas:

- Pond G;
- Infiltration Area 1 (between Pond C and Pond G);
- Infiltration Area 2 (south of Pond G); and
- Infiltration Area 3 (northwest of Pond D).

Results of the double-ring infiltrometer tests are listed in Table 2; results of the EPA method falling head percolation tests are listed in Table 3.

Work on Pond D is still in progress. A third pond location (Pond C) was considered but the presence of groundwater seepage precluded further consideration of infiltration at Pond C. Infiltration in Pond G and Area 2 proved to be unfeasible due to low permeability soils and/or high groundwater levels. Logs of soil borings and test pits are included in Appendix A for Infiltration Areas 1 and 3.

In the following summaries, we include an estimate of the design infiltration rate for each area. This is currently based on the average values of the measured infiltration rates for each area, factored by our estimate of the appropriate correction factors, as stipulated by King County (1998). However, given the variability of the soils encountered to date, the mean value may not be appropriate for the entire facility at each location. Final design would take into account the results of additional facility-specific testing, the actual geometry of the proposed facilities, and additional design adjustments to provide an adequate "factor of safety."

Final measured infiltration values will be recommended for the design of the proposed facilities after completion of the additional borings and tests needed to fulfill KCSWDM requirements.

Infiltration Area 1

Investigative explorations show a consistent slightly silty fine to medium sand occurring across the site. The sand unit starts just below the surface and extends to depths of 8 feet (approximately 268 feet elevation) where deeper material increases in silt content.

The groundwater level measured in the new monitoring well HC00-B333, during November 2000, had an elevation of 268.5 feet. Table 4 lists the seasonal water level variations for two comparable wells east of Infiltration Area 1 with water level records that include last year's seasonal high. Based on the average seasonal fluctuation in these wells, and assuming currently observed water levels correspond to the seasonal low, the projected seasonal high water level for HC00-B333 is 273.1 feet (approximately 8 feet below ground surface).

The locations tested exhibited medium to high infiltration capacities ranging from 4.6 to 20.4 in./hr. Results are summarized in Table 1.

To illustrate the infiltration potential of this site, we have estimated the infiltration capacity of 400 lineal feet of 8-foot-wide infiltration trench(es). Using a design infiltration rate of 4.2 in./hr, such trenches in Area 1 may be expected to infiltrate 0.30 cfs of stormwater from SMP area SDW1A.

Infiltration Area 3

Three test pits revealed varying shallow soil composition. The northern two test pits (HC00-TP338 and HC00-TP339) encountered silty fine to medium sand at elevations between 297 and 308 feet. Test pit HC00-TP337 in the southern portion of the site revealed dry silt from the surface at approximate elevation 309 feet, to the bottom of the test pit (approximate elevation 301 feet). Although not determined at this time, the groundwater level in Infiltration Area 3 is expected to be at a depth of at least 10 feet, based on the absence of seepage into the test pits. Local water table mapping by AESI (2000) suggests that the groundwater elevation in the shallow regional aquifer is around 230 to 240 feet at this location.

Double-ring infiltrometer tests were conducted in test pits approximately 3 to 4 feet below the ground surface (i.e., approximately 302 to 309 feet elevation). Two were located in a silty sand deposit and provided moderate infiltration rates of 7.5 and 5.0 in./hr. The third test was performed in finer-grained silty soil and gave an infiltration rate of 0.94 in./hr.

Using an estimated design infiltration rate of 2.7 in./hr and assuming overall trench dimensions of 400 feet by 8 feet, Area 3 should infiltrate approximately 0.2 cfs of stormwater from SMP area SDW1B. Additional trenches may be an option in this area; however, the proximity of the adjacent slope (greater than 15%) may require regrading to create benches. The KCSWDM indicates that a geotechnical assessment of slope stability would likely be required for construction of an infiltration facility in Area 3.

CONCLUSIONS

The results of our soil borings and infiltration tests show that Areas 1 and 3 are suitable for infiltration of detained stormwater. The infiltration capacities quoted in this report are provisional; the appropriate design infiltration rate for each area depends on the chosen location, layout, depth, and length of infiltration trenches. The implementation of infiltration facilities will necessitate full consideration of relevant engineering requirements as outlined in the KCSWDM.

Sincerely,

HART CROWSER, INC.

ROBERT O. MIDDOUR
Project Hydrogeologist

MICHAEL A.P. KENRICK — STATE OF WASHINGTON — 31228 — REGISTERED PROFESSIONAL ENGINEER

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MICHAEL J. BAILEY, P.E.
Project Manager

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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.

ASTM, 2000. Double Ring Infiltrometer Test, ASTM Method D 3385, Annual Book of ASTM Standards, Soil and Rock (1): D 420 - D 5799.

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

Table 1 - Summary of Infiltration Testing Results; West Side of Third Runway Embankment

Location ID	Approximate Ground Surface Elevation in Feet (msl)	Measured Infiltration Rate in in./hr	Assumed Correction Factors $F_{testing}$	$F_{plugging}$	$F_{geometry}$	Design infiltration rate in in./hr	Estimated Infiltration Capacity in cfs using 200ft x 8ft trench(es) Number of Trenches 1 (200 linear ft)	2 (400 linear ft)	3 (600 linear ft)
Infiltration Area 1	(SDW1A)								
HC00-B327	276.1	20.40	0.3	0.9	1	5.51	0.20	0.41	0.61
HC00-B328	275.4	4.65	0.3	0.9	1	2.06	0.08	0.15	0.23
HC00-B329	280.8	18.45	0.3	0.9	1	4.98	0.18	0.37	0.55
Infiltration Area 2									
HC00-TP301	245.6	0.00	0.5	0.8	1	NA			
HC00-TP302	244.2	0.33	0.5	0.8	1	NA	NA	NA	NA
HC00-TP303	253.5	0.43	0.5	0.8	1	NA			
Infiltration Area 3	(SDW1B)								
HC00-TP307	309.2	0.94	0.5	0.9	1	0.42	0.02	0.03	0.05
HC00-TP308	304.9	5.00	0.5	0.9	1	2.25	0.08	0.17	0.25
HC00-TP309	311.7	7.50	0.5	0.9	1	3.38	0.13	0.25	0.38
Pond G									
HC00-B310A	264.9	0.24	0.3	0.8	0.25	NA	NA	NA	NA
HC00-B313A	260.2	1.68	0.3	0.8	0.25	NA			

Notes:

(1) Infiltration rates determined by double-ring infiltrometer (ASTM method D 3385) or a modified EPA falling head percolation test procedure (Design Manual - Onsite Wastewater Treatment and Disposal Systems, EPA, 1980)

(2) Correction Factors: per King County Surface Water Design Manual (1998)

$F_{testing}$ = 0.5 for ASTM method D3385 and 0.3 for EPA method

$F_{plugging}$ = 0.8 for fine sands and loamy sands, 0.9 for medium sands

$F_{geometry}$ = 0.25 to 1.0, values for the trenches all exceeded 1.0 and Pond G was < 0.25

Design infiltration rate = measure rate x $F_{testing}$ x $F_{plugging}$ x $F_{geometry}$

497806/3rd_infil_tests.xls Table 1

Table 2 - Double Ring Infiltrometer Tests

Test ID	Final Reading from Inner Ring in Inches	Time Increment in Minutes	Infiltration Rate in in./hr	Soil Descrpition
Infiltration Area 2				
HC00-TP301A *	0.11	191	0.03	SILT
HC00-TP302A	0.25	46	0.33	Gravelly, silty SAND
HC00-TP303A	0.28	39	0.43	Slightly gravelly SAND
Infiltration Area 3				
HC00-TP307A	0.25	16	0.94	SILT
HC00-TP308A	0.50	6	5.00	Slightly silty, fine to medium SAND
HC00-TP309A	0.50	4	7.50	Slightly silty, fine to medium SAND

* water seeping into test pit and pooling outside the rings

497806/3rd_infil_tests.xls Table 2

Table 3 - Falling Head Percolation Tests

Location ID	Test Number	Elapsed Time in min	Change in Head in feet	Percolation Rate in in./hr	Soil Type
Infiltration Area 1					
HC00-B327A	1	2	0.06	21.60	Slightly silty, fine to medium SAND
		5	0.15	21.60	
	2	2	0.06	21.60	
		5	0.14	20.16	
	3	2	0.06	21.60	
		5	0.14	20.16	
	4	2	0.05	18.00	
		5	0.14	20.16	
	5	2	0.05	18.00	
		5	0.14	20.16	
	6	2	0.06	21.60	
		5	0.14	20.16	
HC00-B328A	1	2	0.02	5.40	Slightly silty, fine to medium SAND
		5	0.05	7.20	
		10	0.10	7.20	
	2	2	0.02	7.20	
		5	0.06	8.64	
		10	0.11	7.92	
	3	2	0.02	7.20	
		5	0.05	7.20	
		10	0.11	7.92	
	4	2	0.03	10.80	
		5	0.06	8.64	
		10	0.11	7.92	

497806/3rd_infil_tests.xls Table 3

Table 3 - Falling Head Percolation Tests

Location ID	Test Number	Elapsed Time in min	Change in Head in feet	Percolation Rate in in./hr	Soil Type
Infiltration Area 1					
HC00-B329A	1	2	0.05	16.20	Slightly silty, fine to medium SAND
		5	0.10	14.40	
		10	0.20	14.40	
		15	0.29	13.92	
		20	0.37	13.32	
		25	0.45	12.96	
	2	2	0.05	18.00	
		5	0.12	17.28	
		10	0.23	16.56	
		15	0.33	15.84	
		20	0.44	15.84	
	3	2	0.05	18.00	
		5	0.12	17.28	
		10	0.26	18.72	
		15	0.37	17.76	
		20	0.49	17.64	
	4	2	0.06	21.60	
		5	0.14	20.16	
		10	0.26	18.72	
		15	0.39	18.72	
Pond G					
HC00-B310A	1	30	0.01	0.24	Slightly silty, fine to medium SAND
	2	30	0.01	0.24	
	3	30	0.01	0.24	
HC00-B313A	1	30	0.07	1.68	Silty, gravelly SAND
	2	30	0.06	1.44	
	3	30	0.07	1.68	
	4	30	0.07	1.68	

497806/3rd_infil_tests.xls Table 3

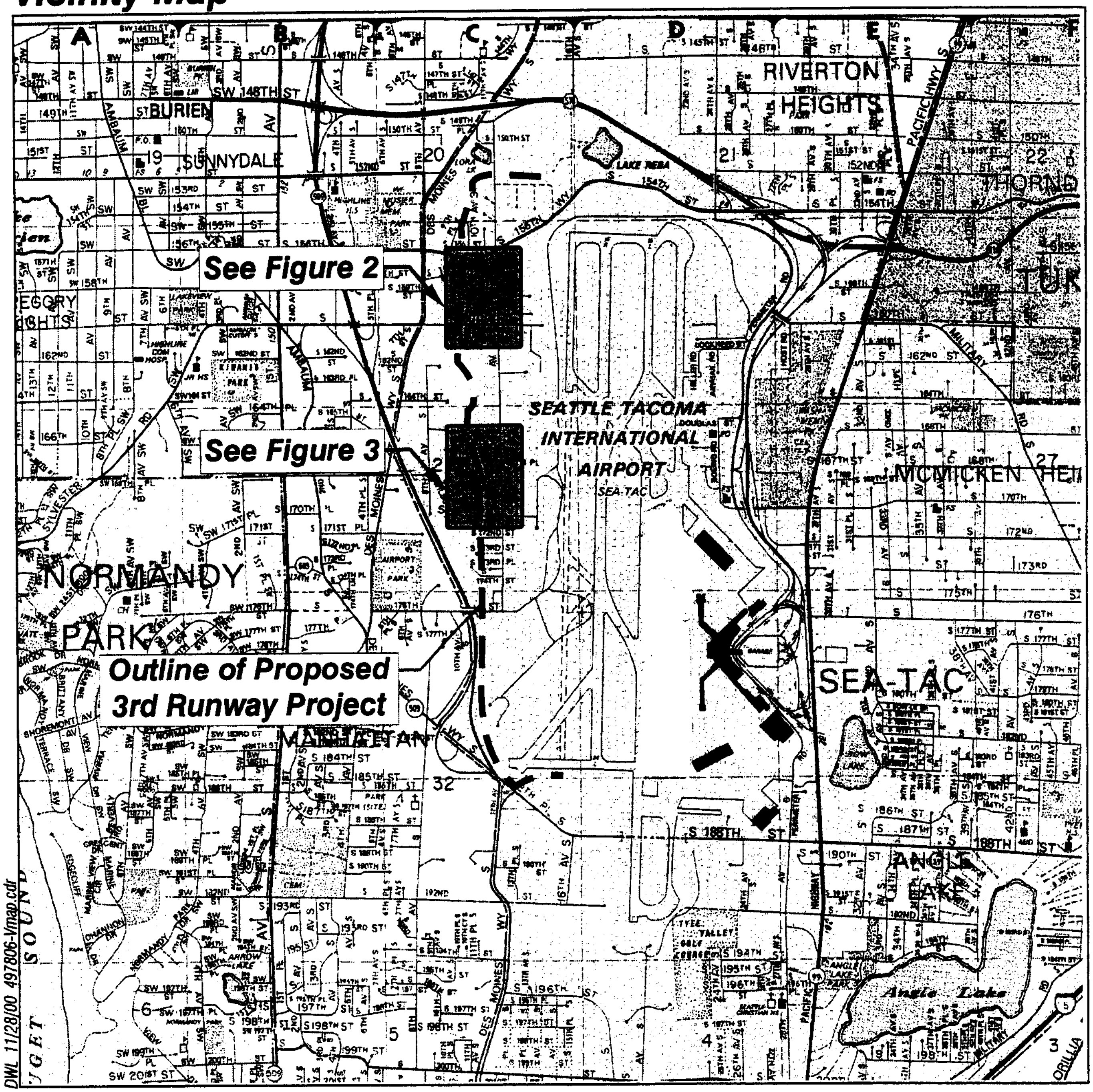
Table 4 - Estimation of Seasonal High Water Level in Infiltration Area 1

Monitoring Well ID	Ground Surface in Feet (msl)	Top of Casing in Feet (msl)	Seasonal Water Level Range: Minimum in Feet (msl)	Date	Maximum in Feet (msl)	Date	Period of Record	Range of Fluctuation in Feet
HC99-B64	292	294.2	284.9	Nov-00	288.2	Jan-00	12/99 to 10/00	3.3
HC99-B73	291.7	293.80	283.42	Oct-99	289.3	Mar-00	10/99 to 10/00	5.88
HC00-B333	281	283.5	268.5	Nov-00				

Projected Seasonal High Groundwater Level in HC00-B333 = **273.09** = 268.5 + (3.3+5.88)/2

497806/3rd_infil_tests.xls Table 4

Vicinity Map



0 2000 4000

Scale in Feet

N

AR 011099

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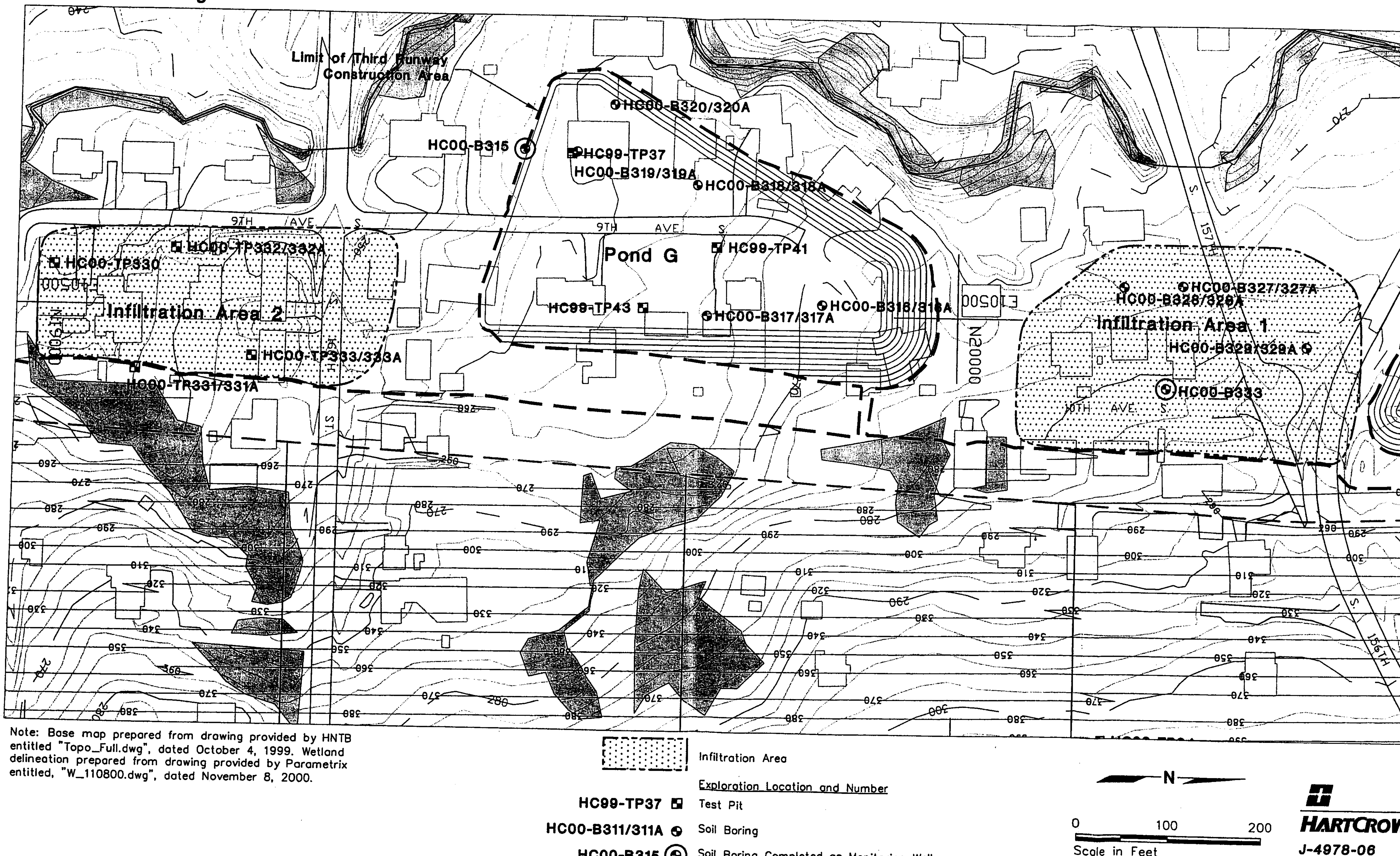
J-4978-06 11/00

Figure 1

Site and Exploration Plan

Infiltration Testing



Note: Base map prepared from drawing provided by HNTB entitled "Topo_Full.dwg", dated October 4, 1999. Wetland delineation prepared from drawing provided by Parametrix entitled, "W_110800.dwg", dated November 8, 2000.

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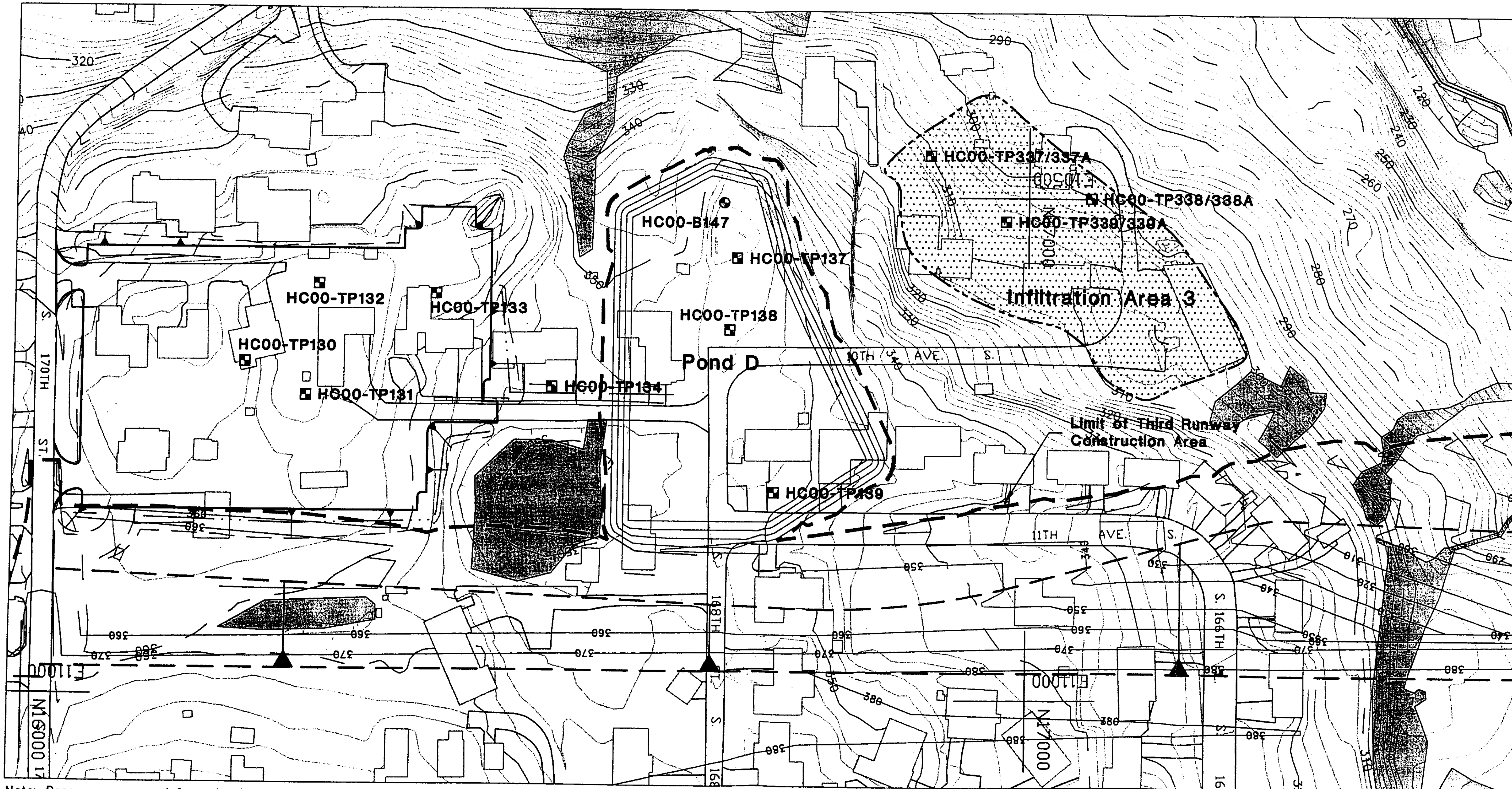
J-4978-06 12/00
Figure 2

AR 011100

hd 12/5/00 1=1 (xref)see drawing file/charlie.pc2
49780648

Site and Exploration Plan

Infiltration Testing



Note: Base map prepared from drawing provided by HNTB entitled "Topo_Full.dwg", dated October 4, 1999. Wetland delineation prepared from drawing provided by Parametrix entitled, "W_110800.dwg", dated November 8, 2000.

Infiltration Area

Exploration Location and Number

HC99-TP37 Test Pit

HC00-B311/311A Soil Boring

N

0 100 200

Scale in Feet

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J-4978-06 12/00

Figure 3

AR 011101

hal 12/5/00 1=1 (xref)see drawing file/charlie.pc2

49780649

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MEMORANDUM

Anchorage Boston Chicago Denver Fairbanks Jersey City Juneau Long Beach Portland Seattle

DATE: May 23, 2001

TO: Jim Thomson, HNTB

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

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

CC: Tom Atkins, Parametrix

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.

Field Investigations

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

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(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

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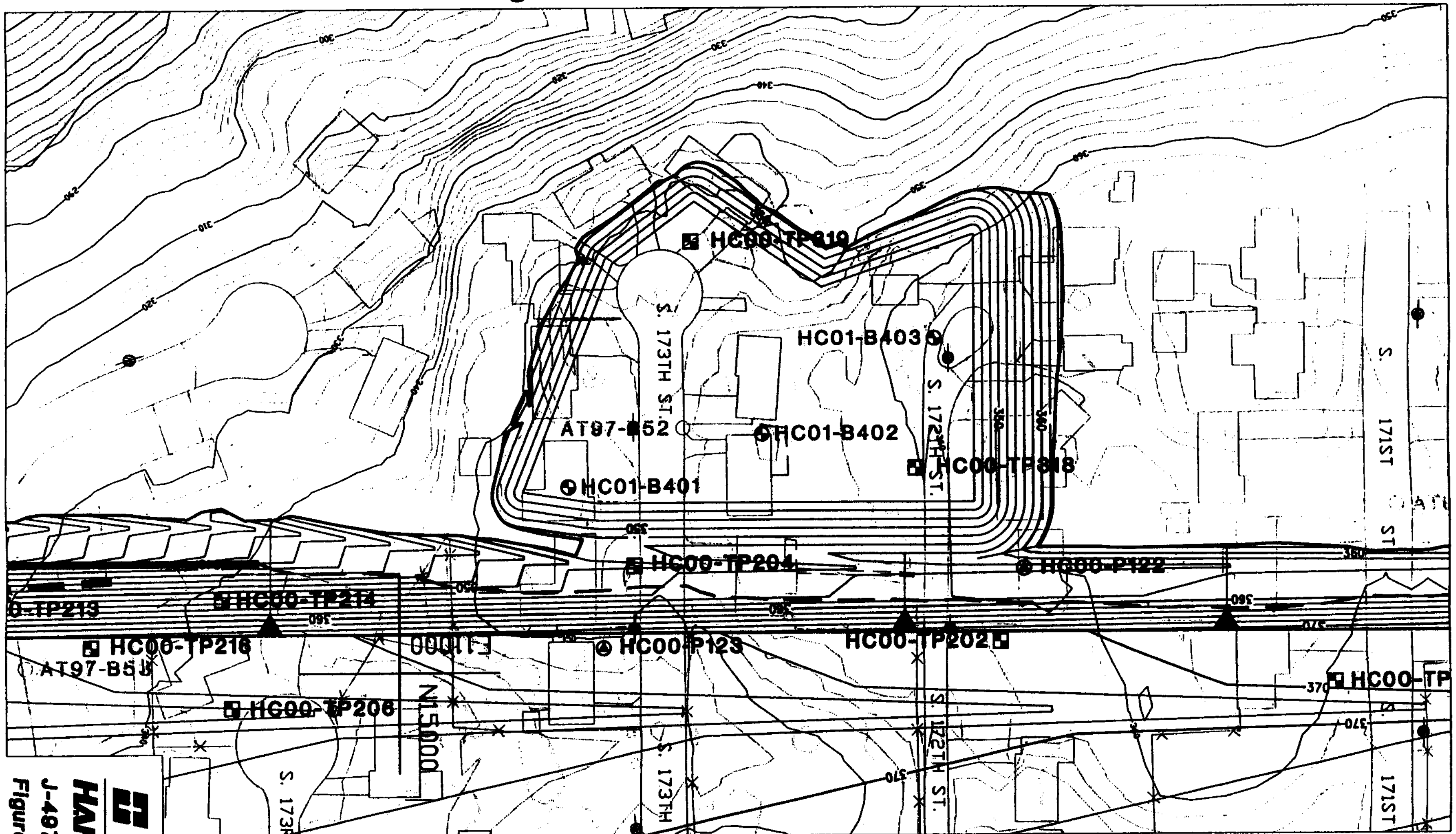
Table 1– Boreholes for Infiltration Feasibility at Pond F

	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 (xref)see drawing file/charlie-B...80658

Pond F Infiltration Testing



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 entitiled, "w_022201.dwg", dated February 22, 2001.

HC01-B403 ⊕ Approximate Boring Location and Designation

N

0 100 200

Scale in Feet

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J-4978-06 5/01

Figure 1

July 2001

556-2912-001 (28)

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

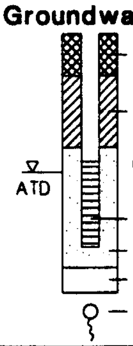
BORING SAMPLES

Symbol	Description
⊠	Split Spoon
⧄	Shelby Tube
▥	Cuttings
◫	Core Run
*	No Sample Recovery
P	Tube Pushed, Not Driven

TEST PIT SAMPLES

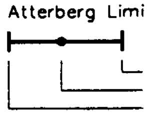
Symbol	Description
⊠	Grab (Jar)
⧄	Bag
⧄	Shelby Tube

Groundwater Observations



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

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J-4978-06 5/01

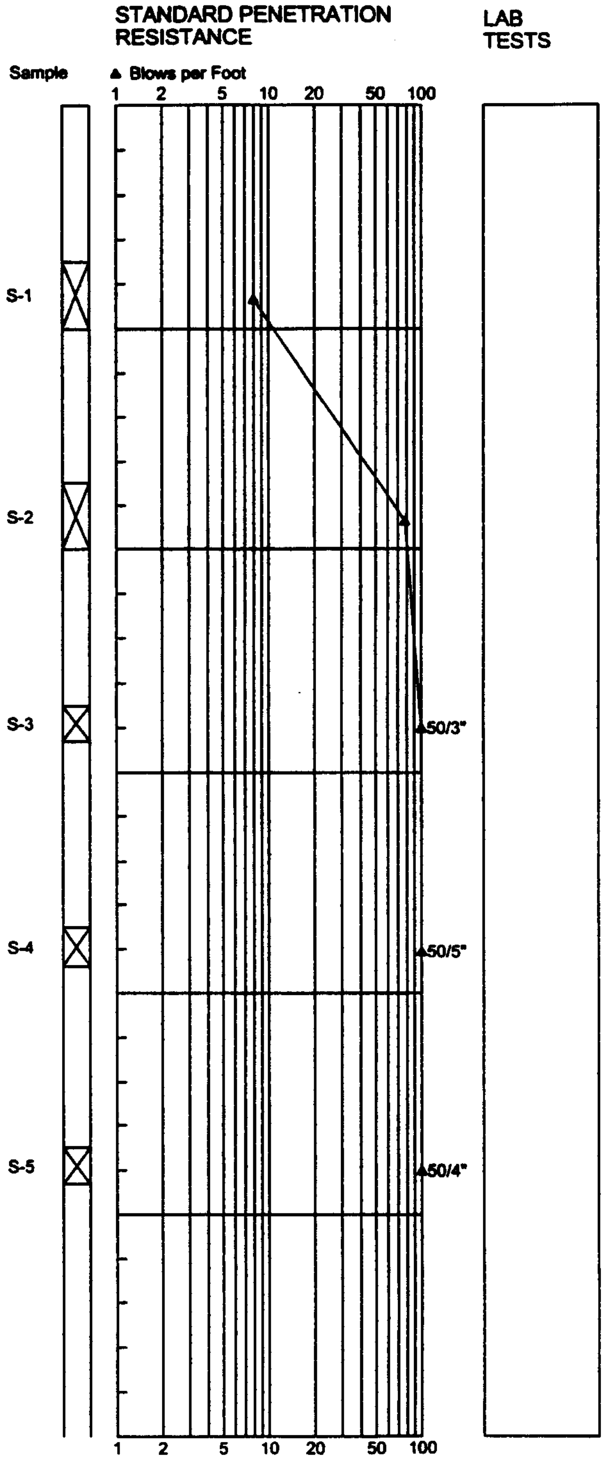
Figure A-1

July 2001
556-2912-001 (28)

Boring Log HC01-B401

Soil Descriptions
Approximate Ground Surface Elevation in Feet: 349.6

Soil Descriptions	Depth in Feet
Loose, moist to wet, gray and red-brown, mottled, gravelly, silty SAND. (WEATHERED TILL)	0 – ~6.5
Very dense, moist, gray, gravelly, silty SAND with slightly silty zone near top. (TILL)	~6.5 – 24.3
Bottom of Boring at 24.3 Feet. Completed 04/25/01.	24.3



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.

BORING LOG 4978068.GPJ HC_CORP.GDT 5/23/01

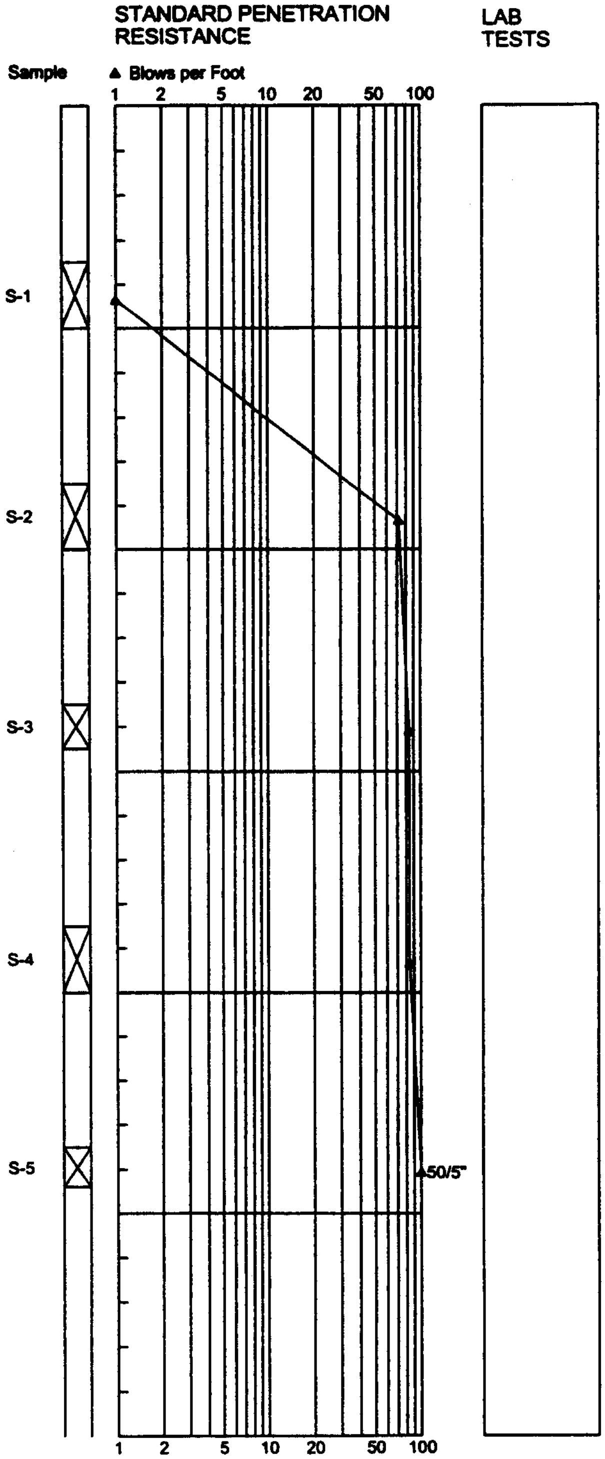
HARTCROWSER
J-4978-06 04/01
Figure A-2

July 2001
556-2912-001 (28)

Boring Log HC01-B402

Soil Descriptions
Approximate Ground Surface Elevation in Feet: 355.7

Depth in Feet	Soil Descriptions
0	Fill with scattered concrete.
5	Very dense, moist, gray, gravelly, silty SAND. (TILL)
24.4	Bottom of Boring at 24.4 Feet. Completed 04/25/01.



BORING LOG 4978068.GPJ HC_CORP.GDT 5/23/01

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

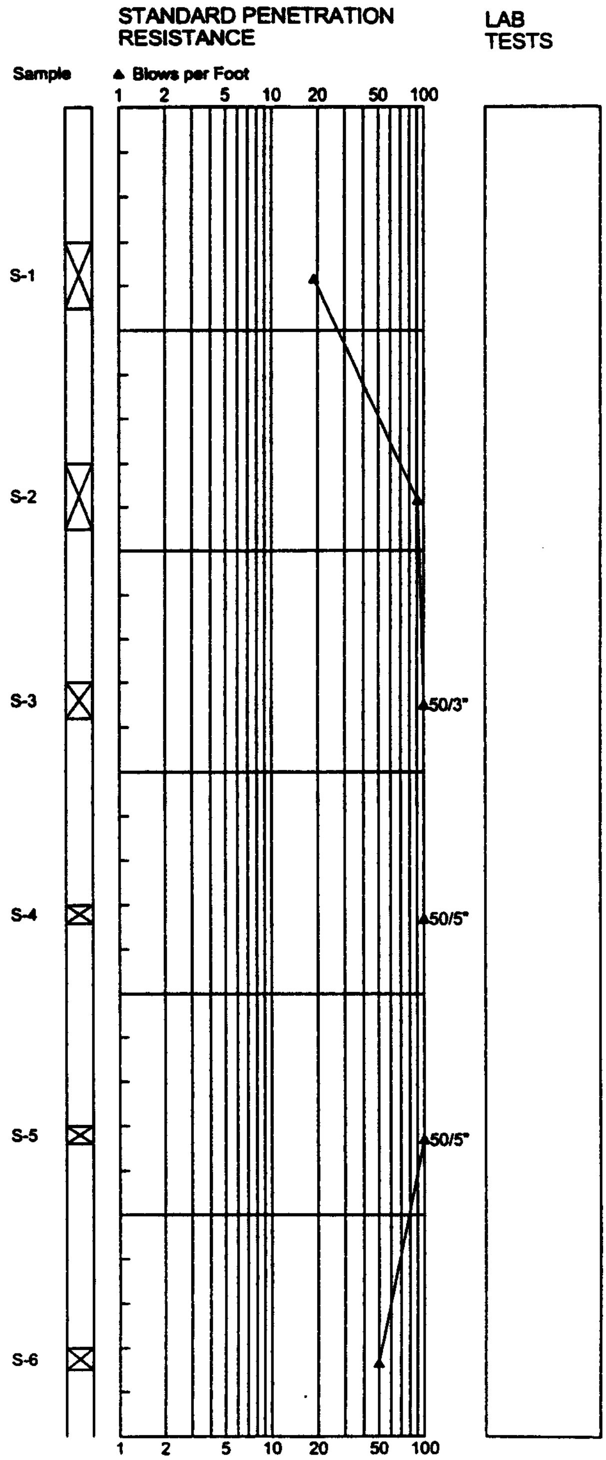
J-4978-06 *04/01*
Figure A-3

July 2001
556-2912-001 (28)

Boring Log HC01-B403

Soil Descriptions
Approximate Ground Surface Elevation in Feet: 361.7

Soil Descriptions	Depth in Feet
Fill and gravelly roadbase.	0
Medium dense, moist, gray and brown mottled, slightly gravelly, silty SAND. (WEATHERED TILL)	
Very dense, moist, gray, gravelly, silty SAND. (TILL)	
Bottom of Boring at 28.5 Feet. Completed 04/25/01.	30



BORING LOG 4978068.GPJ HC_CORP.GDT 5/23/01

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-4

July 2001
556-2912-001 (28)

APPENDIX H

WATER QUALITY TREATMENT FACILITY SIZING CALCULATIONS FOR SASA, STEP, AND THIRD RUNWAY

APPENDIX H

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. WATER QUALITY DESIGN STORM PEAK FLOW CALCULATIONS FOR BIOSWALE AND FILTER STRIP SIZING

Bioswale and filter strip size was based on the water quality design flow rate, specified as the 6-month, 24-hour peak flow rate.

The Santa Barbara Urban Hydrograph (SBUH) method of the StormSHED hydrologic modeling program was used to estimate the 6-month storm flow rate, using 64 percent of the STIA 2-year, 24-hour precipitation of 2.0 inches. The StormSHED calculated flows for the SASA parking lot (17.76 acres), a 300-ft flowpath across a runway-taxiway intersection (assumed to be 145 ft long, for a total of 1.0 acre), and the North Cargo Area (4.30 acres) are provided in Table H-1. The StormSHED output files for these areas are provided in Tables H-2, H-3, and H-4.

Table H-1. Water quality design storm peak flows.

Area	6-month peak flow (64% of 2-yr) (cfs)
SASA Parking Lot	5.03
Taxiway	0.31
North Cargo Area	1.29

Drainage Area: SASA Parking

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number			
Peak Factor:	484.00		SCS Abs:	0.20			
Storm Dur	24.00 hrs						
	Area	CN	TC				
Pervious	0.0000 ac	0.00	0.00 hrs				
Impervious	17.7600 ac	98.00	0.13 hrs				
Total	17.7600 ac						
Supporting Data:							
Impervious CN Data:							
Imp Area		98.00	17.7600 ac				
Impervious TC Data:							
Flow type:	Description:		Length:	Slope:	Coeff:	Travel Time	
Sheet	sheet		250.00 ft	1.00%	0.0110	4.44 min	
Channel	pipes		800.00 ft	2.00%	42.0000	2.24 min	

SASA Parking Event Summary:

BasinID	Peak Q (cfs)	Peak T (hrs)	Peak Vol (ac-ft)	Area ac	Method /Loss	Raintype	Event
-------							
SASA Parking	5.03	8.00	1.5746	17.76	SBUH/SCS	kc24hr	0.64"2y

Drainage Area: RW/TW Intersection

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur	24.00 hrs			
	Area	CN	TC	
Pervious	0.0000 ac	78.00	0.00 hrs	
Impervious	1.0000 ac	98.00	0.08 hrs	
Total	1.0000 ac			

Supporting Data:

Impervious CN Data:

Impervious		98.00	1.0000 ac

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	Sheet	300.00 ft	1.50%	0.0100	5.06 min

RW/TW Intersection Event Summary:

BasinID	Peak Q	Peak T	Peak Vol	Area	Method	Raintype	Event
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
RW/TW Intersection	0.31	7.83	0.0887	1.00	SBUH/SCS	kc24hr	0.64*2y

Drainage Area: North Cargo

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number		
Peak Factor:	484.00		SCS Abs:	0.20		
Storm Dur	24.00 hrs					
	Area	CN	TC			
Pervious	0.0000 ac	78.00	0.00 hrs			
Impervious	4.3000 ac	98.00	0.09 hrs			
Total	4.3000 ac					

Supporting Data:

Impervious CN Data:

Impervious		98.00	4.3000 ac

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	Sheet	200.00 ft	2.00%	0.0100	3.26 min
Channel	Pipe	800.00 ft	2.00%	42.0000	2.24 min

North Cargo Event Summary:

BasinID	Peak Q (cfs)	Peak T (hrs)	Peak Vol (ac-ft)	Area ac	Method /Loss	Raintype	Event
-------							
North Cargo	1.29	7.83	0.3812	4.30	SBUH/SCS	kc24hr	0.64*2y

2. MEAN ANNUAL STORM RUNOFF VOLUME CALCULATIONS FOR WETVAULT SIZING

Wetvault volume was based on the mean annual storm volume. The mean annual storm volume for the STEP service area and Air Cargo Road was calculated using the simplified method described in the King County Manual (King County, 1998). Because the area to be treated is 100 percent impervious, the runoff formula from the King County Manual was simplified to:

Runoff Volume (ft^3), $V_r = 0.9 * A_i * (R/12)$

where: A_i = impervious area (ft^2)
R = mean annual storm precipitation (inches)

The STEP service area and Air Cargo Road are approximately 9.05 acres (394,300 ft^2). The mean annual storm precipitation of 0.47 inch was obtained from the isopluvial map provided in the King County Manual. Therefore, the mean annual runoff was calculated to be:

$$V_r = 0.9 * (394{,}300) * (0.47/12) = 13{,}900 \text{ ft}^3.$$

3. TAXIWAY FILTER STRIP SIZE CALCULATIONS

Calculations were performed for a 300-ft flow path across a runway-taxiway intersection (assumed to be 145-ft long). 300 ft is approximately the longest flow path dimension among taxiways and runways, chosen for conservative BMP calculations.

Note: length measurements for runways and taxiways are perpendicular to length measurements for filter strips. For taxiways and runways, length is measured parallel to the direction of aircraft landing and takeoff; for filter strips, length is the dimension parallel to the direction of flow.

Assumptions:

WQ design flow, $Q = 0.31$ cfs (see Section 1 in this appendix)
Manning's roughness, $n = 0.35$ (per the King County Manual)
Strip width, $W = 145$ ft (assumed)
Longitudinal slope, $s = 0.02$[1]

Calculations:

$$\text{Flow depth, } d = \left[\frac{Q * n}{1.49 * W * s^{0.5}}\right]^{0.6} = \left[\frac{0.31 * 0.35}{1.49 * 145 * 0.02^{0.5}}\right]^{0.6} \approx 0.034 \text{ ft}$$

$$\text{Flow velocity, } V = \frac{Q}{W * d} = \frac{0.31}{145 * 0.034} \approx 0.063 \text{ fps}$$

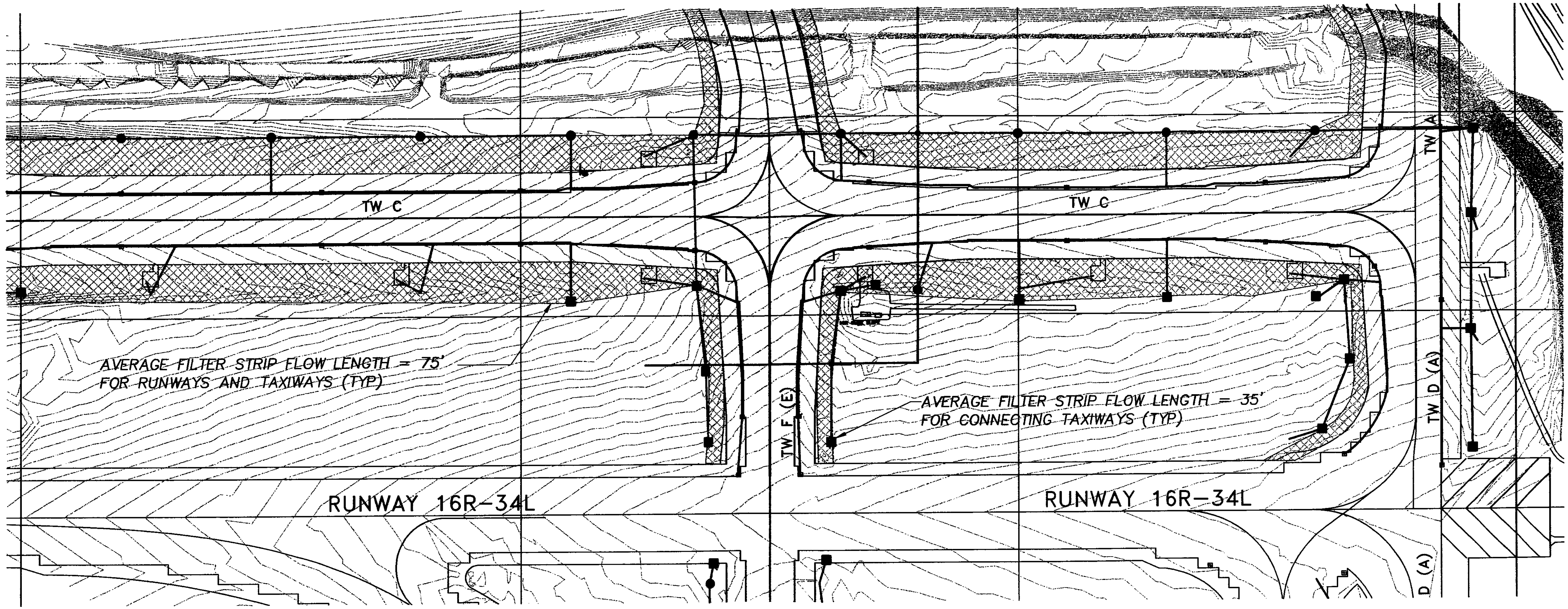
Per the King County Manual, the strip must have a minimum 9-minute (540-second) residence time.

Strip Length, $L = 540 * V = 540 * 0.063 = 34$ ft

The plan view for a typical segment of filter strip drain is shown in Figure H-1, and the typical filter strip detail is shown in Figure H-2. As shown, the typical filter strip width will exceed the minimum required width in most locations, and the filter strips will meet the minimum required width in all locations.

---

[1] Nominal STIA design specifications call for a slope of 1.5 percent as shown on Figure H-2. This assumed slope results in a conservative size estimate.



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0 100 200
SCALE IN FEET

N

LEGEND

FILTER STRIP
MANHOLE/CATCHBASIN
CATCHBASIN/INLET
UNDER DRAIN
DRAINAGE PIPES

Figure H-1
Third Runway Taxiway C
Typical Segment, Filter Strip and Drainage
Plan View

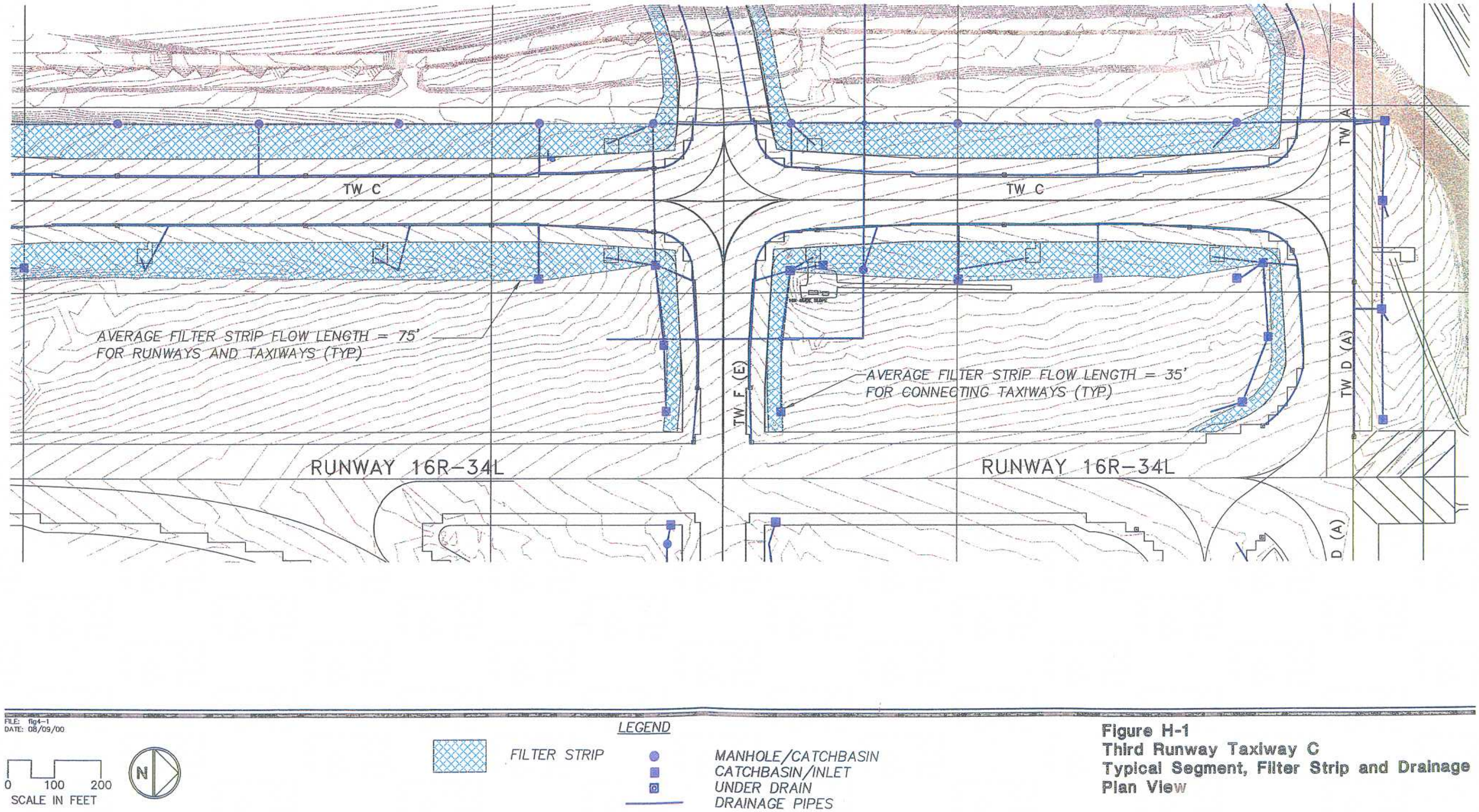


Figure H-1
Third Runway Taxiway C
Typical Segment, Filter Strip and Drainage
Plan View

AR 011120

4. SASA BIOSWALE SIZE CALCULATIONS

The following assumptions were used for the SASA bioswale calculations:

Flow depth, $y = 2$ inches $= 0.167$ ft (per the King County Manual for regularly mowed swale)
H:V side slopes, $Z = 3$ (chosen value)
Manning's roughness, $n = 0.20$ (per the King County Manual)
Longitudinal slope, $s = 0.05$ (chosen value)

The SASA parking area was divided into four subareas (A through D). Bioswale sizes were calculated for each subarea. To calculate bioswale sizes, the total discharge of 5.03 cfs was divided among the subareas (weighted by area), as shown in Table H-5.

Table H-5. The SASA SDS subareas (conceptual).

Subarea	Area (acres)	% of SASA PGIS	Q (cfs)[a]
A	2.82	35%	1.76
B	3.06	38%	1.91
C	1.17	14%	0.70
D	1.02	13%	0.65
TOTAL	**8.07**	**100%**	**5.03**

[a] For this feasibility analysis, the total SASA water quality flow rate of 5.03 cfs was divided among the subareas (prorated by area). This is a conservative estimate of flows for each subarea–flows modeled individually for the subareas would be smaller.

An example calculation for Area B is shown below:

$$\text{Bottom width, } b = \frac{Q * n}{1.49 * y^{1.67} * s^{0.5}} = \frac{1.91 * 0.20}{1.49 * (0.167)^{1.67} * (0.05)^{0.5}} = 22.9 \text{ ft}$$

Bottom width cannot be greater than 10 ft. The swale was therefore divided into three flow channels, each taking one-third of the flow (= 0.64 cfs).

$$\text{Bottom width, } b = \frac{Q * n}{1.49 * y^{1.67} * s^{0.5}} = \frac{0.64 * 0.20}{1.49 * (0.167)^{1.67} * (0.05)^{0.5}} = 7.7 \text{ ft}$$

$$V = \frac{Q}{A} = \frac{Q}{by + Zy^2} = \frac{0.64}{(7.7 * 0.167) + (3 * 0.167^2)} = 0.47 \text{ ft/s}$$

The flow must have a minimum 9-minute (540-second) residence time.

Swale Length, $L = 540 * V = 540 * 0.47 \approx 254$ ft

The complete bioswale calculations for the four subareas are summarized in Table H-6. Subareas A and B required splitting the flow.

Table H-6. Bioswale sizing calculations for the SASA SDS (conceptual).

Subarea		Q	Z	n	y	s	b	V	L
A		1.76	3	0.20	0.17	0.05	21.1[a]		
	1.76 ÷ 3 =	0.59	3	0.20	0.17	0.05	7.0	0.47	253
B		1.91	3	0.20	0.17	0.05	22.9[a]		
	1.91 ÷ 3 =	0.64	3	0.20	0.17	0.05	7.7	0.47	254
C		0.70	3	0.20	0.17	0.05	8.4	0.47	256
D		0.65	3	0.20	0.17	0.05	7.8	0.47	254

[a] *b* must be less than 10 ft; therefore, divide flow into three equal-width swales.

The SASA parking lot conceptual bioswale layout is shown in Figure H-3, and the typical bioswale detail is shown in Figure H-4.

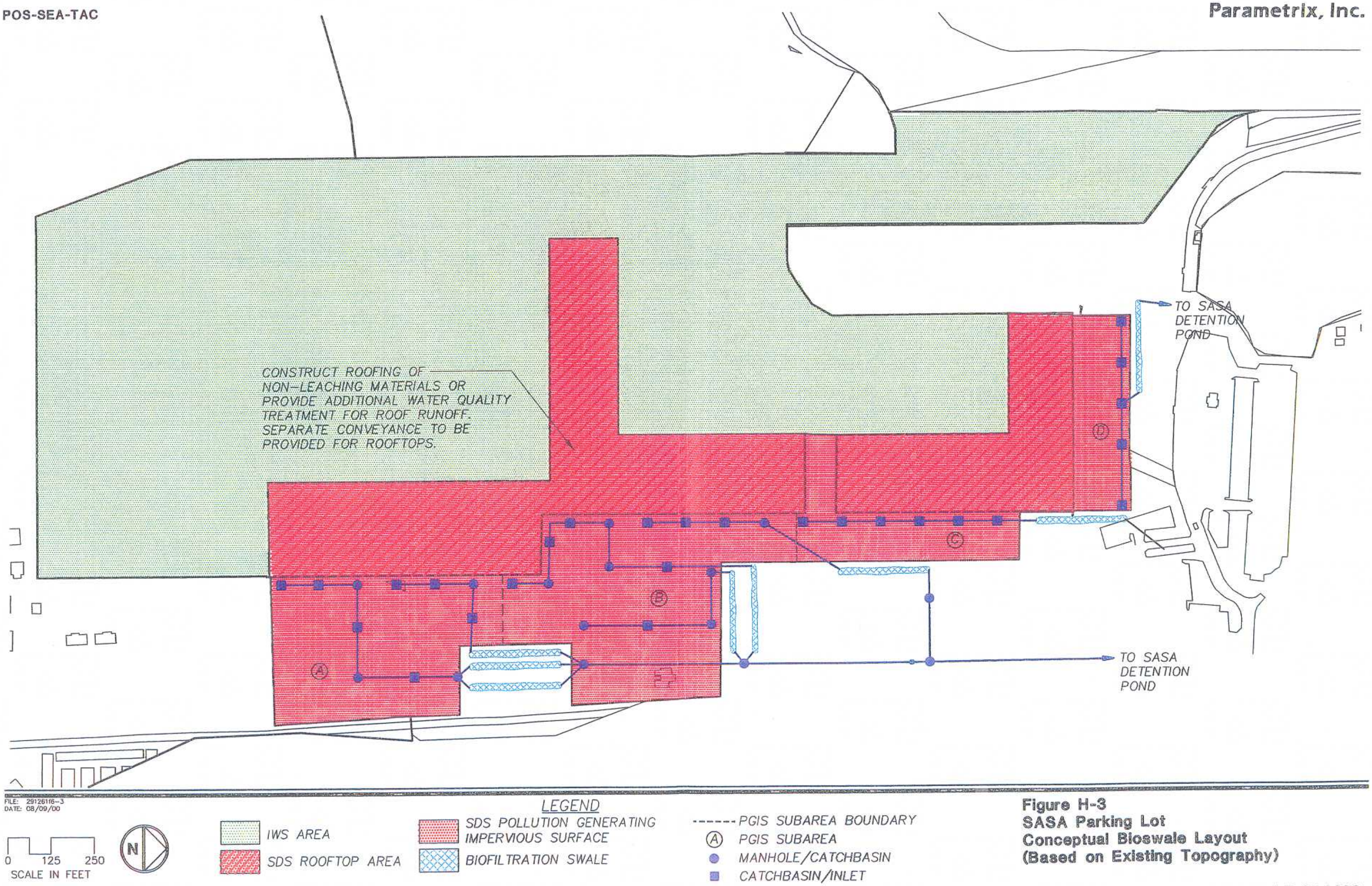
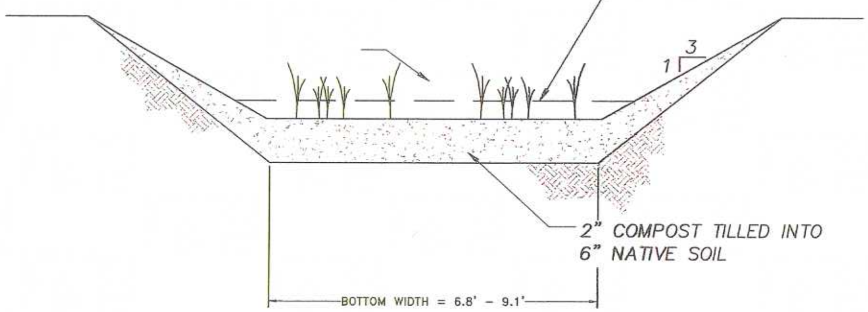
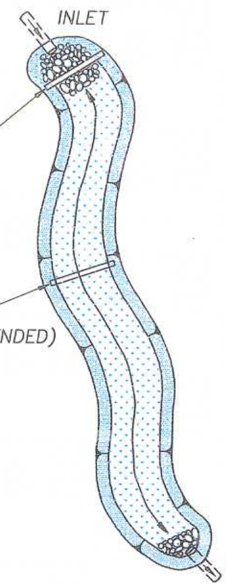


Figure H-3
SASA Parking Lot
Conceptual Bioswale Layout
(Based on Existing Topography)



TYPICAL SWALE
SECTION
NTS



NOTES:
LONGITUDINAL SLOPES 1-6%.
PROVIDE UNDERDRAIN FOR SLOPES < 1.5%.

BIOFILTRATION SWALE
PLAN
NTS

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Figure H-4
Typical SASA Parking Lot Bioswale Detail

5. NORTH CARGO AREA BIOSWALE CALCULATIONS

The following assumptions were used for the North Cargo Area bioswale calculations:

WQ design flow, Q = 1.29 cfs (see Section 1 in this appendix)

Flow depth, y = 2 inches = 0.167 ft (per the King County Manual for regularly mowed swale)

H:V side slopes, $Z = 3$ (chosen value)

Manning's roughness, $n = 0.20$ (per the King County Manual)

Longitudinal slope, $s = 0.05$ (chosen value)

The calculations are shown below:

$$\text{Bottom width, } b = \frac{Q * n}{1.49 * y^{1.67} * s^{0.5}} = \frac{1.29 * 0.20}{1.49 * (0.167)^{1.67} * (0.05)^{0.5}} = 15.4 \text{ ft}$$

The swale width of 15.4 ft is greater than the 10-ft minimum; therefore, the swale will be divided in the center to form two 7.7-ft wide swales. Each swale will treat half the flow (0.65 cfs each).

$$V = \frac{Q}{A} = \frac{Q}{by + Zy^2} = \frac{0.65}{(7.7 * 0.167) + (3 * 0.167^2)} = 0.47 \text{ ft/s}$$

The flow must have a minimum 9-minute (540-second) residence time.

Swale Length, $L = 540 * V = 540 * 0.47 = 254$ ft

The bioswale calculations are summarized in Table H-6.

Table H-6. Bioswale sizing calculations for the North Cargo Area (conceptual).

No. of Swales	Q (each swale)	Z	n	y	s	b	V	L
2	0.65	3	0.20	0.17	0.05	7.7	0.47	254

6. STEP WETVAULT SIZE CALCULATIONS

The following assumption was used for STEP Wetvault size calculations:

Basic Wetpond size (per the King County Manual), therefore:
Wetpool volume = 3 * [Volume of mean annual 24-hour storm runoff]

The calculation is shown below:

From Section 2 of this appendix, the mean annual storm runoff volume from STEP and Air Cargo Road = 13,900 ft^3.

Wetvault volume = 3 * 13,900 = 41,700 ft^3.

The dimension criteria are shown below:

- The wetvault shall be divided into two cells by a baffle;
- First cell shall have minimum sediment storage of at least 1 ft;
- Second cell shall be minimum 3 ft deep; and
- First cell shall be sized for 25 percent to 35 percent of wetvault volume.

A wetvault 350-ft-long by 10.5-ft-deep by 15-ft-wide would meet the above criteria. The first cell would be 87 ft long, the second cell would be 263 ft long. The 10.5-ft depth includes 2 ft of sediment storage provided in both cells of the vault.

The STEP drainage layout and wetvault location are shown in Figure H-5, and the wetvault details are shown in Figure H-6.

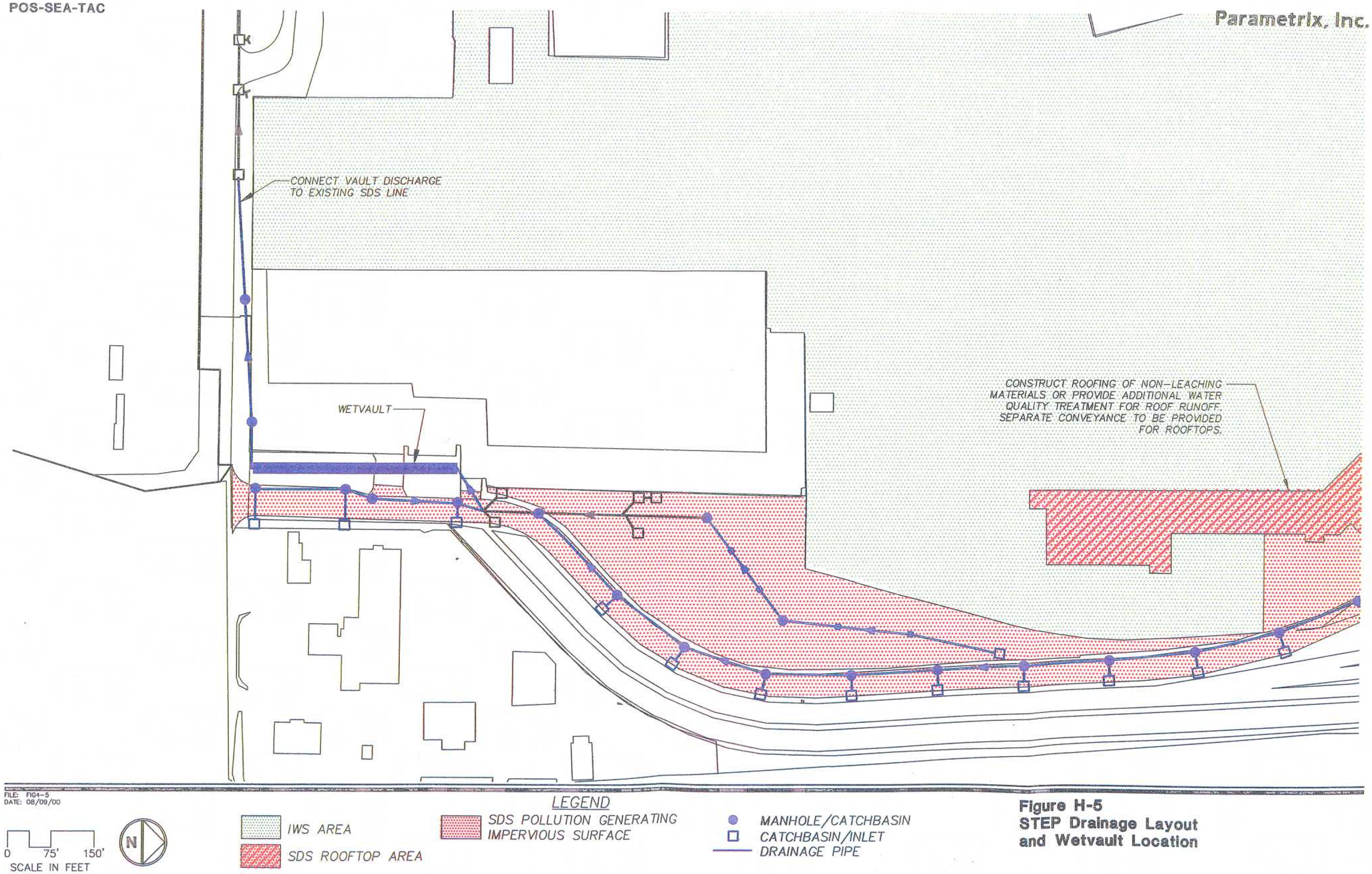

Figure H-5
STEP Drainage Layout and Wetvault Location

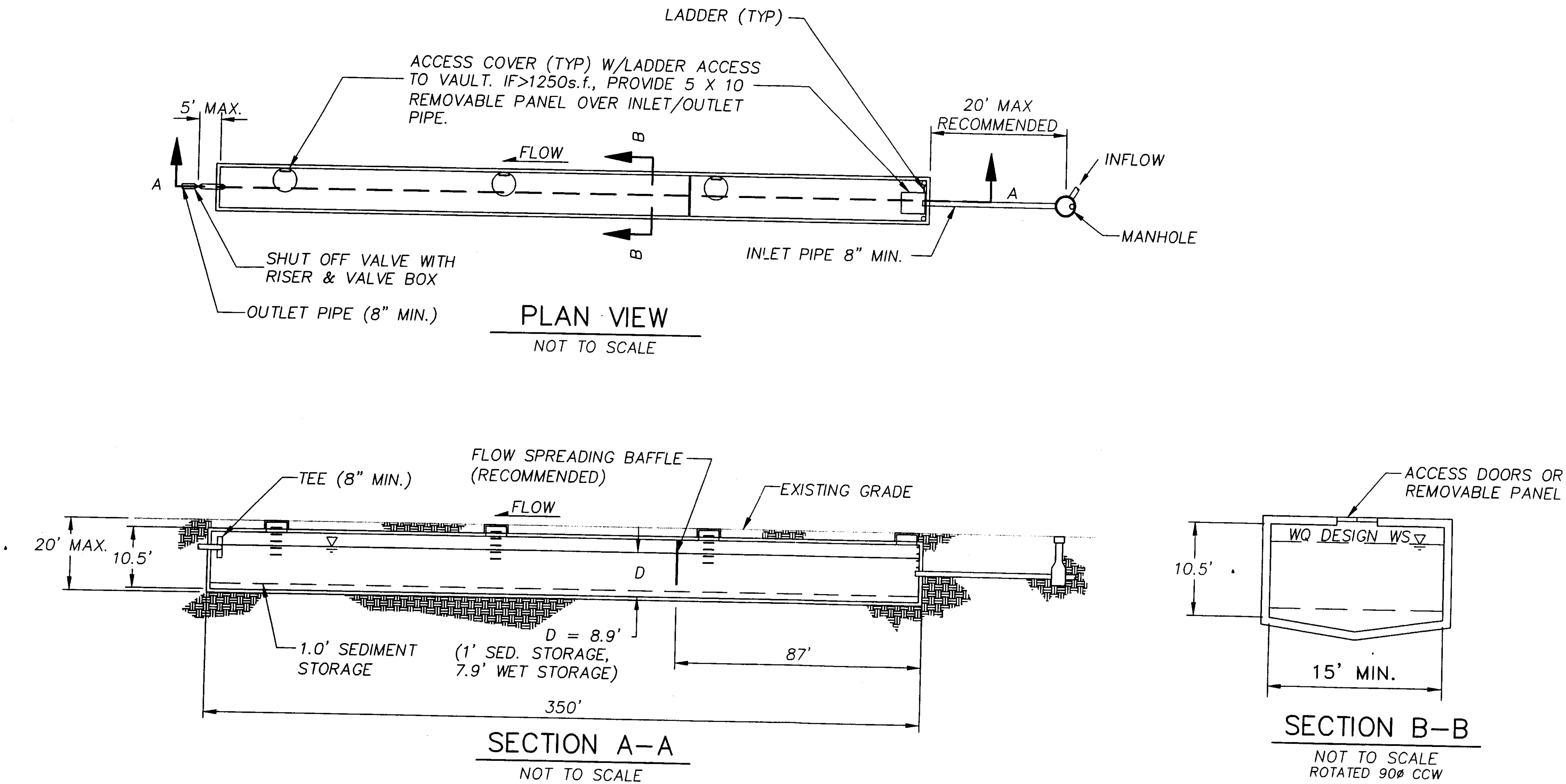

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Figure H-6
STEP Wetvault Details

7. NORTH EMPLOYEE PARKING LOT BIOSWALE CALCULATIONS

For information on the North Employee Parking Lot bioswale calculations, see the attached excerpt from the technical information report prepared by David Evans and Associates, Inc.

Water Quantity Control

Detention facilities will be sized to limit peak rate runoff control to be at or below the existing 2, 10 and 100-year, 24-hour design storm event. Detention will be accomplished with an underground concrete detention vault located at the west end of the site. The outlet structure will consist of a flow restrictor/oil pollution control device with two orifices and a notch weir to control the 2, 10 and 100 year design storm events.

On-site water quantity calculations are contained in Appendix A.

Existing Flow (cfs)			Developed Flow (cfs)		
2 yr	10yr	100 yr	2 yr	10 yr	100 yr
2.99	8.14	15.84	19.00	28.84	41.07

Water Quality Control

On-site water quality control will be provided through the use of a grass-lined swale.

The water quality facility will be placed downstream of the detention facility which allows for the use of existing condition flow sizing for the biofiltration swale. Swale bottom width was determined using peak flow from a 2-year, 24-hour storm with existing conditions, 6.0% slope, 3:1 side slopes, Mannings "n" of 0.35 and a flow depth of 4 inches. The schematic layout for the water quantity and water quality facilities are shown in Figure 5.

On-site water quality calculations are contained in Appendix B.

CHANNEL DESIGN FORM

PROJECT: Port of Seattle - North Employee Parking Lot

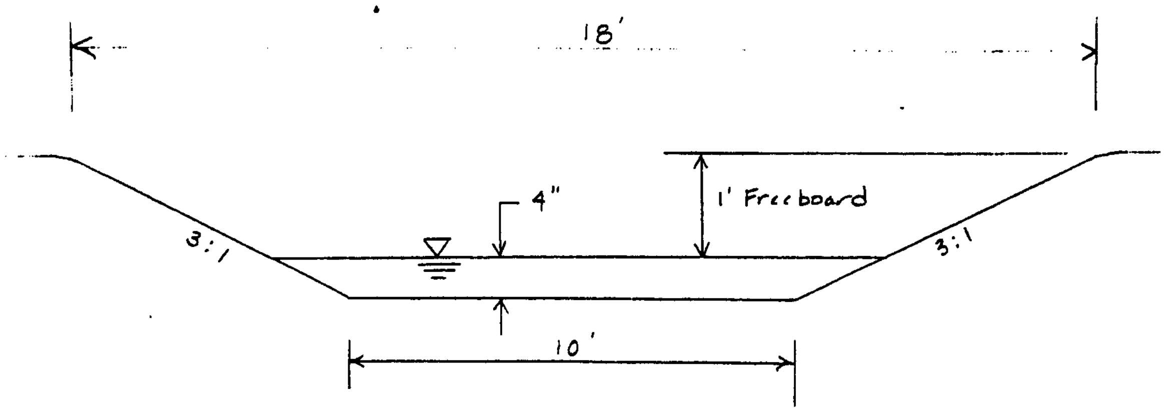
DESCRIPTION: Biofiltration Swale

BEGIN LOCATION:
END LOCATION:

LENGTH 200 LF

	Input		Output	
FREEBOARD DEPTH (FT)	f =	1		
WATER DEPTH (FT)	y =	0.33	Velocity =	0.82
SIDE SLOPE 1 = (1/H)	H1 =	3	Flow, CFS =	2.96
SIDE SLOPE 2 = (1/H)	H2 =	3	Top Width =	17.98
BOTTOM WIDTH IN FEET	b =	10		
MANNINGS VALUE	n =	0.2		
SLOPE OF CHANNEL FT/FT	s =	0.06		

The above indicates the design for biofiltration swale function for the 2-year event for existing conditions.
Per KCSWM, a swale slope of up to 6 % and Mannings "n" value of 0.20 shall be used when designing for swale function.



TYPICAL SECTION

CHANNEL DESIGN FORM

PROJECT: Port of Seattle - North Employee Parking Lot

DESCRIPTION: Biofiltration Swale

BEGIN LOCATION:
END LOCATION:

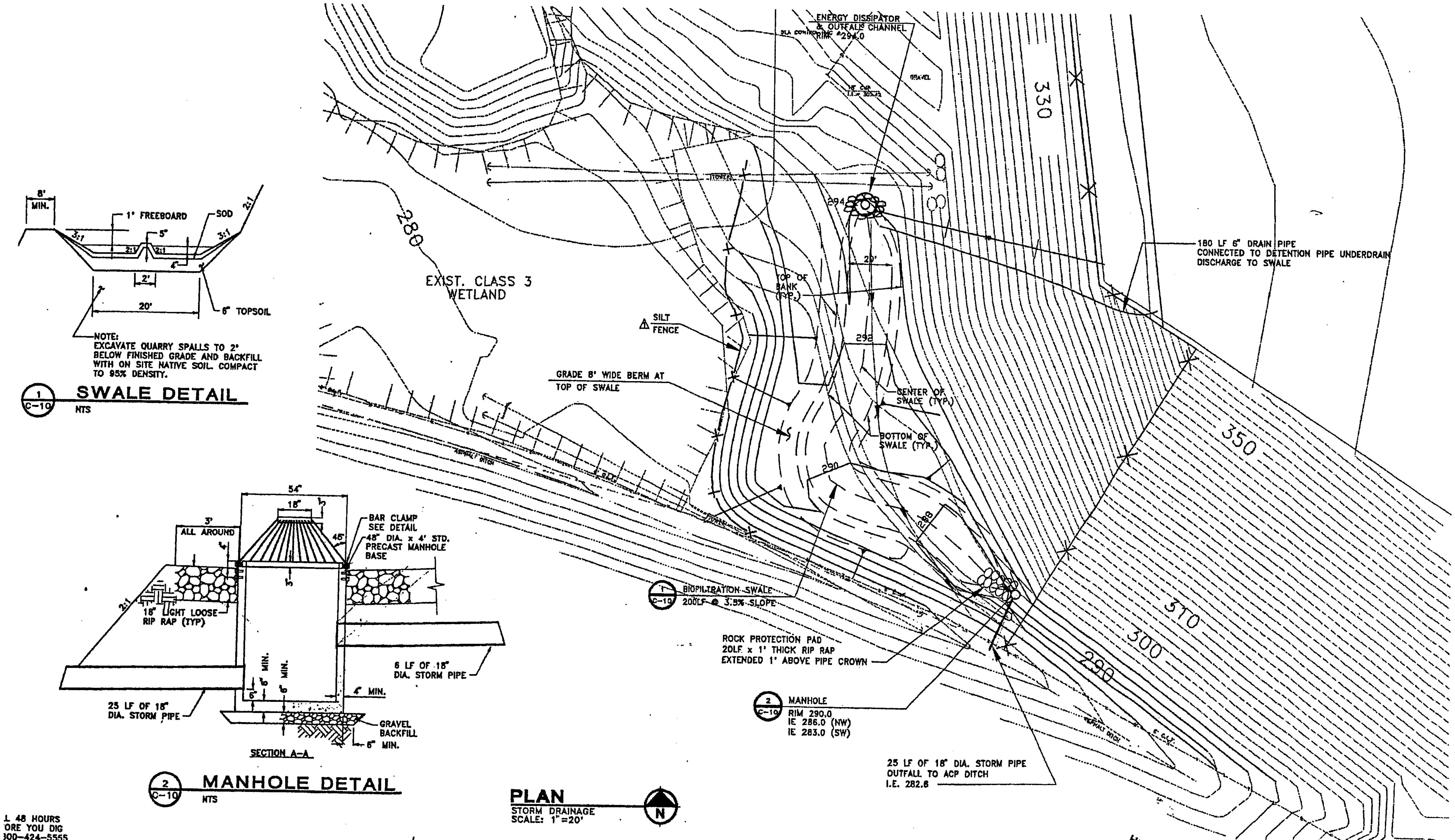
LENGTH 200 LF

	Input		Output	
FREEBOARD DEPTH (FT)	f =	1	Velocity =	4.94
WATER DEPTH (FT)	y =	0.33	Flow, CFS =	17.93
SIDE SLOPE 1 = (1/H)	H1 =	3	Top Width =	17.98
SIDE SLOPE 2 = (1/H)	H2 =	3		
BOTTOM WIDTH IN FEET	b =	10		
MANNINGS VALUE	n =	0.033		
SLOPE OF CHANNEL FT/FT	s =	0.06		

The above indicates the swale conveyance and stability calculations.
The actual swale slope and Mannings "n" value are used.
The swale has the capacity to conveys the 100-year design flow of 15.84 cfs and maintain a freeboard of 1 foot with a velocity of less than 5 ft/sec.

SEE PREVIOUS SHEET FOR TYPICAL SECTION

TYPICAL SECTION



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300-424-5555

DAVID EVANS AND ASSOCIATES, INC.
415 - 118TH AVENUE S.E.
BELLEVUE, WA.

PROJECT ENGR./ARCH.: MIKE CLARK
DESIGNED: CATHERINE ROSA
DRAWN BY: DIANA OLSEN
SCALE: 1"=20'
DATE: 6/10/97

6.3.98

REVISIONS

NO.	DATE	BY	DESCRIPTION
	4.28.98	MDC	RFP #16
△	6.02.98	MDC	REVISED PER 5/4/98 COMMENTS

Figure H-7

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: NORTH EMPLOYEE PARKING LOT
SHEET TITLE: BIOFILTRATION SWALE PLAN

WORK ORDER NO. C-3459
CONSULTANT'S NO. 5
PORT OF SEATTLE NO. STIA-9719-C10

AR 011133

8. SOUTH 154TH STREET/156TH WAY RELOCATION BIOSWALE CALCULATIONS AND STORMWATER DRAINAGE PLANS

For information on the South 154th Street/156th Way relocation bioswale calculations and stormwater drainage plans, see the attached excerpt from the technical information report prepared by Kato and Warren, Inc.

Surface Water Technical Information Report Appendix B Biofiltration Swale Calculations

for

Runways 16L/16R Safety Area Improvement Project South 154th Street/156th Way Relocation

Presented to:
Port of Seattle
Sea-Tac International Airport

Presented by:
Kato & Warren, Inc. ***August 1998***

AR 011135

KATO & WARREN, INC.
2003 - WESTERN AVENUE
SUITE 555 • MARKET PLACE ONE
SEATTLE, WASHINGTON 98121
(206) 448-4200
FAX (206) 728-5608

CLIENT PORT OF SEATTLE
PROJECT S. 154th St./156th Way
CONTACT
PHONE ( )

By KRS
Date 7/21/98
Chkd
Date

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96-382
Job No.

BIOFILTRATION SWALE SIZING

DESIGN CRITERIA

draft 1997 King County Surface Water Design Manual (KCSWDM)
flow depth = 4 inches (unless otherwise noted to achieve $W_{min} = 2'$)
$Q_{WQ} = 60\% (Q_2)$ [15-minute time step]
n = 0.20 sizing for biofiltration
n = 0.027 100-yr conveyance check
$V_{max} = 1$ ft/s @ Q_{WQ}
$V_{max} = 5$ ft/s @ Q_{100}

BIOSWALE #1	89+00 to 90+75
BIOSWALE #2	90+75 to 115+50
BIOSWALE #3	115+50 to 148+70
BIOSWALE #4	PERIM. ROAD 140+00 to E. END

2 & 100 yr. peak flow rates (Q_2 & Q_{100})
KCRTS
Rainfall region / scale factor : SeaTac 1.0
Time step 15-minute

Swale bottom width
sized using Manning's equation (FlowMaster software) rather than eqn's (6-1)-(6-4)

Swale Length
9-min residence time: L = V (540) (eqn. 6-5)

KATO & WARREN, INC.
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(206) 448-4200 • FAX (206) 728-5608
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CLIENT PORT OF SEATTLE
PROJECT S. 154th St./156th Way
CONTACT
PHONE ( )

By KRS
Date 7/21/98
Chkd
Date

sheet of
96-382
Job No.

BIOSWALE #1 88+82 to 90+75

Impervious area:
11,549 S.F. → 0.27 AC
Pervious area:
13,060 − 11549 = 1511 S.F. → 0.04 AC

2 & 100-yr peak runoff (KCRTS)
Flow paths:
Impervious − 21.5' @ 2%
Pervious − 8' @ 2%

Q_2 = 0.19 cfs Q_{WQ} = 0.6 (Q_2) = 0.11 cfs
Q_{100} = 0.39 cfs

Swale geometry options:

SLOPE	WIDTH	DEPTH	VELOCITY	LENGTH	
1.5%	2'	0.18'	0.25fps	135'	← selection
2%	2'	0.16'	0.27fps	146'	
2.5%	2'	0.15'	0.30fps	162'	

Swale design:
Bottom width = 2'
Bottom slope = 1.5%
Length = 135'

100-yr conveyance check
d_{100} = 0.35' ✓OK
V_{100} = 0.36 fps ✓OK

BIOSWALE #1

Flow Frequency Analysis
Time Series File:pos-bs1.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---		
Flow Rate (CFS)	Rank	Time of Peak
0.201	4	8/27/ 1 18:00
0.128	8	1/ 6/ 2 1:00
0.343	2	12/ 8/ 2 17:15
0.137	7	8/25/ 4 23:45
0.200	5	10/28/ 4 16:00
0.207	3	10/22/ 5 10:00
0.190	6	10/25/ 6 22:45
0.393	1	1/ 9/ 8 6:30
Computed Peaks		

-----Flow Frequency Analysis-------			
- - Peaks - - (CFS)	Rank	Return Period	Prob
0.393	1	100.00	0.990
0.343	2	25.00	0.960
0.207	3	10.00	0.900
0.201	4	5.00	0.800
0.200	5	3.00	0.667
0.190	6	2.00	0.500
0.137	7	1.30	0.231
0.128	8	1.10	0.091
0.377		50.00	0.980

Biofiltration Swale #1
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\fm\96382.fm2
Worksheet	Biofiltration sizing
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.200	
Channel Slope	0.015000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	2.00	ft
Discharge	0.11	ft^3/s

Results		
Depth	0.18	ft
Flow Area	0.44	ft^2
Wetted Perimeter	3.11	ft
Top Width	3.05	ft
Critical Depth	0.04	ft
Critical Slope	1.693355	ft/ft
Velocity	0.25	ft/s
Velocity Head	0.96e-3	ft
Specific Energy	0.18	ft
Froude Number	0.11	
Flow is subcritical.		

Biofiltration Swale #1
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\fm\96382.fm2
Worksheet	Biofiltration 100-year conveyance
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.200	
Channel Slope	0.015000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	2.00	ft
Discharge	0.39	ft^3/s

Results		
Depth	0.35	ft
Flow Area	1.07	ft^2
Wetted Perimeter	4.22	ft
Top Width	4.10	ft
Critical Depth	0.10	ft
Critical Slope	1.328946	ft/ft
Velocity	0.36	ft/s
Velocity Head	0.21e-2	ft
Specific Energy	0.35	ft
Froude Number	0.13	
Flow is subcritical.		

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By KRS
Date 7/21/98
Chkd
Date

sheet of

96-382
Job No.

BIOSWALE #2 90+75 to 115+50

Impervious area:
41' (115+50 - 90+75) = 101,475 S.F.
Widening @ W. end : 1017 S.F.
} 2.35 AC

Pervious area:
16' (115+50 - 90+75) = 0.91 Ac (till grass)

2 & 100 yr. peak runoff (KCRTS)
Flow paths:
Impervious - 16' @ 2%
Pervious - 8' @ 2%

Q_2 = 1.67 cfs Q_{wq} = 0.6(Q_2) = 1.0 cfs
Q_{100} = 3.72 cfs

Swale geometry options:

SLOPE	WIDTH	VELOCITY	LENGTH	ELEVATIONAL DROP
1%	8.2'	0.33 fps	178'	1.8'
1.5%	6.6'	0.40 fps	216'	3.2'
2%	5.7'	0.45 fps	243'	4.9'

← selection (1% row)

Swale design
Bottom width = 9'
Bottom slope = 1%
Length = 180'

100-yr conveyance check
d_{100} = 0.67' √OK
V_{100} = 0.50 fps √OK

BIOSWALE #2

Flow Frequency Analysis
Time Series File:pos-bs2.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak
1.76	5	8/27/ 1 18:00
1.20	8	1/ 6/ 2 1:00
3.24	2	12/ 8/ 2 17:15
1.22	7	8/25/ 4 23:45
2.00	3	11/17/ 4 5:00
1.82	4	10/22/ 5 10:00
1.67	6	10/25/ 6 22:45
3.72	1	1/ 9/ 8 6:30

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	Rank	Return Period	Prob
3.72	1	100.00	0.990
3.24	2	25.00	0.960
2.00	3	10.00	0.900
1.82	4	5.00	0.800
1.76	5	3.00	0.667
1.67	6	2.00	0.500
1.22	7	1.30	0.231
1.20	8	1.10	0.091
Computed Peaks 3.56		50.00	0.980

Biofiltration Swale #2
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\fm\96382.fm2
Worksheet	Biofiltration sizing
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Bottom Width

Input Data		
Mannings Coefficient	0.200	
Channel Slope	0.010000	ft/ft
Depth	0.33	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.00	ft^3/s

Results		
Bottom Width	8.22	ft
Flow Area	3.04	ft^2
Wetted Perimeter	10.30	ft
Top Width	10.20	ft
Critical Depth	0.08	ft
Critical Slope	1.390935	ft/ft
Velocity	0.33	ft/s
Velocity Head	0.17e-2	ft
Specific Energy	0.33	ft
Froude Number	0.11	
Flow is subcritical.		

Biofiltration Swale #2
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\fm\96382.fm2
Worksheet	Biofiltration 100-year conveyance
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.200	
Channel Slope	0.010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	9.00	ft
Discharge	3.72	ft^3/s

Results		
Depth	0.67	ft
Flow Area	7.39	ft^2
Wetted Perimeter	13.24	ft
Top Width	13.03	ft
Critical Depth	0.17	ft
Critical Slope	1.076273	ft/ft
Velocity	0.50	ft/s
Velocity Head	0.39e-2	ft
Specific Energy	0.67	ft
Froude Number	0.12	
Flow is subcritical.		

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Date 7/16/98
Chkd
Date

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Job No.

BIOSWALE #3 115+50 to 148+70

Impervious area:
41' (148+70 - 115+50) = 136,120 S.F.
Widening @ E. end: 1011 SF.
Vehicle turn-outs/driveways: 450+4471 S.F = 4,921 S.F.
} 3.26 AC

Pervious area:
16' (145+00 - 115+50) = 47,200 S.F.
5' (148+70 - 145+00) = 1,850 S.F.
} 1.13 AC (till grass)

2 & 100 yr. peak runoff (KCRTS)
Flow paths
Impervious - 16' @ 2%
Pervious - 8' @ 2%

Q_2 = 2.34 cfs $Q_{WQ} = 0.6\ Q_2$ = 1.40 cfs
Q_{100} = 5.21 cfs

Swale geometry options:

SLOPE	WIDTH	VELOCITY	LENGTH	
1.5%	9.5'	0.41 fps	221'	
2.5%	7.2'	0.52 fps	281'	
3.0%	6.6'	0.56 fps	300'	← selection (avg. swale slope)
3.5%	6.1'	0.60 fps	324'	

Swale design:
Bottom width = 8'
Bottom slope = avg 3% (min 2.5%, max 3.5%)
Length = 300'

100yr conveyance check:
d_{100} = 0.86' ✓OK
V_{100} = 0.57 fps ✓OK

BIOSWALE #3

Flow Frequency Analysis
Time Series File:pos-bs3.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak
2.46	5	8/27/ 1 18:00
1.66	8	1/ 6/ 2 1:00
4.49	2	12/ 8/ 2 17:15
1.70	7	8/25/ 4 23:45
2.69	3	11/17/ 4 5:00
2.57	4	10/22/ 5 10:00
2.34	6	10/26/ 6 0:45
5.21	1	1/ 9/ 8 6:30

Computed Peaks

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	Rank	Return Period	Prob
5.21	1	100.00	0.990
4.49	2	25.00	0.960
2.69	3	10.00	0.900
2.57	4	5.00	0.800
2.46	5	3.00	0.667
2.34	6	2.00	0.500
1.70	7	1.30	0.231
1.66	8	1.10	0.091
4.97		50.00	0.980

Biofiltration Swale #3
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\fm\96382.fm2
Worksheet	Biofiltration sizing
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Bottom Width

Input Data		
Mannings Coefficient	0.200	
Channel Slope	0.030000	ft/ft
Depth	0.33	ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Discharge	1.40	ft^3/s

Results		
Bottom Width	6.57	ft
Flow Area	2.49	ft^2
Wetted Perimeter	8.65	ft
Top Width	8.55	ft
Critical Depth	0.11	ft
Critical Slope	1.242869	ft/ft
Velocity	0.56	ft/s
Velocity Head	0.49e-2	ft
Specific Energy	0.33	ft
Froude Number	0.18	
Flow is subcritical.		

Biofiltration Swale #3
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\fm\96382.fm2
Worksheet	Biofiltration 100-year conveyance
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.200	
Channel Slope	0.010000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	8.00	ft
Discharge	5.21	ft^3/s

Results		
Depth	0.86	ft
Flow Area	9.10	ft^2
Wetted Perimeter	13.44	ft
Top Width	13.16	ft
Critical Depth	0.23	ft
Critical Slope	0.987059	ft/ft
Velocity	0.57	ft/s
Velocity Head	0.01	ft
Specific Energy	0.86	ft
Froude Number	0.12	
Flow is subcritical.		

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By KRS
Date 7/16/98
Chkd
Date

sheet of
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Job No.

BIOSWALE #4 PERIM. RD. 140+00 to E. END

Impervious area:

20'(147+00 − 140+00) = 14,000 S.F. → 0.32 AC

Pervious area

[Basin E1] − [Area downstream of bioswale] − [impervious area]
[1.54 AC] − (25'×250') − [0.32 AC] = 1.08 AC (till grass)

2 & 100-yr peak runoff (KCRTS)

flow paths

Impervious − 20' @ 2%

Pervious − 130' @ 16%

Q_2 = 0.27 cfs Q_{wq} = 0.6(Q_2) = 0.16 cfs

Q_{100} = 1.02 cfs

Swale geometry options:

SLOPE	WIDTH	DEPTH	VELOCITY	LENGTH	
4%	3'	0.13'	0.36 fps	194'	
4.5%	3'	0.13'	0.37 fps	200'	← selection
6%	3'	0.12'	0.41 fps	221'	

Swale design:

Bottom width = 3'

Bottom slope = 4.5%

*NOTE − Since the adjacent road slope is 6.5%, 1'-high check dams will be placed every 50' to reduce slope to 4.5%

Length = 200'

*NOTE − The design criteria for "continuous inflow bioswale" was not used because the majority of runoff enters at the end, and the road receives little travel.

100-yr conveyance check

d_{100} = 0.38' ✓OK

V_{100} = 0.69 fps ✓OK

BIOSWALE #4

Flow Frequency Analysis
Time Series File:pos-bs4.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---			
Flow Rate (CFS)	Rank	Time of Peak	
0.301	4	2/ 9/ 1	12:30
0.235	7	1/ 6/ 2	1:00
0.666	2	12/ 8/ 2	17:15
0.183	8	8/26/ 4	0:45
0.621	3	11/17/ 4	5:00
0.266	6	10/27/ 5	10:45
0.281	5	11/24/ 6	1:00
1.02	1	1/ 9/ 8	6:30
Computed Peaks			

-----Flow Frequency Analysis-------			
- - Peaks - - (CFS)	Rank	Return Period	Prob
1.02	1	100.00	0.990
0.666	2	25.00	0.960
0.621	3	10.00	0.900
0.301	4	5.00	0.800
0.281	5	3.00	0.667
0.266	6	2.00	0.500
0.235	7	1.30	0.231
0.183	8	1.10	0.091
0.899		50.00	0.980

Biofiltration Swale #4
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\~fm\96382.fm2
Worksheet	Biofiltration sizing
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.200	
Channel Slope	0.045000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Discharge	0.16	ft^3/s

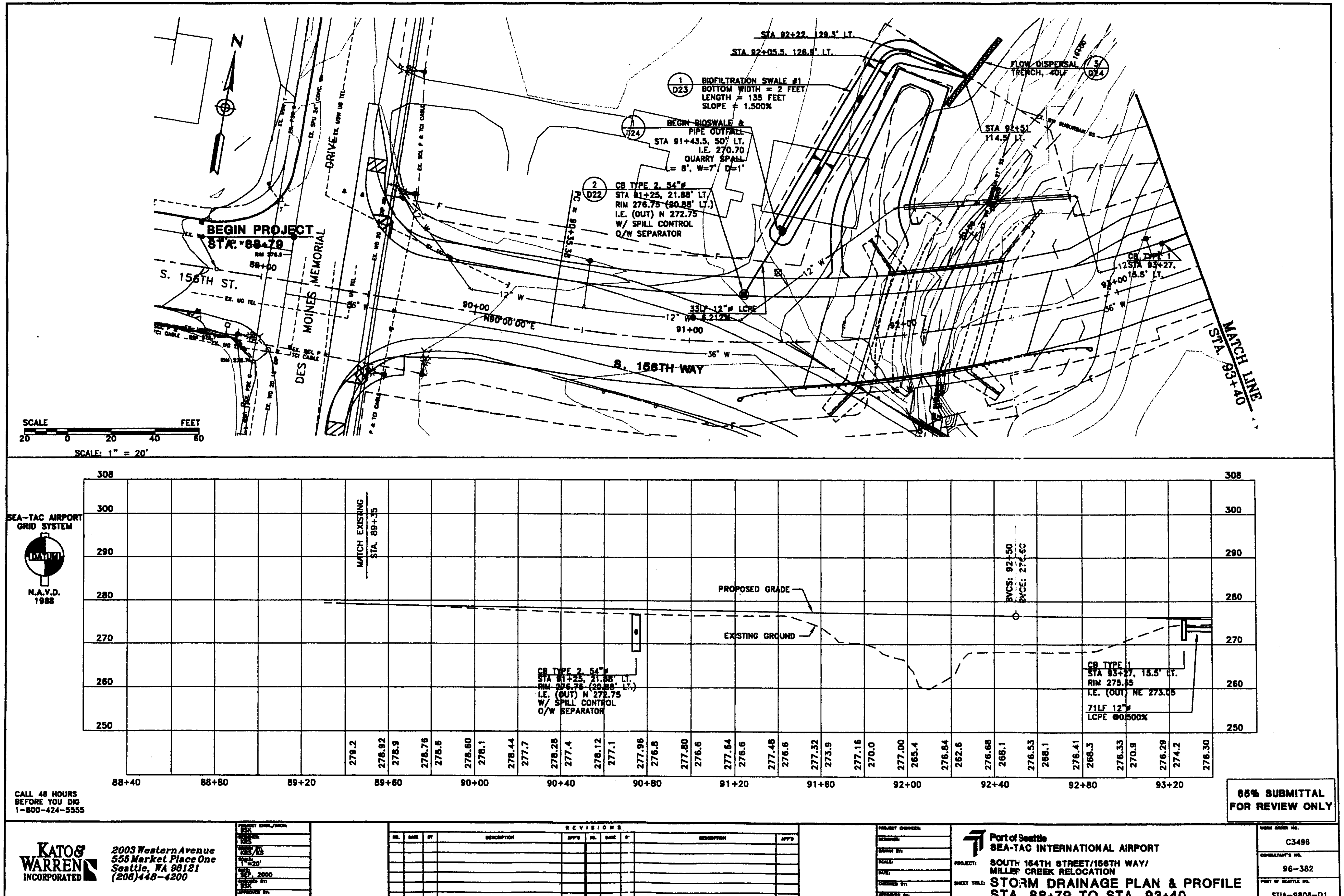
Results		
Depth	0.13	ft
Flow Area	0.43	ft^2
Wetted Perimeter	3.81	ft
Top Width	3.77	ft
Critical Depth	0.04	ft
Critical Slope	1.684690	ft/ft
Velocity	0.37	ft/s
Velocity Head	0.21e-2	ft
Specific Energy	0.13	ft
Froude Number	0.19	
Flow is subcritical.		

Biofiltration Swale #4
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\~fm\96382.fm2
Worksheet	Biofiltration 100-year conveyance
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.200	
Channel Slope	0.045000	ft/ft
Left Side Slope	3.00	H : V
Right Side Slope	3.00	H : V
Bottom Width	3.00	ft
Discharge	1.02	ft^3/s

Results		
Depth	0.37	ft
Flow Area	1.50	ft^2
Wetted Perimeter	5.32	ft
Top Width	5.20	ft
Critical Depth	0.15	ft
Critical Slope	1.171746	ft/ft
Velocity	0.68	ft/s
Velocity Head	0.01	ft
Specific Energy	0.37	ft
Froude Number	0.22	
Flow is subcritical.		



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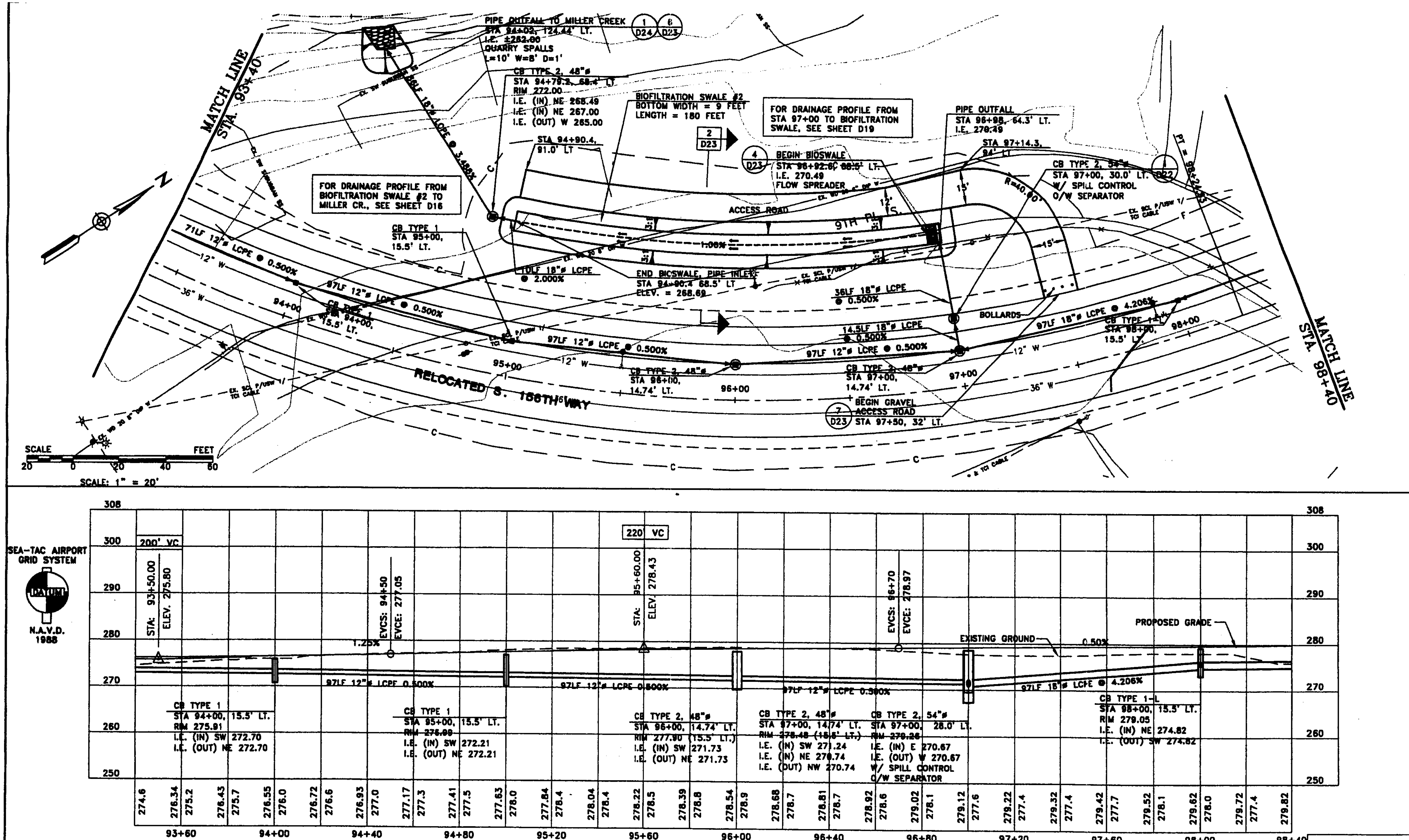

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SCALE: 1"=20'
DATE: SEP. 2000

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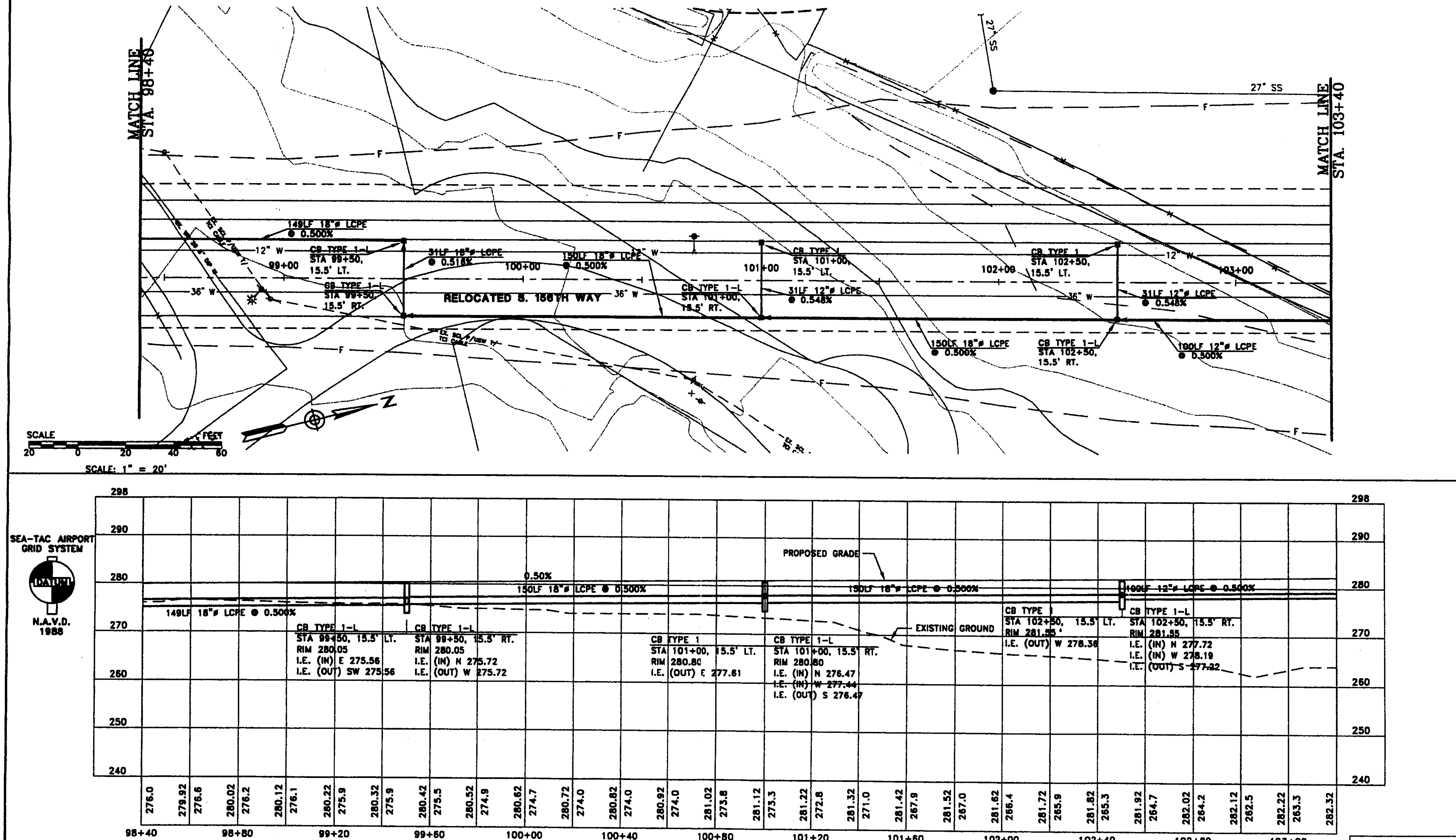

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PROJECT ENGR./ARCH: BSK
DESIGNED BY: KRS
DRAWN BY: KRS/KS
SCALE: 1"=20'
DATE: SEP. 2000
CHECKED BY: BSK
APPROVED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PROJECT ENGINEER:
DESIGNED BY:
DRAWN BY:
SCALE:
DATE:
CHECKED BY:
APPROVED BY:

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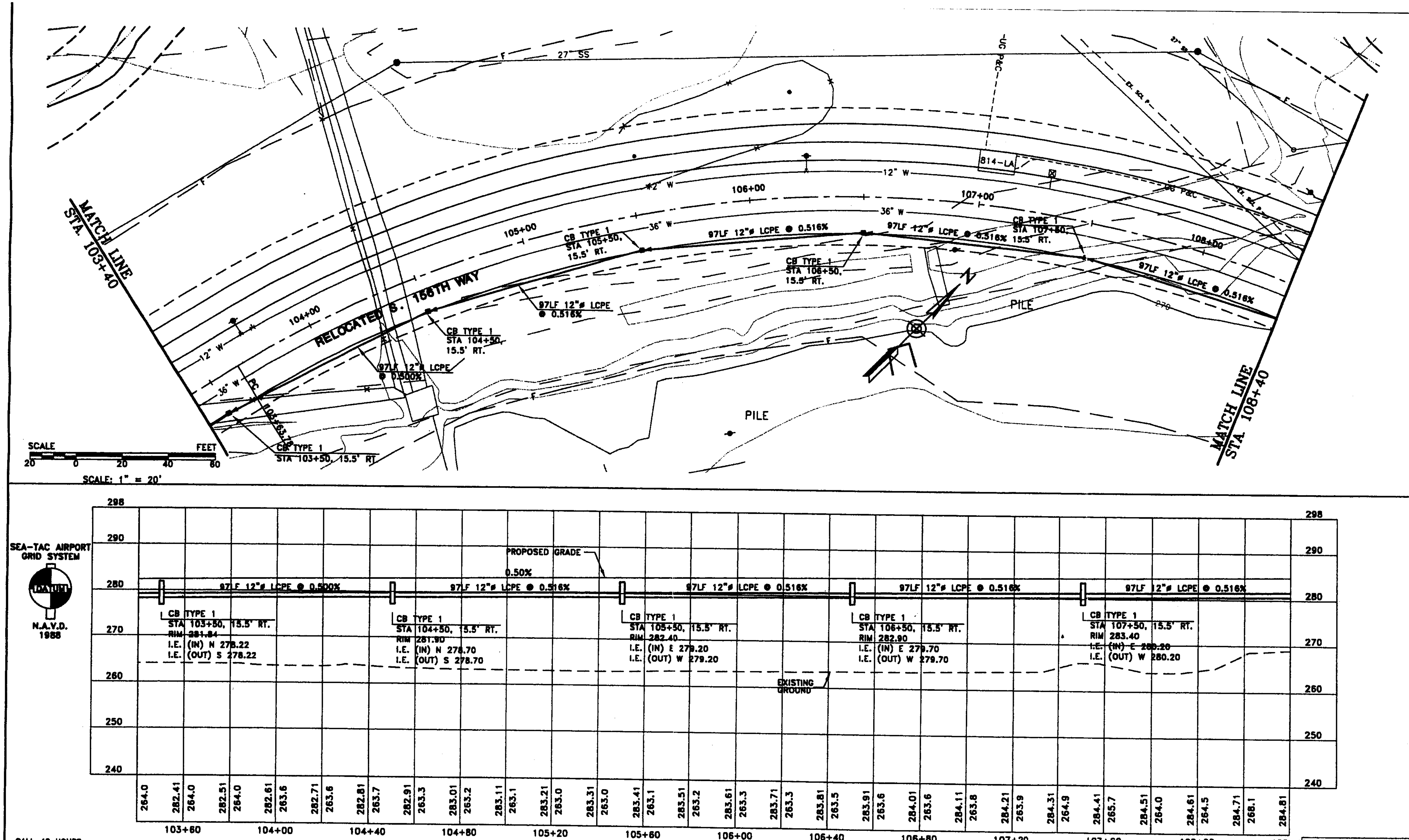

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SHEET TITLE: STORM DRAINAGE PLAN & PROFILE STA. 103+40 TO STA. 108+40

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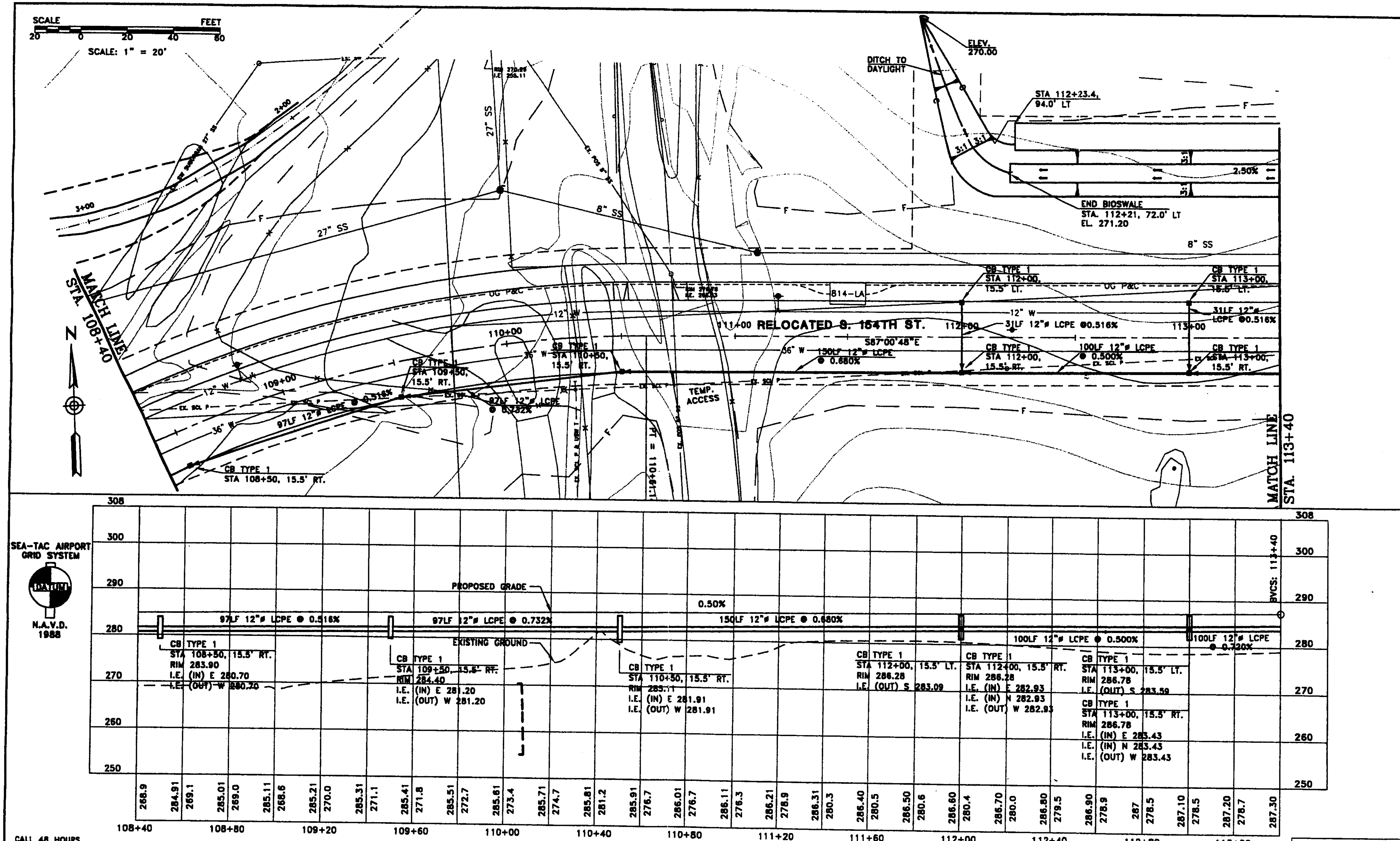

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SHEET TITLE: STORM DRAINAGE PLAN & PROFILE STA. 108+40 TO STA. 113+40

C3496
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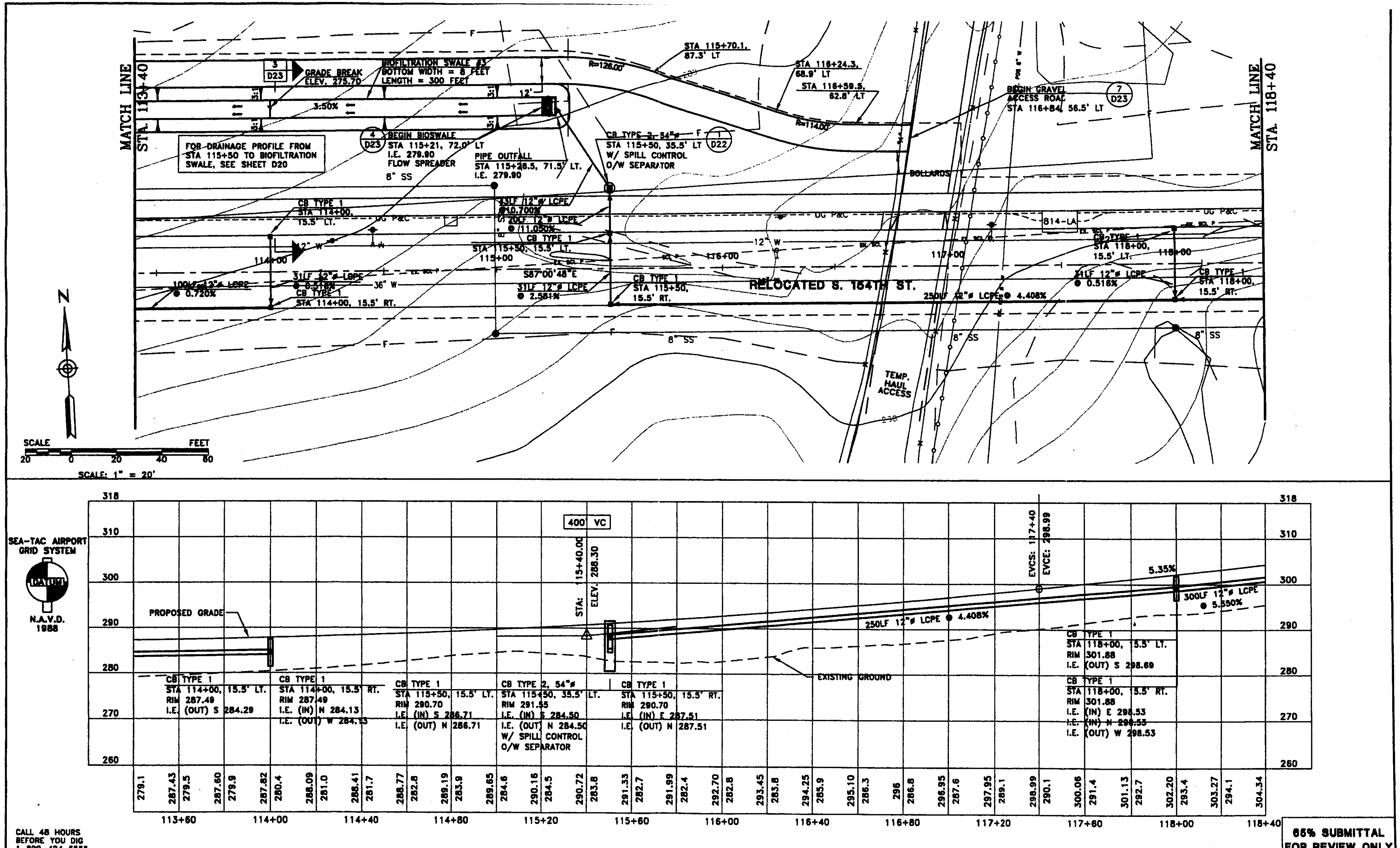

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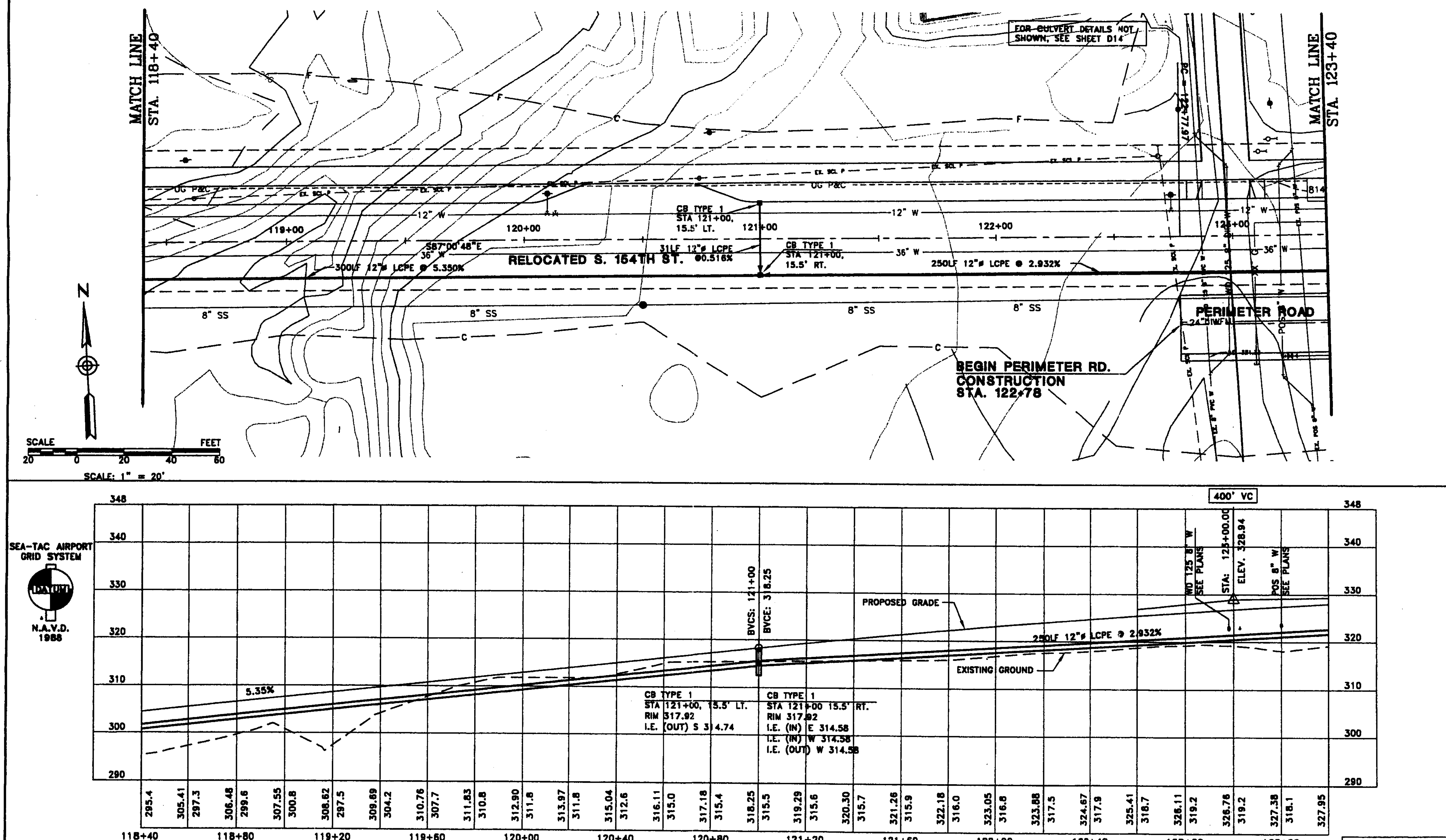

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STIA-9806-D7

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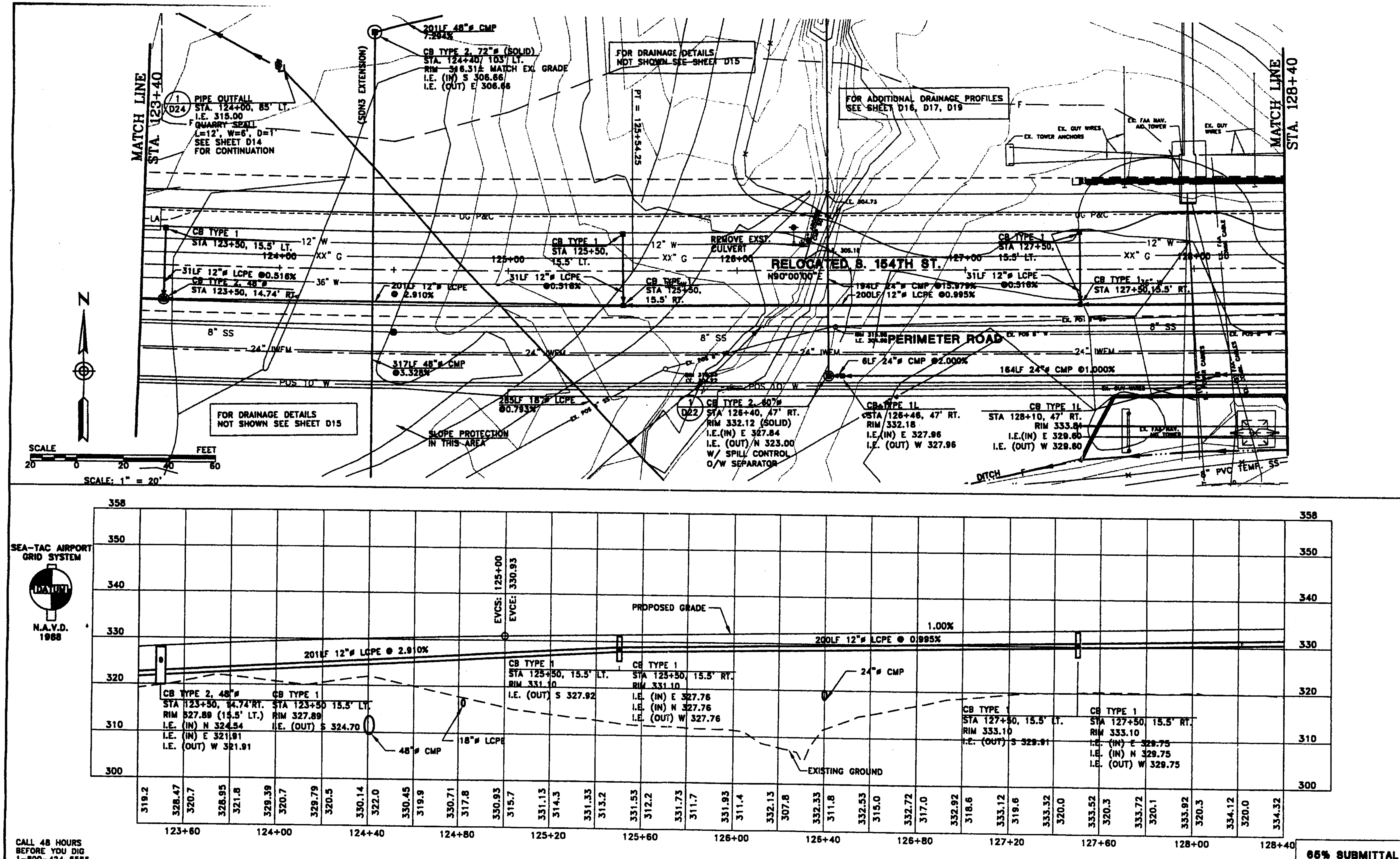

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PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION

SHEET TITLE: **STORM DRAINAGE PLAN & PROFILE STA. 123+40 TO STA. 128+40**

WORK ORDER NO. C3496
CONSULTANT'S NO. 96-382
PORT OF SEATTLE NO. STIA-9805-D8

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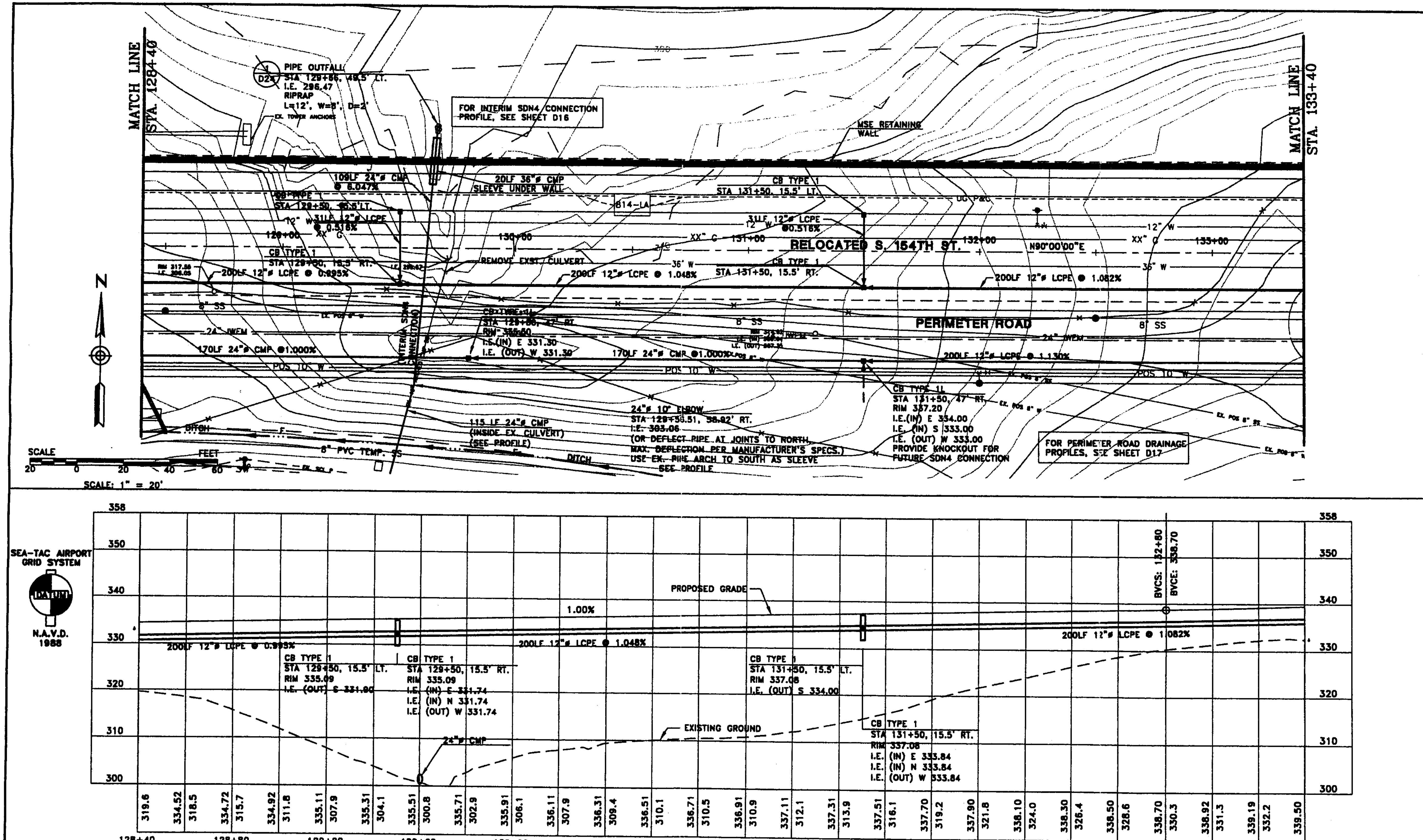

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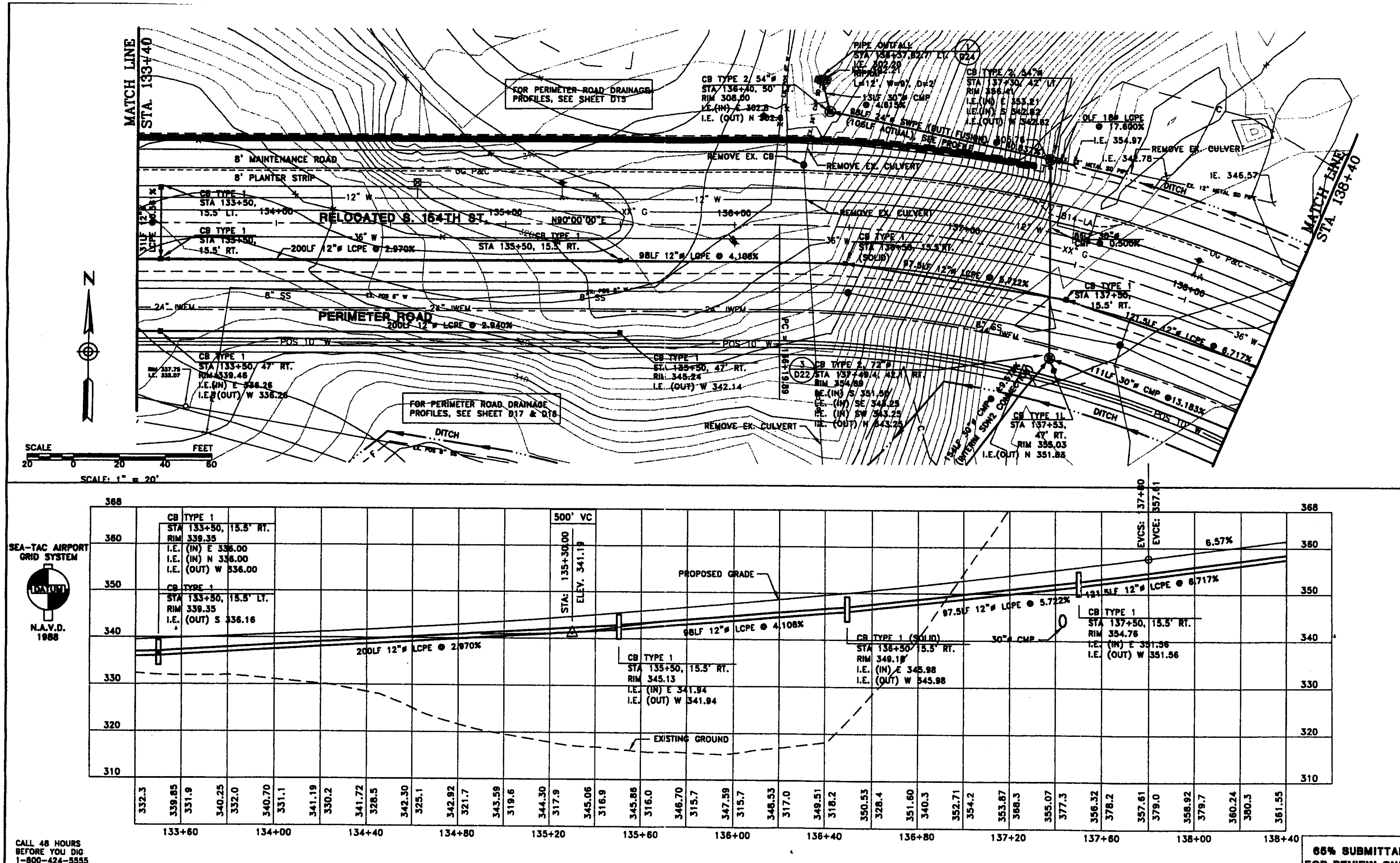
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: STORM DRAINAGE PLAN & PROFILE STA. 128+40 TO STA. 133+40

C3496
96-382
STIA-9806-D9

XREFS: 96382\planset\DRAIN9.dwg & UTILITIES.DWG \util\UTILITY.DWG \planset\J_PH1PH2.DWG \1997pres\MODBASE.DWG basemap\CONTOUR1.DWG

H-16

AR 011161



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PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION

SHEET TITLE: STORM DRAINAGE PLAN & PROFILE STA. 133+40 TO STA. 138+40

C3496

96-382

STIA-9806-D10

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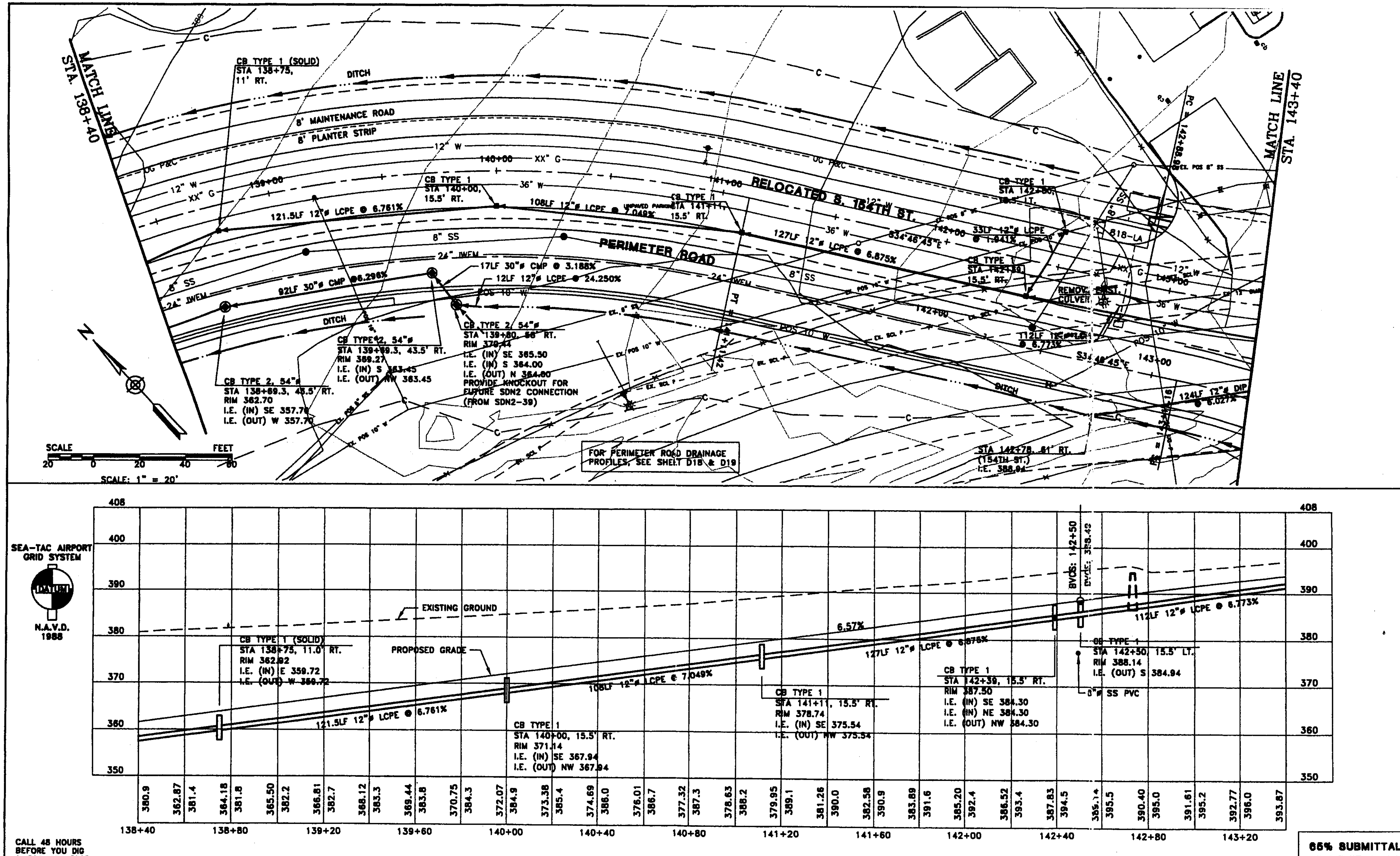

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PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: **STORM DRAINAGE PLAN & PROFILE STA. 138+40 TO STA. 143+40**

C3496
96-382
STIA-9806-D11

XREFS: 96382\planset\DRAIN11.dwg UTILITIES.DWG \util\UTILITY.DWG \planset\J_PH1PH2.DWG \1997pres\MODBASE.DWG basemap\CONTOUR1.DWG

H-18

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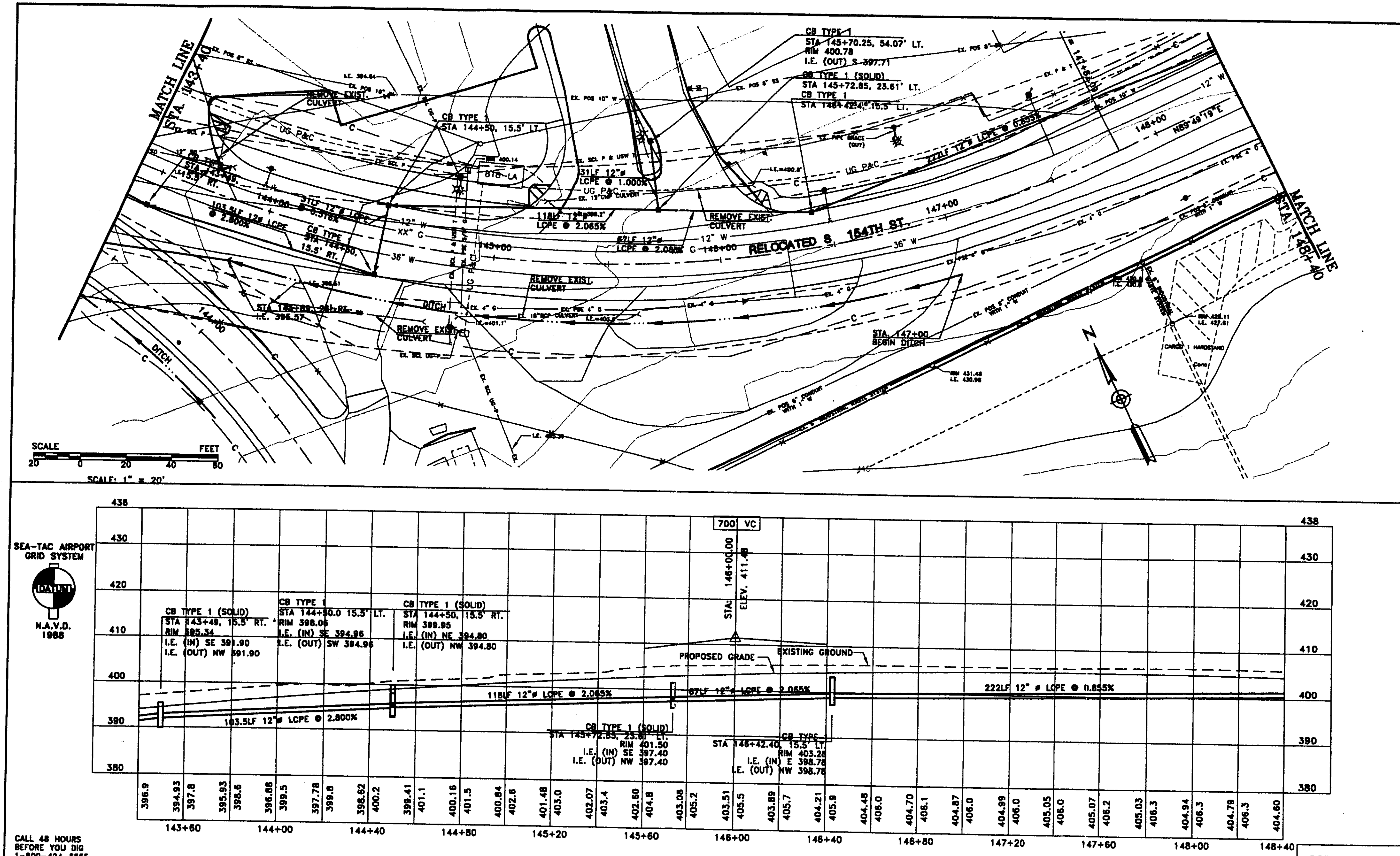

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DESIGNED: KRS
DRAWN BY: KRS/KS
SCALE: 1"=20'
DATE: SEP. 2000
CHECKED BY: BSK

REVISIONS

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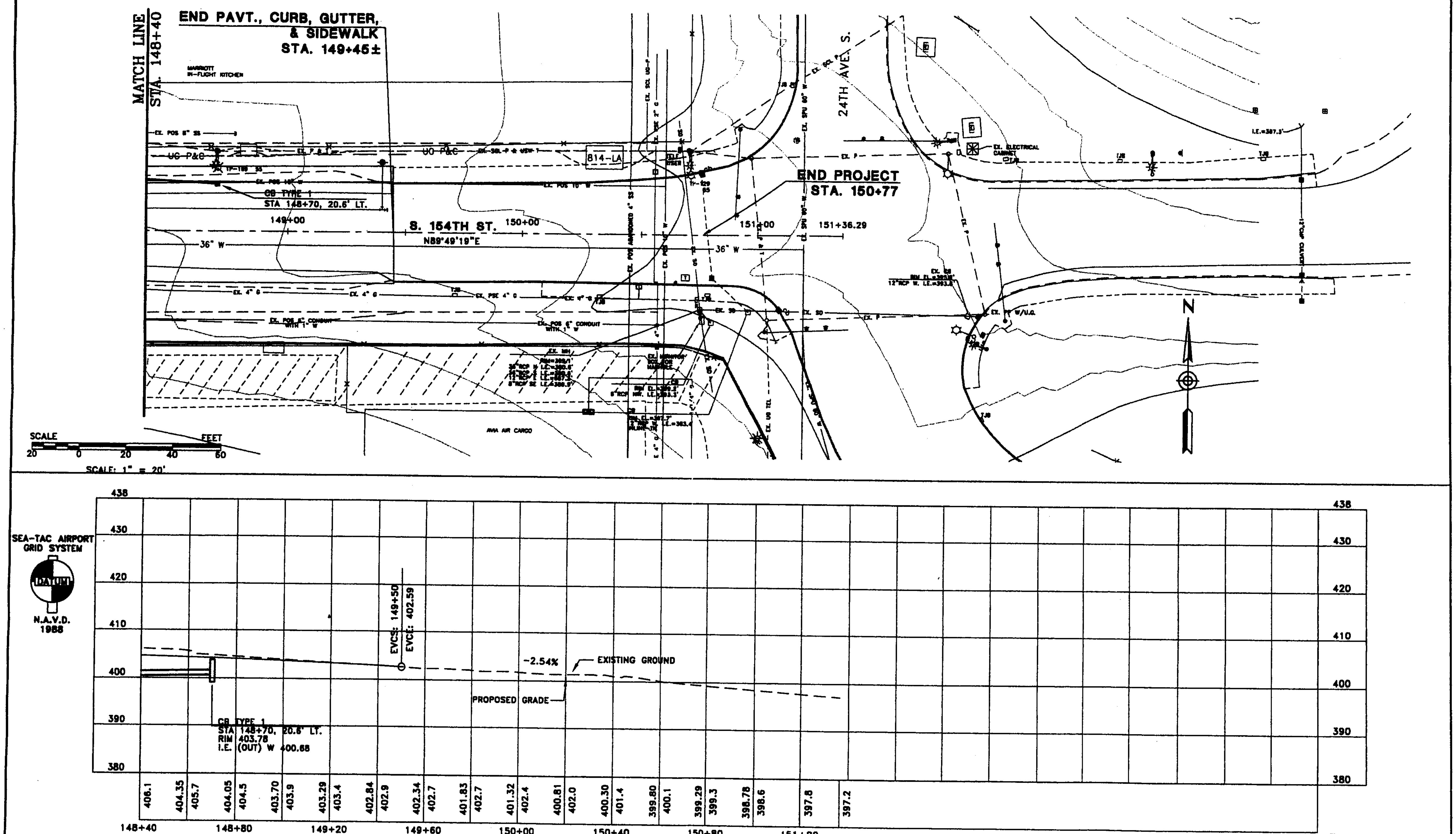
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION

SHEET TITLE: **STORM DRAINAGE PLAN & PROFILE STA. 143+40 TO STA. 148+40**

WORK ORDER NO. C3496
CONSULTANT'S NO. 96-382
PORT OF SEATTLE NO. STIA-9806-D12

XREFS: 96382\planset\DRAIN12.dwg UTILITIES.DWG \util\UTILITY.DWG \planset\J_PH1PH2.DWG \1997pres\MOOBASE.DWG basemap\CONTOUR1.DWG



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SEA-TAC INTERNATIONAL AIRPORT
PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: STORM DRAINAGE PLAN & PROFILE
STA. 148+40 TO STA. 150+77

C3496
96-382
STIA-9806-D13

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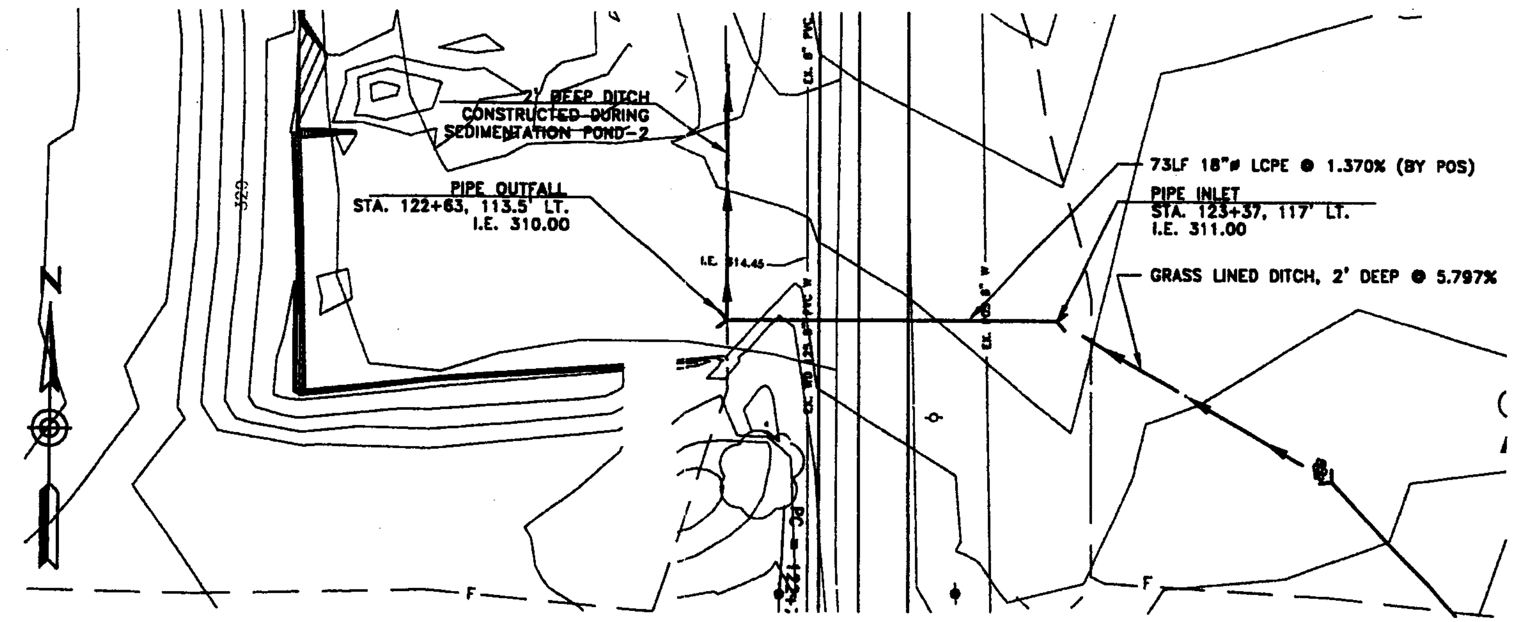

PIPE OUTFALL @ STA 124+00, 85' LT.

SCALE 20 0 20 40 60 FEET
SCALE: 1" = 20'

SEA-TAC AIRPORT GRID SYSTEM
DATUM
N.A.V.D. 1988

STORM DRAINAGE NOTES:

1. ALL LABELED PIPE LENGTHS ARE MEASURED IN THE HORIZONTAL PLANE BETWEEN CENTERS OF STRUCTURES, ROUNDED TO THE NEAREST FOOT. LABELED PIPE SLOPES WERE COMPUTED USING THESE LENGTHS. ACTUAL PIPE LENGTHS AND SLOPES SHALL BE COMPUTED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
2. PIPES LABELED LCPE SHALL BE CORRUGATED POLYETHYLENE STORM SEWER PIPE.
3. PIPES LABELED CMP SHALL BE STEEL STORM SEWER PIPE.
4. PIPES LABELED DIP SHALL BE DUCTILE IRON STORM SEWER PIPE.
5. PIPES LABELED SWPE SHALL BE SOLID WALL POLYETHYLENE PIPE.
6. CATCH BASINS WITHIN THE RELOCATED S. 154TH WAY SHALL HAVE THROUGH-CURB INLETS WITH VANED GRATES, UNLESS OTHERWISE NOTED (SEE KCRS STD. DWGS. 2-016 & 2-017).
7. CATCH BASINS WITHIN THE AIRPORT PERIMETER ROAD SHALL HAVE STANDARD FRAMES AND VANED GRATES, UNLESS OTHERWISE NOTED.
8. STATION AND OFFSET CALLOUTS FOR AREA INLETS AND CATCH BASINS ARE FOR CENTER OF STRUCTURE, UNLESS OTHERWISE NOTED.

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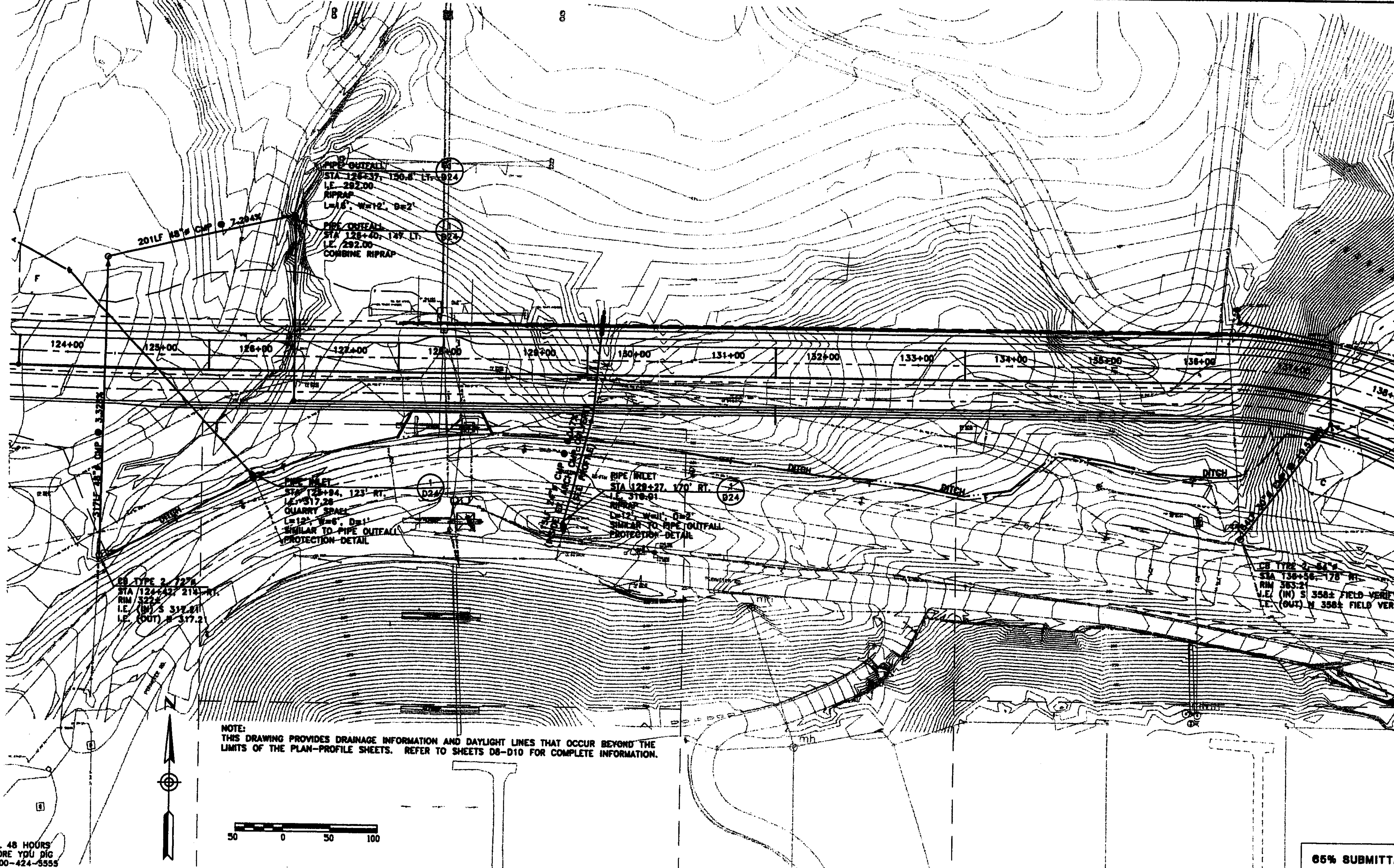
PROJECT ENGR./ARCH: BSK
DESIGNED: KRS
DRAWN BY: KS
SCALE: 1"=20'
DATE: SEP. 2000
CHECKED BY: BSK
APPROVED BY:

REVISIONS									
NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: STORM DRAINAGE PLAN & NOTES

WORK ORDER NO. C3496
CONSULTANT'S NO. 96-382
PORT OF SEATTLE NO. STIA-9806-D14

XREFS: 96382\engr\J_PH1PH2.DWG \planset\J_154PRF.DWG \1997pres\MODBASE.DWG \util\UTILITY.DWG \engr\drain_tesc_ss\SD-SS.DWG \basemap\CONTOUR1



NOTE:
THIS DRAWING PROVIDES DRAINAGE INFORMATION AND DAYLIGHT LINES THAT OCCUR BEYOND THE LIMITS OF THE PLAN-PROFILE SHEETS. REFER TO SHEETS D8-D10 FOR COMPLETE INFORMATION.

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SCALE: 1"=50'

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SEA-TAC INTERNATIONAL AIRPORT
PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: DRAINAGE PLAN AREA "A"

WORK ORDER NO. C3496
CONSULTANT'S NO. 96-382
PORT OF SEATTLE NO. STIA-9806-D15

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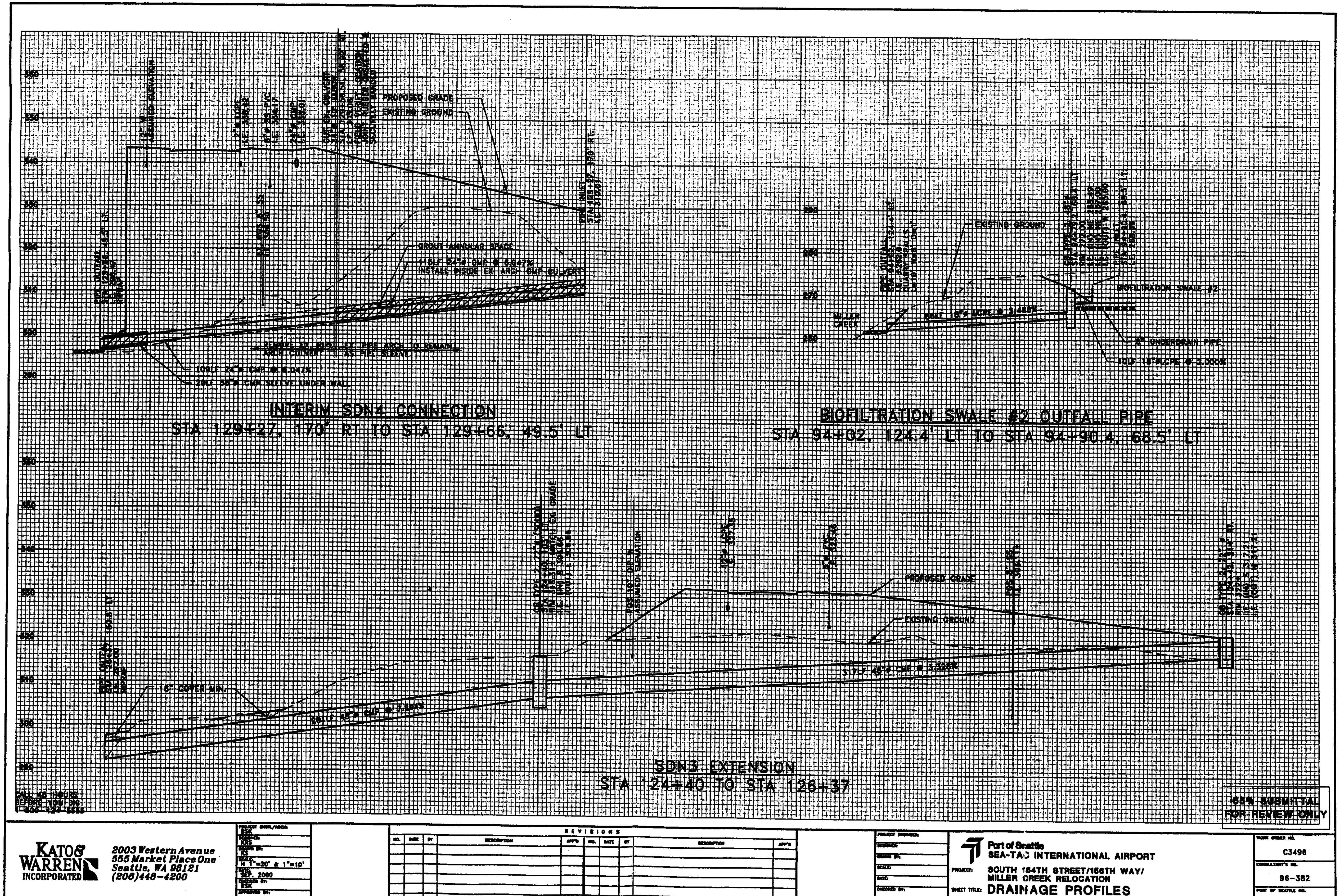
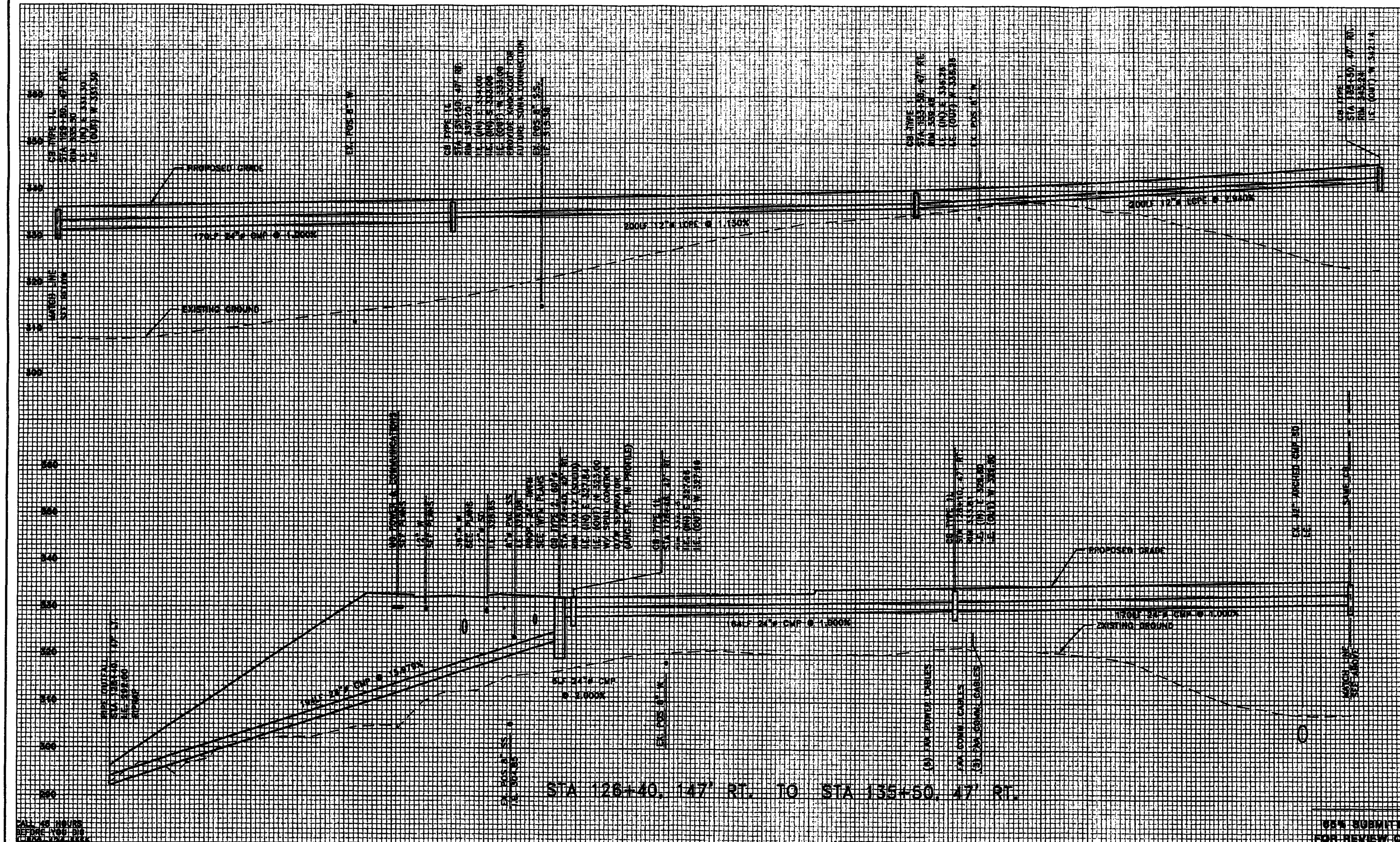


XREFS:

AR 011168



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PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION

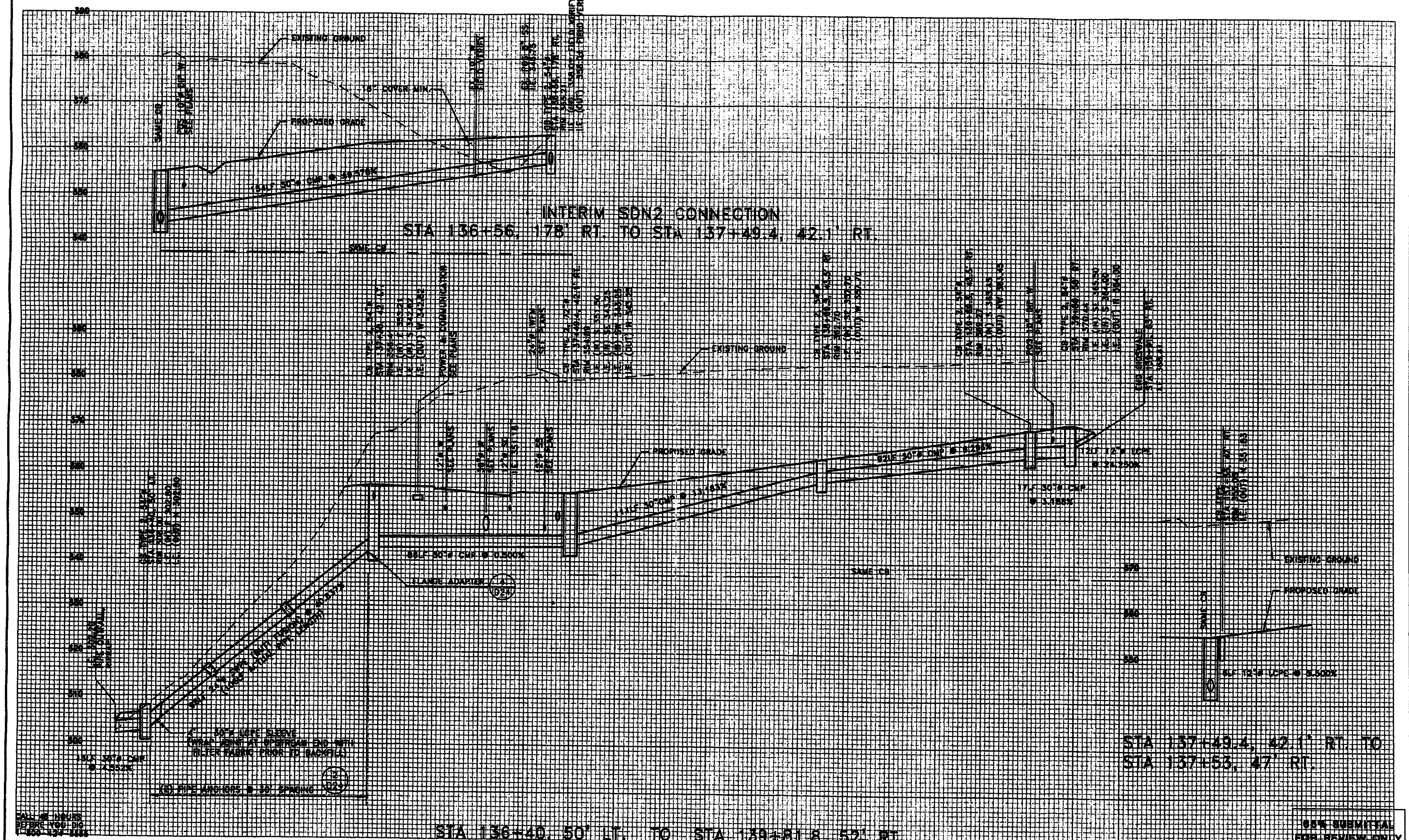
SHEET TITLE: DRAINAGE PROFILES PERIMETER ROAD

C3496

96-382

STIA-9806-D17

XREFS:



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DATE: SEPT. 2000

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PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION

SHEET TITLE: DRAINAGE PROFILES

WORK ORDER NO. C3496

CONSULTANT'S NO. 96-382

PORT OF SEATTLE NO. STIA-9806-D18

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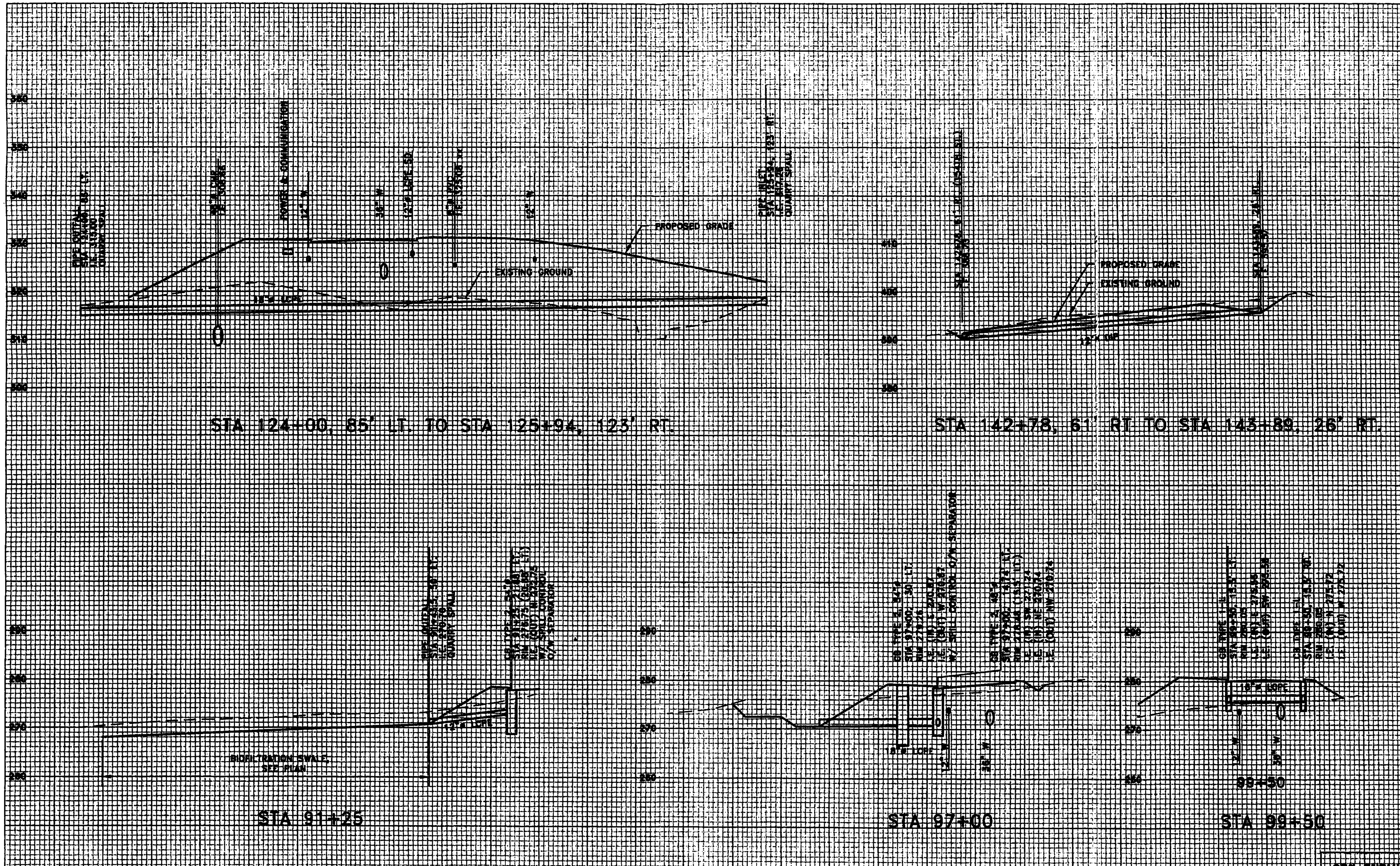

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DATE: SEP. 2000

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PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: DRAINAGE PROFILES

WORK ORDER NO. C3496
CONSULTANT'S NO. 96-382
PORT OF SEATTLE NO. STIA-9806-D19

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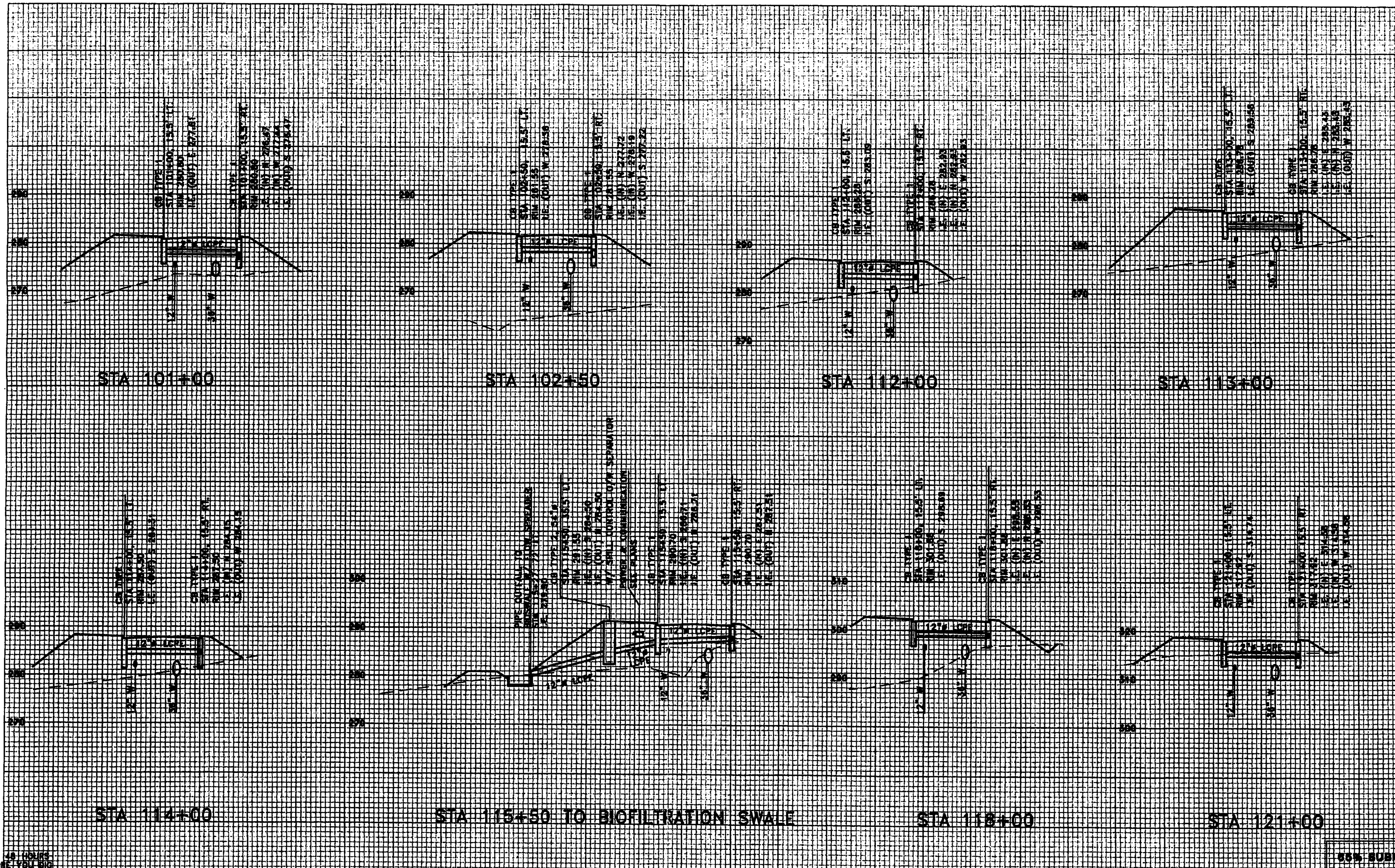

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PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION

SHEET TITLE: DRAINAGE PROFILES

WORK ORDER NO. C3496
CONSULTANT'S NO. 96-382
PORT OF SEATTLE NO. STIA-9808-D20

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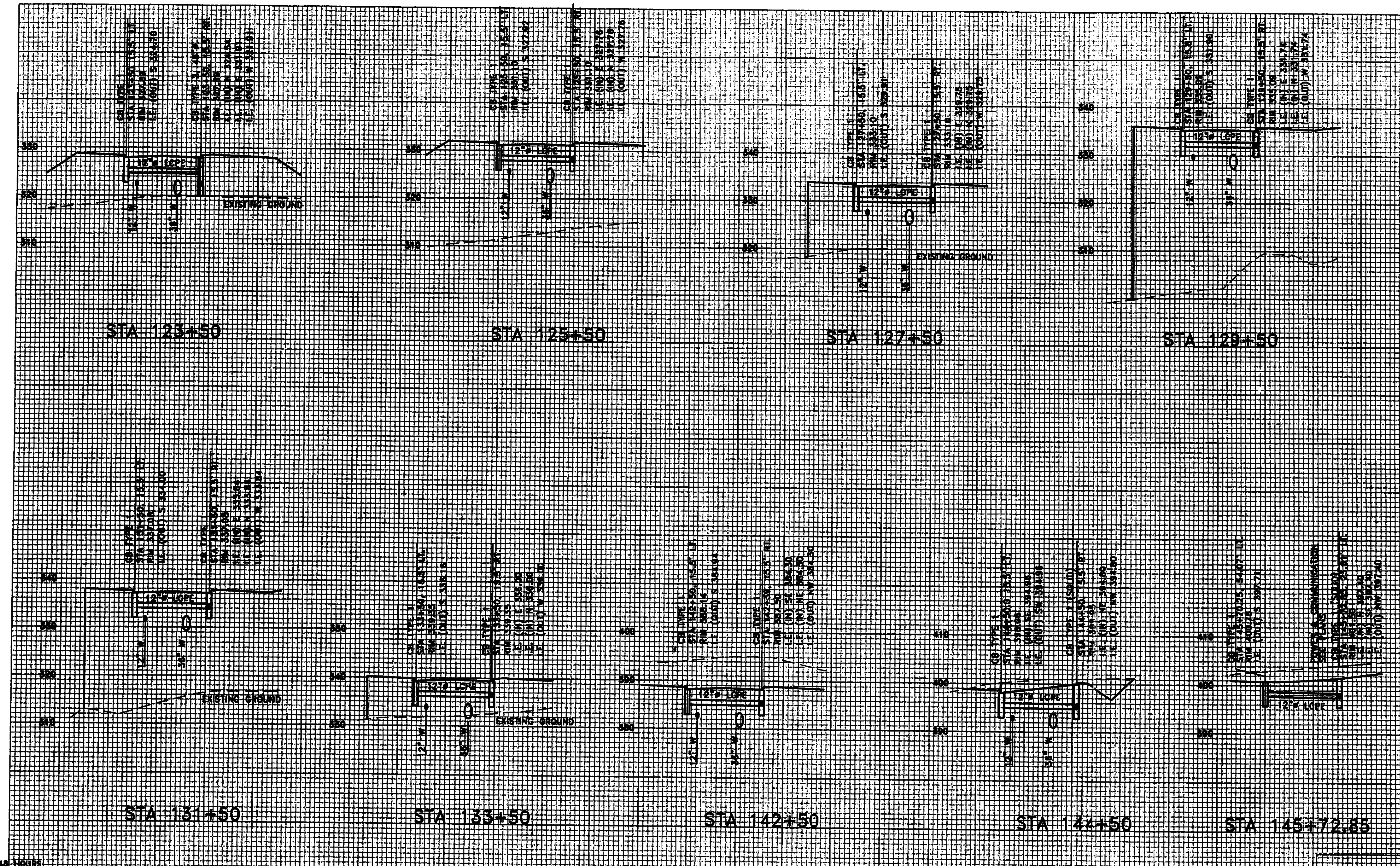

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DATE: SEPT. 2000

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PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: DRAINAGE PROFILES

WORK ORDER NO. C3496
CONSULTANT'S NO. 96-382
PORT OF SEATTLE NO. STIA-9806-D21

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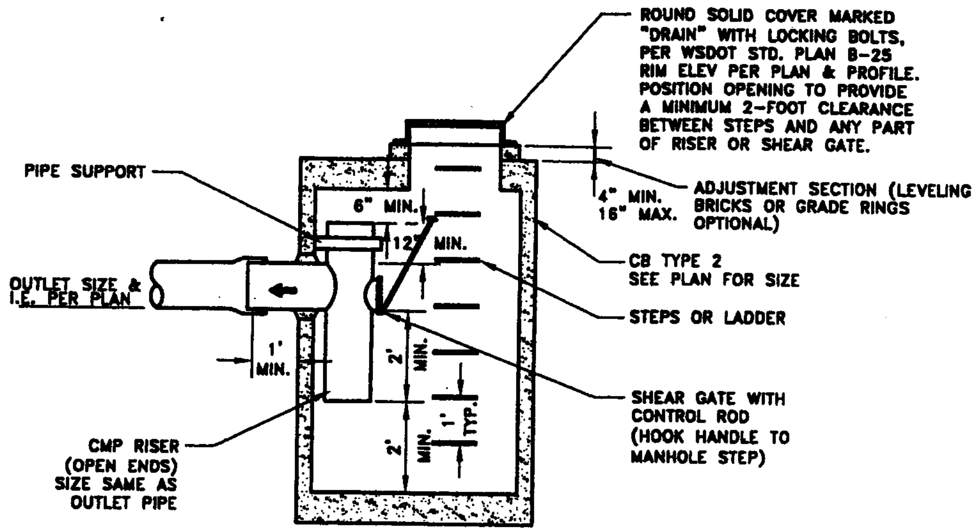
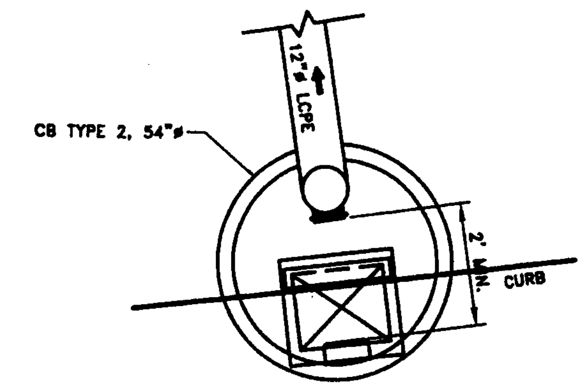


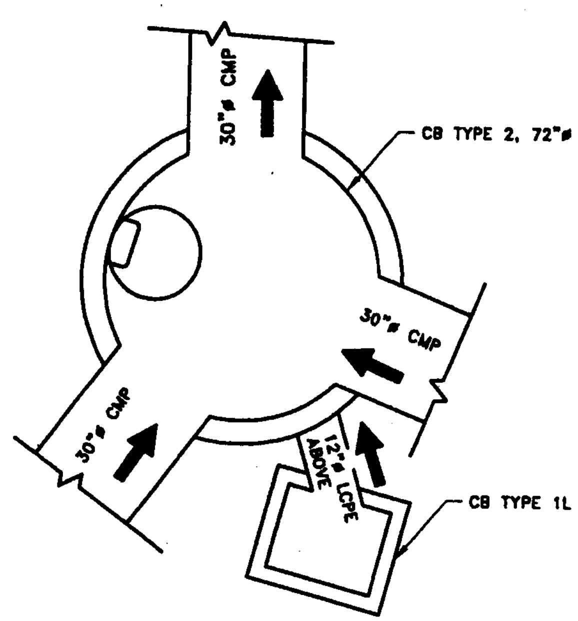
NOTE:
CONSTRUCT PER WSDOT STANDARD PLAN B-3, EXCEPT AS NOTED OTHERWISE.

ELEVATION (1 / D2,6,8)

SPILL CONTROL O/W SEPARATOR
STA. 97+00, 28.0' LT.
STA. 115+50, 35.5' LT.
STA. 126+40, 47' RT.
SCALE: N.T.S.



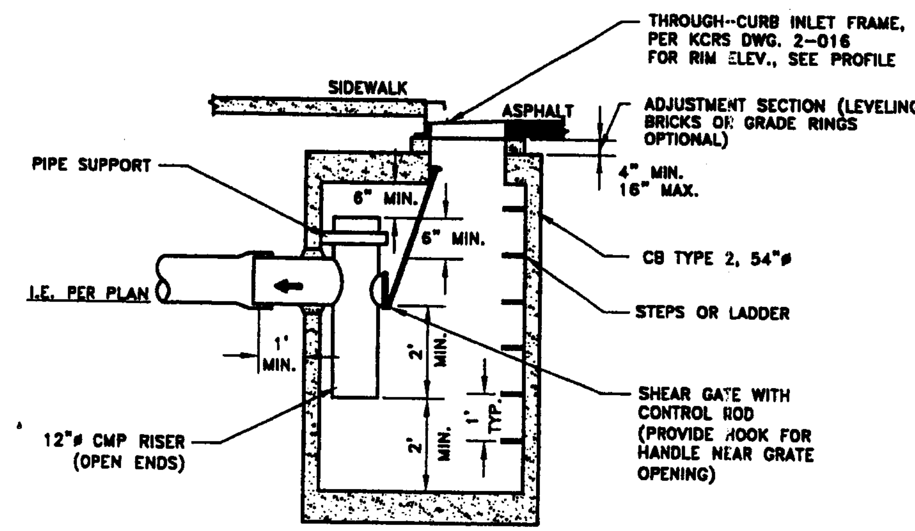
PLAN



NOTE:
1. INVERT ELEVATIONS, SEE PLAN

PLAN (3 / D10)

CB TYPE 1L & CB TYPE 2, STA 137+50
SCALE: 1" = 2'



NOTE:
CONSTRUCT PER WSDOT STANDARD PLAN B-3, EXCEPT AS NOTED OTHERWISE.

ELEVATION

PLAN & ELEVATION (2 / D1)

SPILL CONTROL O/W SEPARATOR
STA. 91+25, 21.88' LT.
SCALE: N.T.S.

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NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

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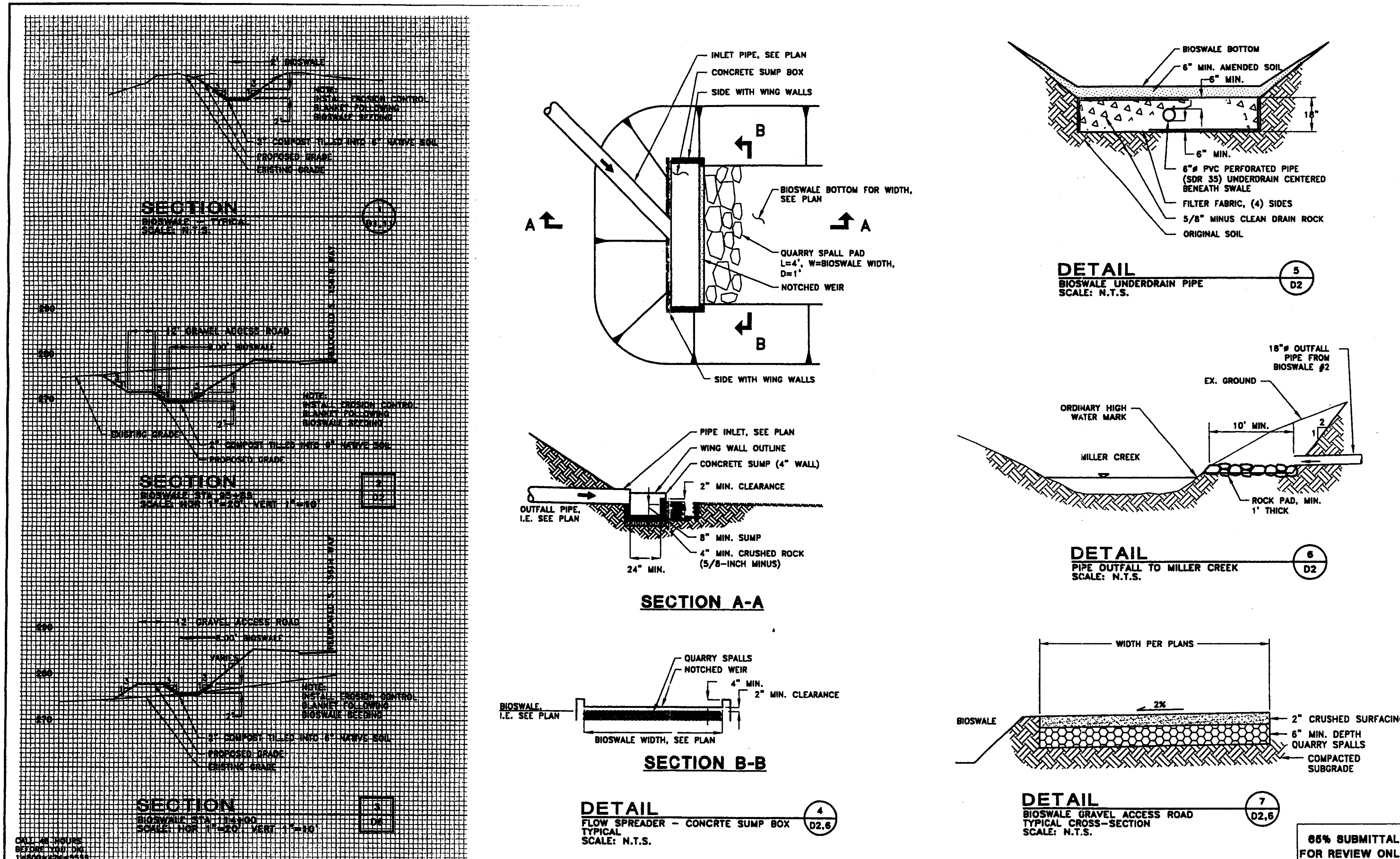
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: DRAINAGE DETAILS

WORK ORDER NO.: C3496
CONSULTANT'S NO.: 96-382
PORT OF SEATTLE NO.: STIA-9806-D22

XREFS: DETAIL-SD1



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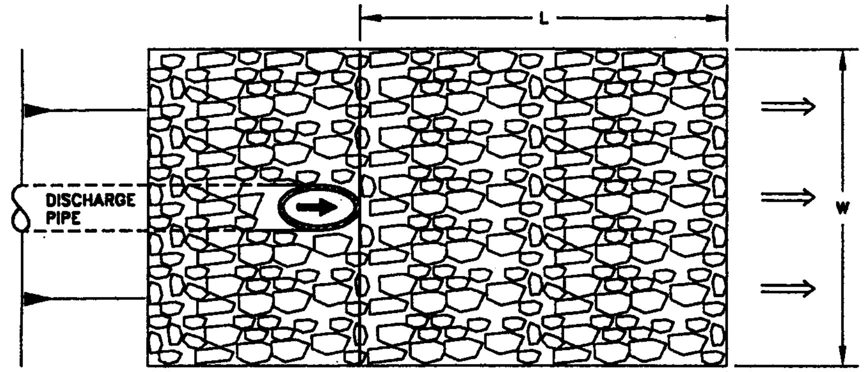
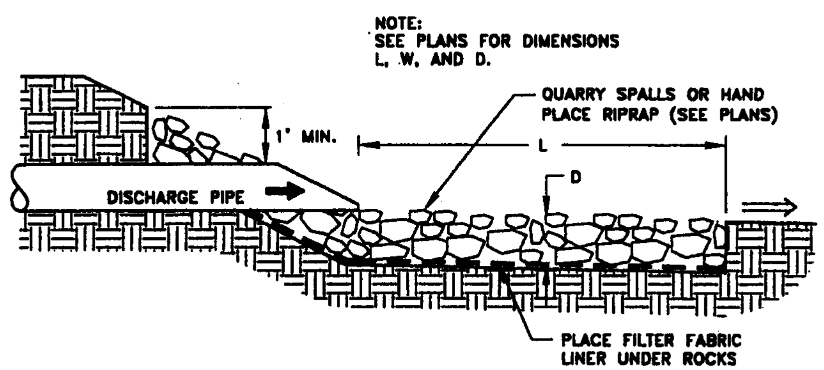
PROJECT: SOUTH 154TH STREET/156TH WAY/ MILLER CREEK RELOCATION
SHEET TITLE: DRAINAGE DETAILS

WORK ORDER NO. C3496
CONSULTANT'S NO. 96-382
PORT OF SEATTLE NO. STIA-9806-D23

XREFS: DETAIL-SD1

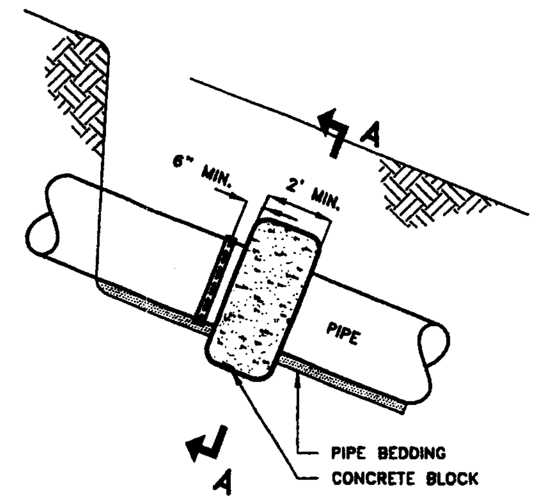


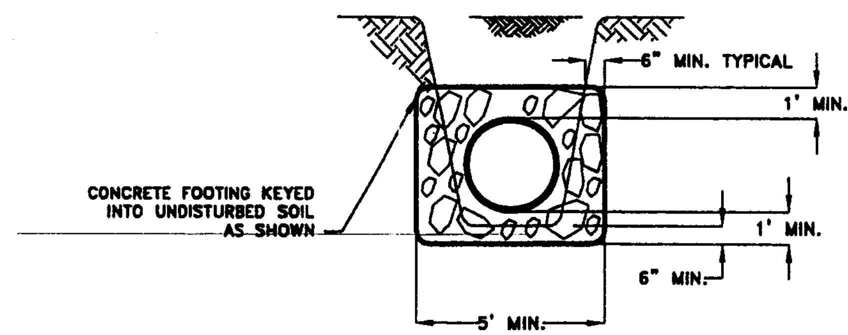
PLAN



ELEVATION

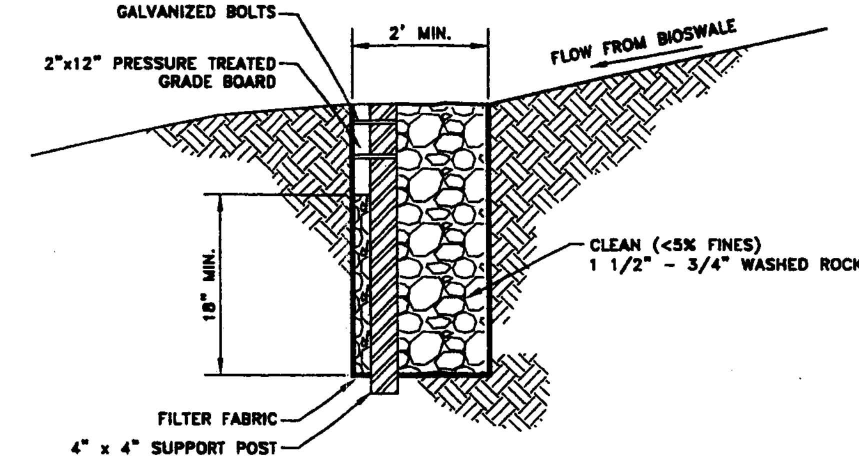
PLAN & ELEVATION (1/–)
PIPE OUTFALL PROTECTION
TYPICAL
SCALE: N.T.S.

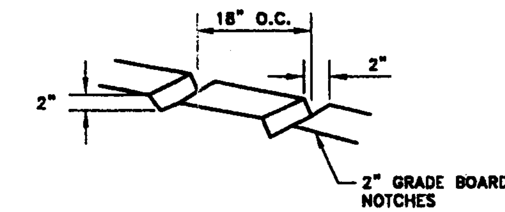




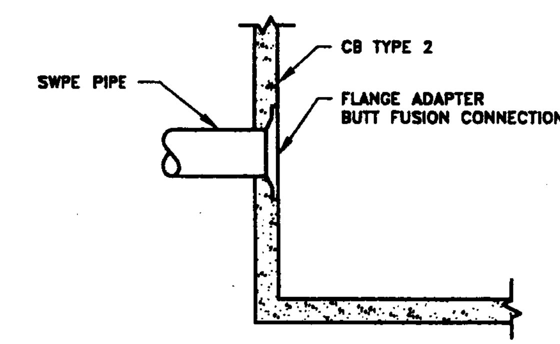
SECTION A-A

DETAIL (2/D18)
PIPE ANCHOR – TYPICAL
SCALE: N.T.S.





DETAIL (3/D1)
FLOW DISPERSAL TRENCH
SCALE: N.T.S.



DETAIL (4/D18)
FLANGE ADAPTER
SCALE: N.T.S.

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SHEET TITLE: DRAINAGE DETAILS

C3496
96-382
STIA-9806-D24

XREFS:

AR 011176

APPENDIX M

WATER QUALITY BMP COST ESTIMATES FOR AREAS DETERMINED TO BE NON-PRACTICABLE FOR RETROFITTING

ENGINEER'S ESTIMATE

Parametrix, Inc.	Job No. 556-2912-001-28	Date 6/8/00	Sheet 1 of 1
Project Title: SDE-4 WETVAULT			
Location: Seattle-Tacoma International Airport			
Owner: Port of Seattle			
Estimated By: P. McAvoy	Checked By: G. McDonald	Approved By:	

Item No.	Description	Estimated Quantity	Unit	Unit Price Mat. & Lab.	Estimated Amount
	SDE-4 VAULT				
1	MOBILIZATION (10 %)	LUMP SUM	L.S.	$405,830	$405,830
2	SDE-4 VAULT (454'x151'x8')	12.631	Acre Feet	$250,000	$3,157,750
3	SAW CUTTING ASPHALT CONC. PAVEMENT	300	L.F.	$5.00	$1,500
4	UTILITY ADJUSTMENT (STRUCTURES)	9	EACH	$5,000.00	$45,000
5	CONC. STORM DRAIN PIPE	200	L.F.	$50.00	$10,000
6	REMOVING CEM. CONC. PAVEMENT	0	C.Y.	$25.00	$0
7	REMOVING ASPH. CONC. PAVEMENT	555	S.Y.	$10.00	$5,550
8	REMOVE AND REPLACE SOD	1,820	C.Y.	$10.00	$18,200
9	STRUCTURE EXCAVATION	55,250	C.Y.	$10.00	$552,500
10	GRAVEL BACKFILL	8,000	C.Y.	$20.00	$160,000
11	CSBC -ROADWAY	175	TON	$20.00	$3,500
12	CSTC -ROADWAY	115	TON	$20.00	$2,300
13	APHALT CONC. PVMT.-ROADWAY	200	TON	$45.00	$9,000
14	LANDSCAPING(SOD)-ROADWAY	18,000	S.F.	$1.00	$18,000
15	TRAFFIC CONTROL/DETOURING-ROADWAY	LUMP SUM	L.S.	$75,000	$75,000
			Subtotal Items		$4,464,130
			Total Items		$4,464,130
			Sales Tax 8.4%)		$374,987
			Subtotal		$4,839,117
			Contingency (50%)		$2,419,558
	TOTAL				**$7,258,675**

ENGINEER'S ESTIMATE

Parametrix, Inc.	Job No. 556-2912-001-28	Date 6/8/00	Sheet 1 of 2
Project Title: SDS-3 WETVAULTS			
Location: Seattle-Tacoma International Airport			
Owner: Port of Seattle			
Estimated By: P. McAvoy	Checked By: G. McDonald	Approved By:	

Item No.	Description	Estimated Quantity	Unit	Unit Price Mat. & Lab.	Estimated Amount
	SDS-3 VAULT 1				
1	MOBILIZATION (10 %)	LUMP SUM	L.S.	$108,350	$108,350
2	SDS-3 VAULT 1 (217'x72'x8')	2.870	Acre Feet	$250,000	$717,500
3	SAW CUTTING CEMENT CONC. PAVEMENT	225	L.F.	$16.00	$3,600
4	UTILITY ADJUSTMENT (STRUCTURES)	2	EACH	$5,000.00	$10,000
5	REMOVING CEM. CONC. PAVEMENT	6300	S.F.	$12.00	$75,600
6	CONSTRUCT NEW TAXIWAY (16" TH CONC)	6300	S.F.	$15.00	$94,500
7	STRUCTURE EXCAVATION	11,800	C.Y.	$10.00	$118,000
8	GRAVEL BACKFILL	2,090	C.Y.	$20.00	$41,800
9	LANDSCAPING(SOD)	22,500	S.F.	$1.00	$22,500
			Subtotal Items		$1,191,850
	SDS-3 VAULT 2				
1	MOBILIZATION (10 %)	LUMP SUM	L.S.	$28,400	$28,400
2	SDS-3 VAULT 2 (109'x36'x8')	0.730	Acre Feet	$250,000	$182,500
3	SAW CUTTING CEMENT CONC. PAVEMENT	0	L.F.	$16.00	$0
4	UTILITY ADJUSTMENT (STRUCTURES)	2	EACH	$5,000.00	$10,000
5	CONC. STORM DRAIN PIPE	325	L.F.	$50.00	$16,250
6	REMOVING CEM. CONC. PAVEMENT	250	S.F.	$12.00	$3,000
7	CONSTRUCT NEW TAXIWAY (16" TH CONC)	250	S.F.	$15.00	$3,750
8	STRUCTURE EXCAVATION	4,900	C.Y.	$10.00	$49,000
9	GRAVEL BACKFILL	625	C.Y.	$20.00	$12,500
10	LANDSCAPING(SOD)	7,000	S.F.	$1.00	$7,000
			Subtotal Items		$312,400
	SDS-3 VAULT 3				
1	MOBILIZATION (10 %)	LUMP SUM	L.S.	$195,336	$195,336
2	SDS-3 VAULT 3 (230'x77'x8')	3.253	Acre Feet	$250,000	$813,250
3	SAW CUTTING CEMENT CONC. PAVEMENT	810	L.F.	$16.00	$12,960
4	UTILITY ADJUSTMENT (STRUCTURES)	1	EACH	$5,000.00	$5,000
5	CONC. STORM DRAIN PIPE	150	L.F.	$50.00	$7,500
6	REMOVING CEM. CONC. PAVEMENT	34,750	S.F.	$12.00	$417,000
7	CONSTRUCT NEW TAXIWAY (16" TH CONC)	34,750	S.F.	$15.00	$521,250
8	STRUCTURE EXCAVATION	12,840	C.Y.	$10.00	$128,400
9	GRAVEL BACKFILL	2,400	C.Y.	$20.00	$48,000
10	LANDSCAPING(SOD)	0	S.F.	$1.00	$0
			Subtotal Items		$2,148,696
	SDS-3 VAULT 4				
1	MOBILIZATION (10 %)	LUMP SUM	L.S.	$63,005	$63,005
2	SDS-3 VAULT 4 (166'x55'x8')	1.692	Acre Feet	$250,000	$423,000
3	SAW CUTTING CEMENT CONC. PAVEMENT (RUNWAY)	500	L.F.	$25.00	$12,500
4	UTILITY ADJUSTMENT (STRUCTURES)	2	EACH	$5,000.00	$10,000
5	CONC. STORM DRAIN PIPE	400	L.F.	$50.00	$20,000
6	REMOVING CEM. CONC. PAVEMENT (RUNWAY)	1,250	S.F.	$15.00	$18,750
7	CONSTRUCT NEW RUNWAY (24" TH CONC)	1,250	S.F.	$20.00	$25,000
8	STRUCTURE EXCAVATION	8,200	C.Y.	$10.00	$82,000
9	GRAVEL BACKFILL	1,290	C.Y.	$20.00	$25,800
10	LANDSCAPING(SOD)	13,000	S.F.	$1.00	$13,000
			Subtotal Items		$693,055

continued on next page

ENGINEER'S ESTIMATE

Parametrix, Inc.	Job No. 556-2912-001-28	Date 6/8/00	Sheet 2 of 2
Project Title: SDS-3 WETVAULTS			
Location: Seattle-Tacoma International Airport			
Owner: Port of Seattle			
Estimated By: P. McAvoy	Checked By: G. McDonald	Approved By:	

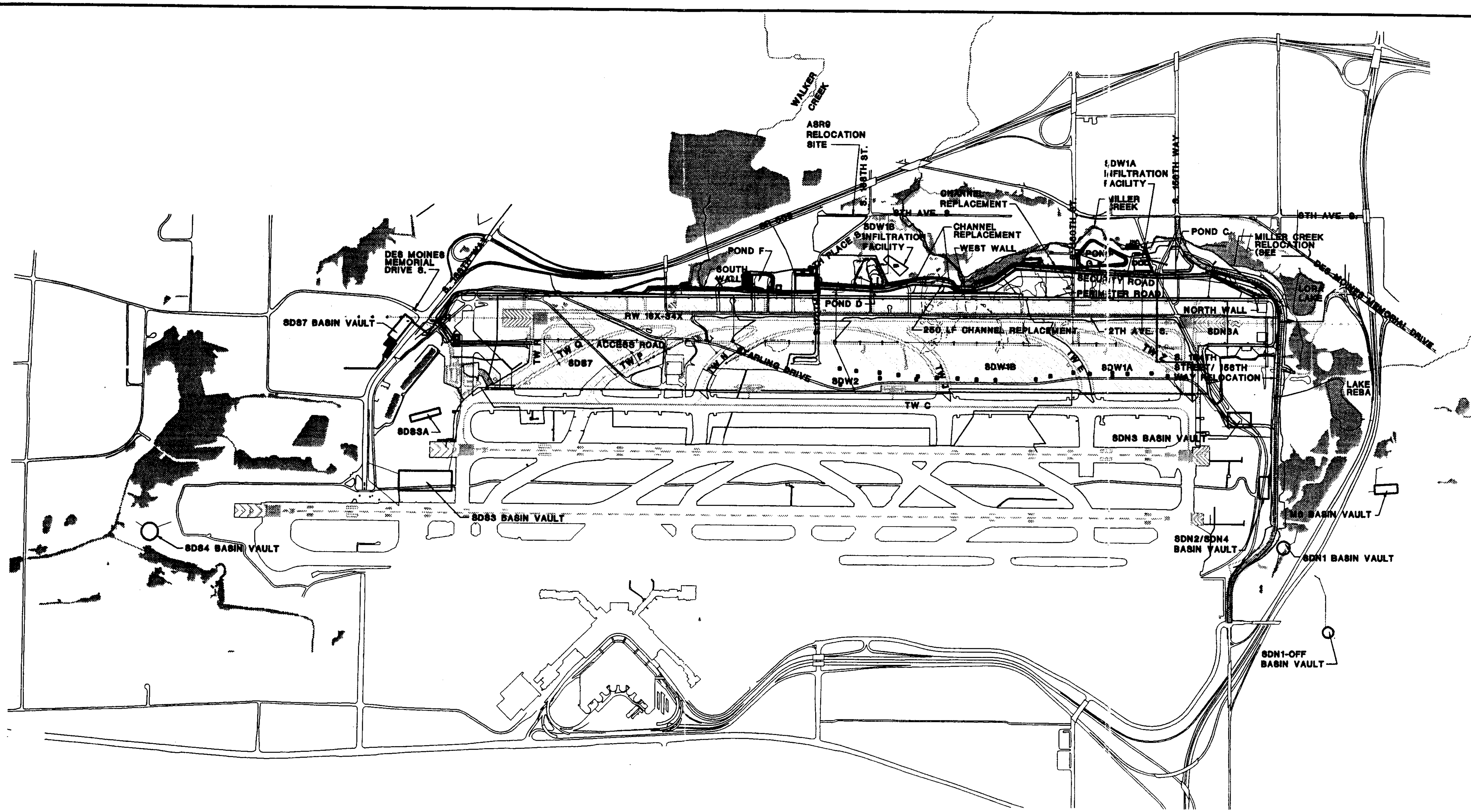
Item No.	Description	Estimated Quantity	Unit	Unit Price Mat. & Lab.	Estimated Amount
	10 INCH. DIA. CONC. STORM DRAIN PIPE				
1	MOBILIZATION (10 %)	LUMP SUM	L.S.	$23,218	$23,218
2	UTILITY ADJUSTMENT (STRUCTURES)	2	EACH	$5,000.00	$10,000
3	10 INCH. DIA. CONC. STORM DRAIN PIPE	2,580	L.F.	$30.00	$77,400
4	STRUCTURE EXCAVATION	1,500	C.Y.	$10.00	$15,000
5	GRAVEL BACKFILL FOR DRAIN	1,500	C.Y.	$25.00	$37,500
6	LANDSCAPING(REMOVE & REPLACE SOD)	10,450	S.F.	$1.00	$10,450
7	SAW CUTTING CEMENT CONC. PAVEMENT	980	L.F.	$16.00	$15,680
8	REMOVING CEM. CONC. PAVEMENT	2,450	S.F.	$12.00	$29,400
9	CONSTRUCT NEW TAXIWAY (16" TH CONC)	2,450	S.F.	$15.00	$36,750
		Subtotal Items			$255,398
	18 INCH. DIA. CONC. STORM DRAIN PIPE				
1	MOBILIZATION (10 %)	LUMP SUM	L.S.	$11,224.50	$11,225
2	UTILITY ADJUSTMENT (STRUCTURES)	2	EACH	$5,000.00	$10,000
3	18 INCH. DIA. CONC. STORM DRAIN PIPE	575	L.F.	$40.00	$23,000
4	STRUCTURE EXCAVATION	320	C.Y.	$10.00	$3,200
5	GRAVEL BACKFILL FOR DRAIN	320	C.Y.	$25.00	$8,000
6	LANDSCAPING(REMOVE & REPLACE SOD)	1,150	S.F.	$1.00	$1,150
7	SAW CUTTING CEMENT CONC. PAVEMENT (TAXIWAY)	370	L.F.	$16.00	$5,920
8	SAW CUTTING CEMENT CONC. PAVEMENT (RUNWAY)	320	L.F.	$25.00	$8,000
9	REMOVING CEM. CONC. PAVEMENT (TAXIWAY)	925	S.F.	$12.00	$11,100
10	REMOVING CEM. CONC. PAVEMENT (RUNWAY)	800	S.F.	$15.00	$12,000
11	CONSTRUCT NEW TAXIWAY (16" TH CONC)	925	S.F.	$15.00	$13,875
12	CONSTRUCT NEW RUNWAY (24" TH CONC)	800	S.F.	$20.00	$16,000
		Subtotal Items			$123,470
			Total Items		$4,724,869
		Sales Tax 8.4%)			$396,889
			Subtotal		$5,121,757
		Contingency (50%)			$2,560,879
	TOTAL				**$7,682,636**

APPENDIX Q

PROPOSED STORMWATER CONVEYANCE FIGURES

GRADING AND DRAINAGE PLAN

Plan Ref. No.	Sheet Title
C109	GRADING AND DRAINAGE LAYOUT
C110	GRADING AND DRAINAGE PLAN
C111	GRADING AND DRAINAGE PLAN
C112	GRADING AND DRAINAGE PLAN
C113	GRADING AND DRAINAGE PLAN
C114	GRADING AND DRAINAGE PLAN
C115	GRADING AND DRAINAGE PLAN
C116	GRADING AND DRAINAGE PLAN
C117	GRADING AND DRAINAGE PLAN
C118	GRADING AND DRAINAGE PLAN
C119	GRADING AND DRAINAGE PLAN
C120	GRADING AND DRAINAGE PLAN
C121	GRADING AND DRAINAGE PLAN
C122	GRADING AND DRAINAGE PLAN
C123	GRADING AND DRAINAGE PLAN
C124	GRADING AND DRAINAGE PLAN
C125	GRADING AND DRAINAGE PLAN
C126	GRADING AND DRAINAGE PLAN
C127	GRADING AND DRAINAGE PLAN
C128	GRADING AND DRAINAGE PLAN
C129	GRADING AND DRAINAGE PLAN
C130	GRADING AND DRAINAGE PLAN



PLAN
GRADING AND DRAINAGE LAYOUT
1" = 600'

AR 011183

600' 0 600' 1200'
SCALE: 1"=600'

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

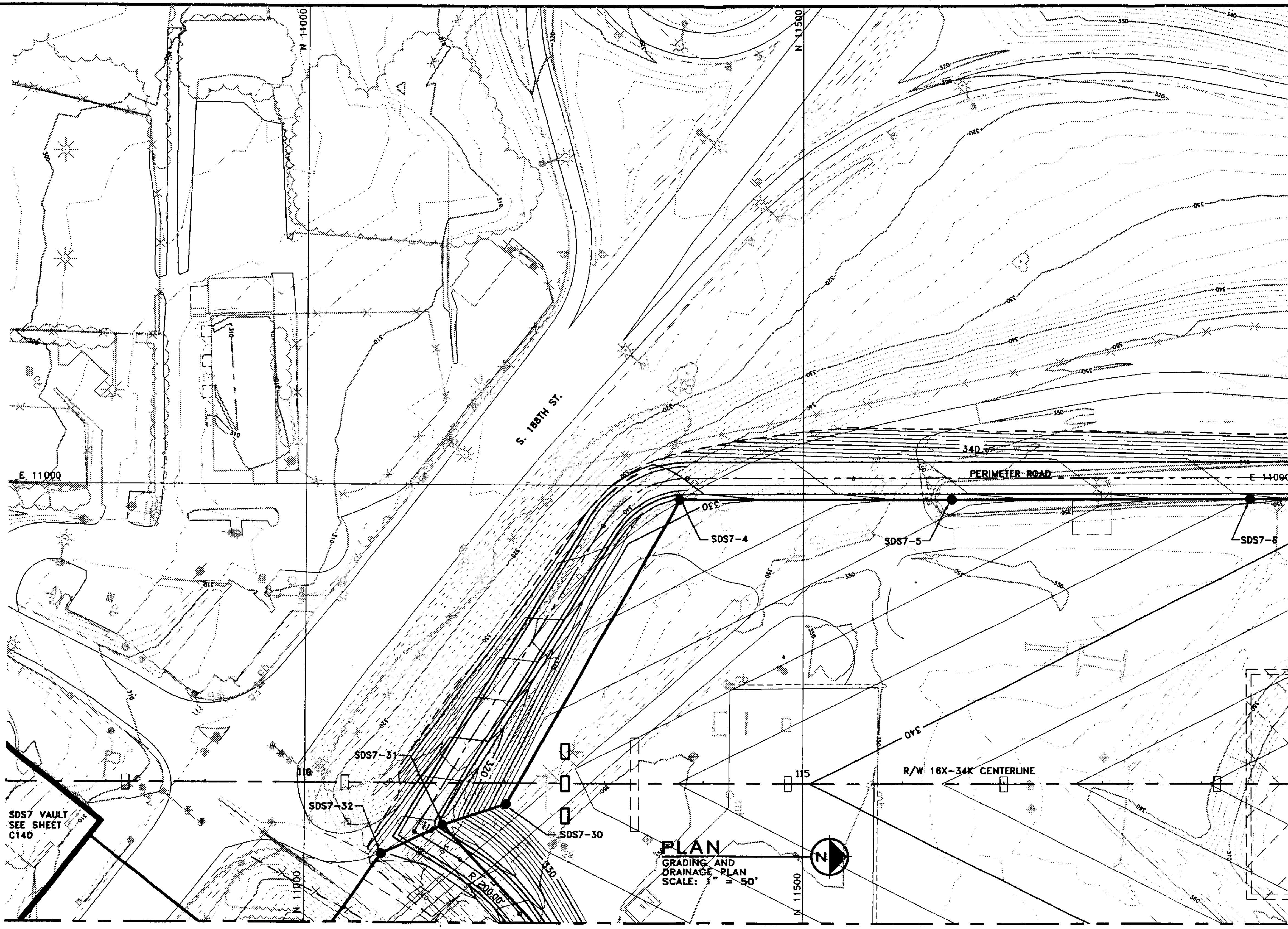
SHEET TITLE: GRADING AND DRAINAGE LAYOUT

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C109



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

SCALE: 1"=50'

KEY PLAN

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

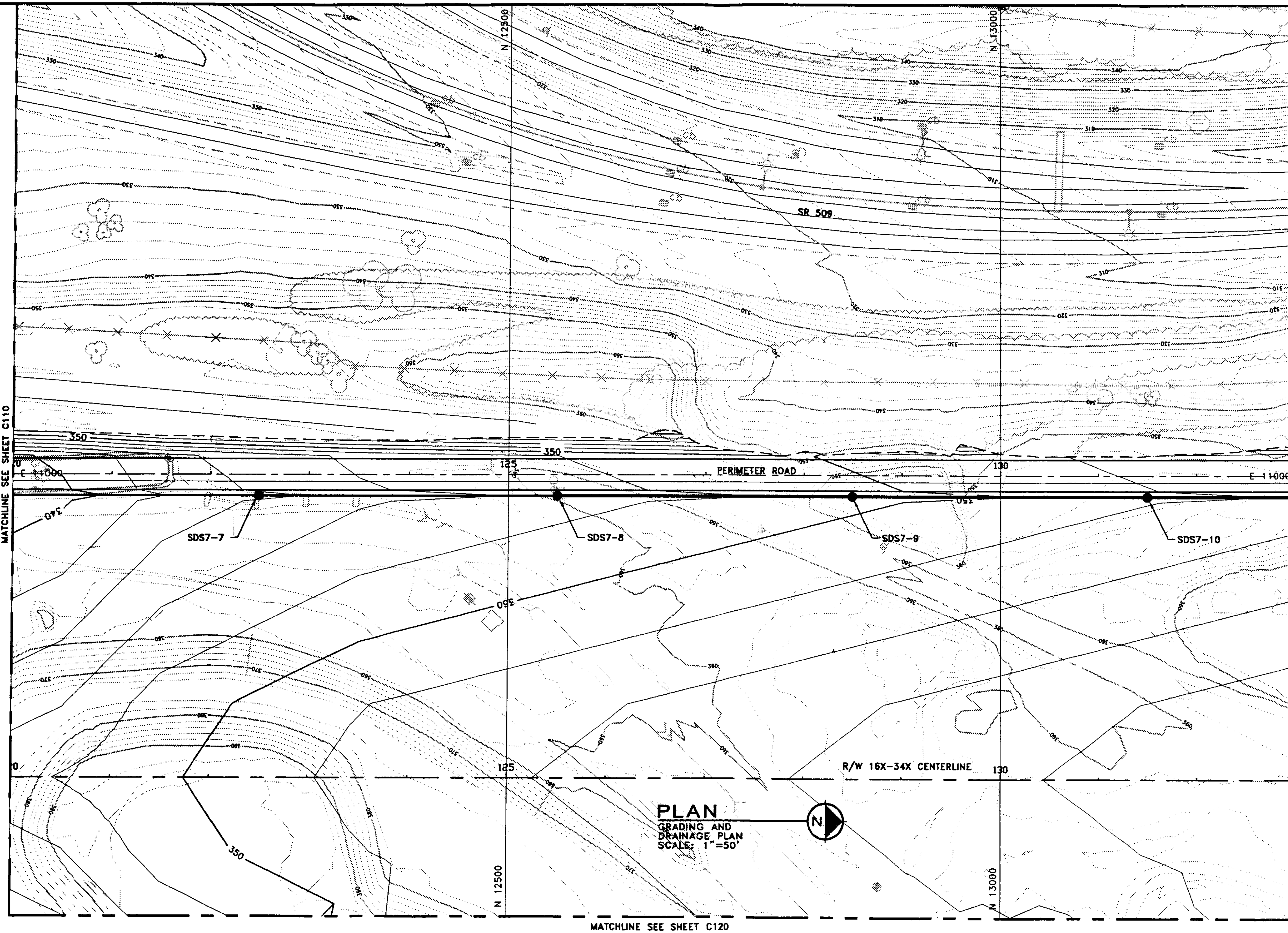
DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C110

AR 011184



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

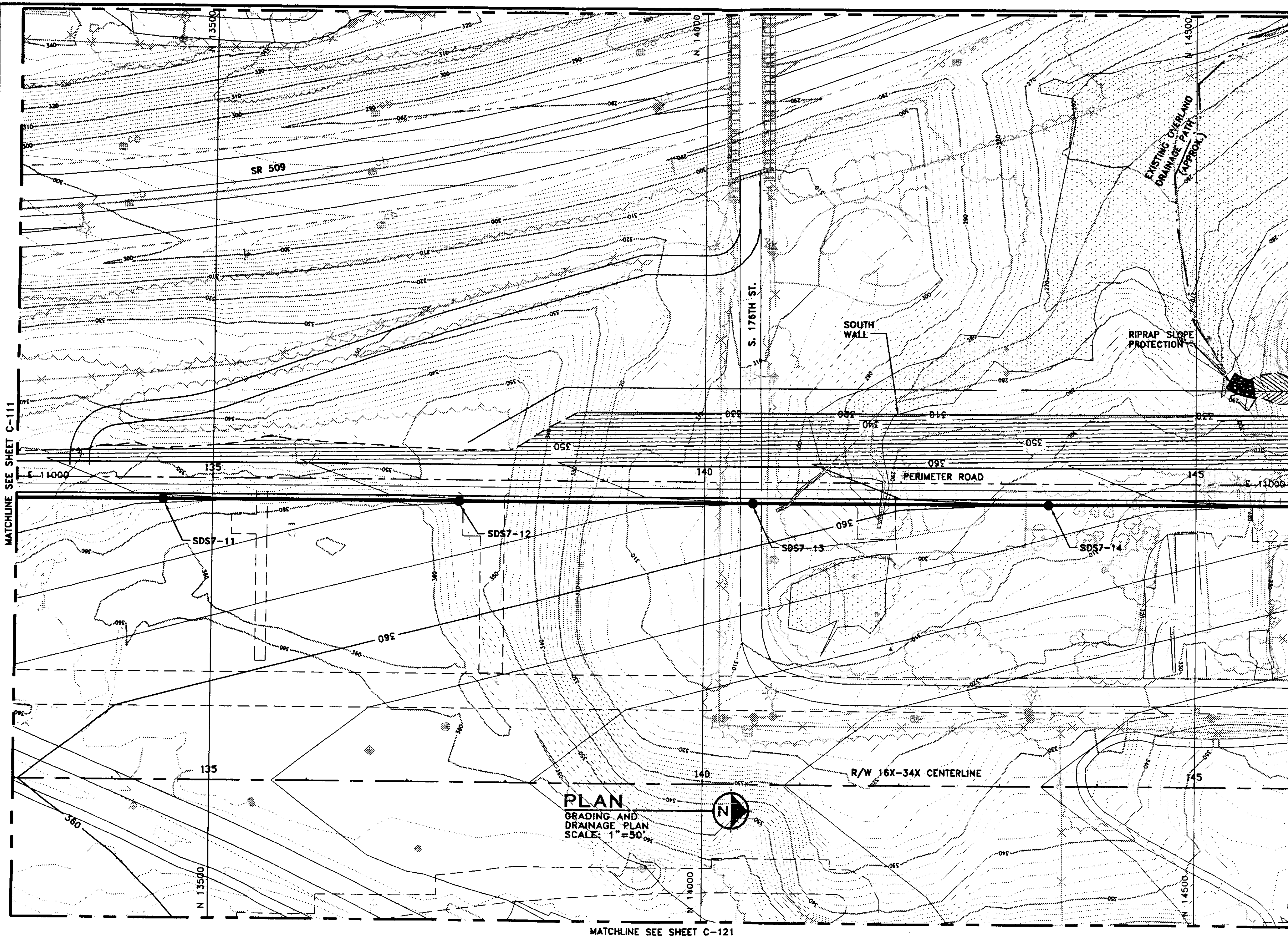
DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C111

AR 011185



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

50' 0 50' 100'
SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

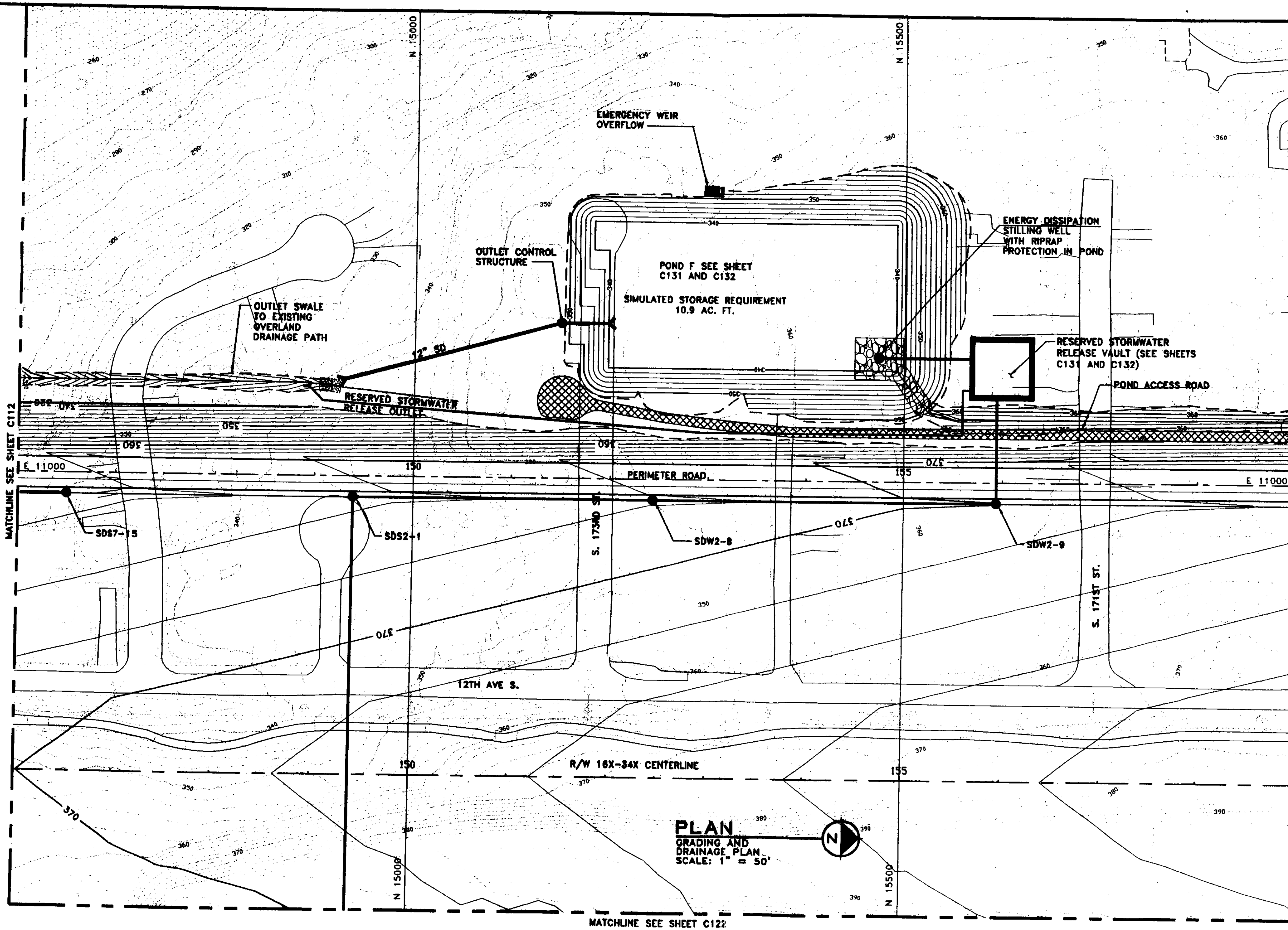
SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO. EXHIBIT_ C112

AR 011186



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011187

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

July 2001
556-2912-001 (28)

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

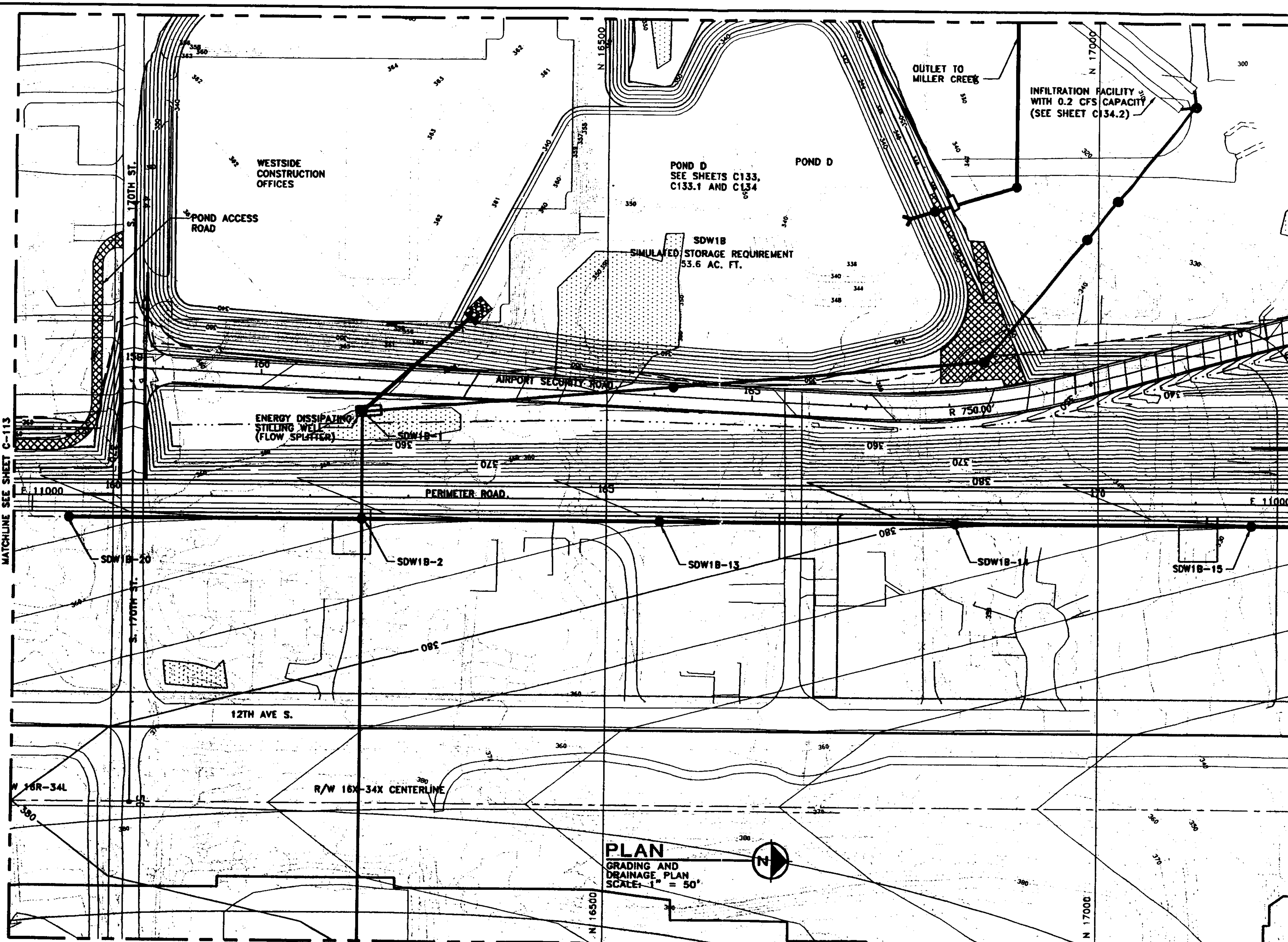
SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: MAY 10, 2001

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C113



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011188

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

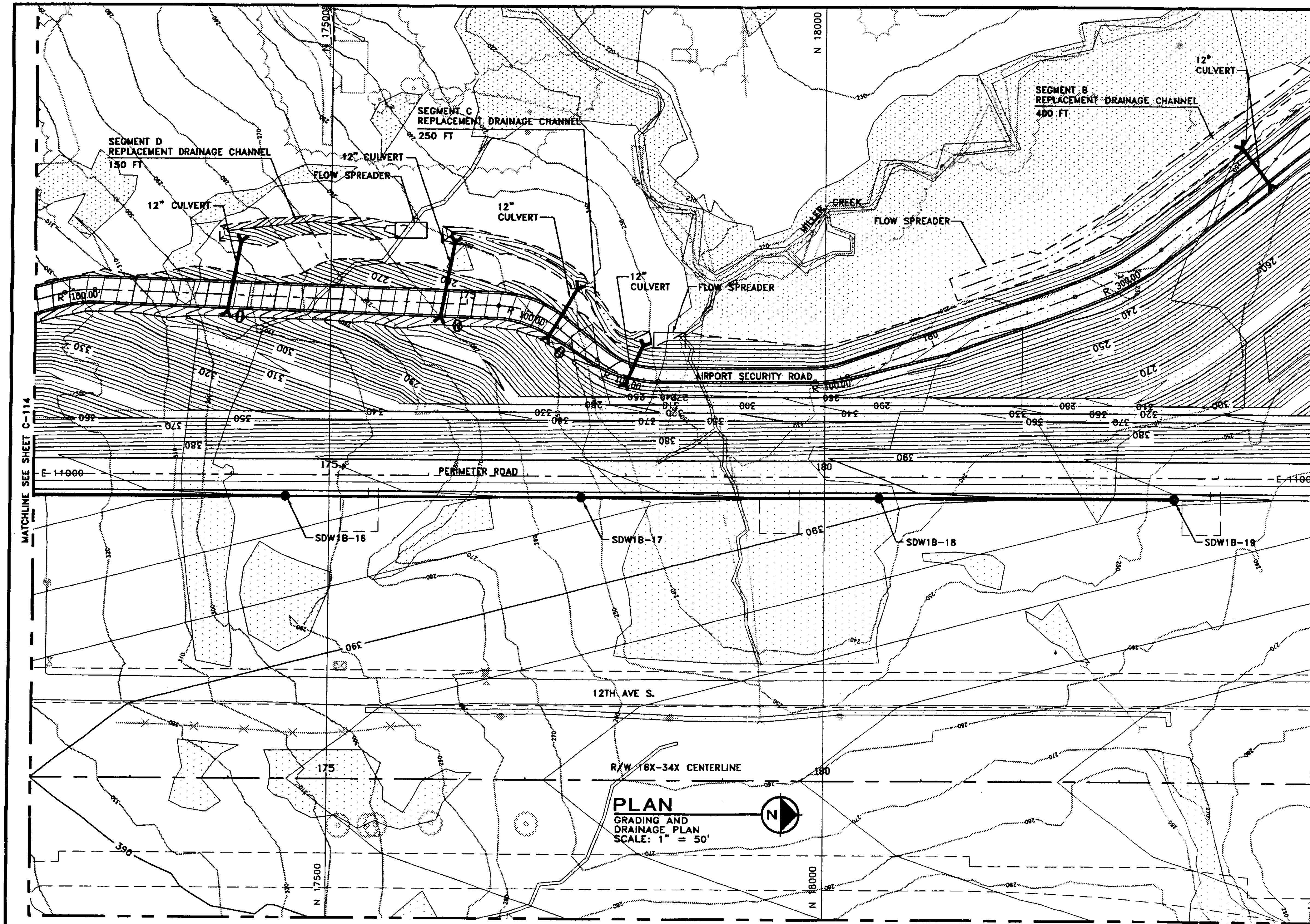
SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: JUNE 28, 2001

CONSULTANT'S NO.

PORT OF SEATTLE NO. EXHIBIT_ C114

July 2001
556-2912-001 (28)



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011189

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

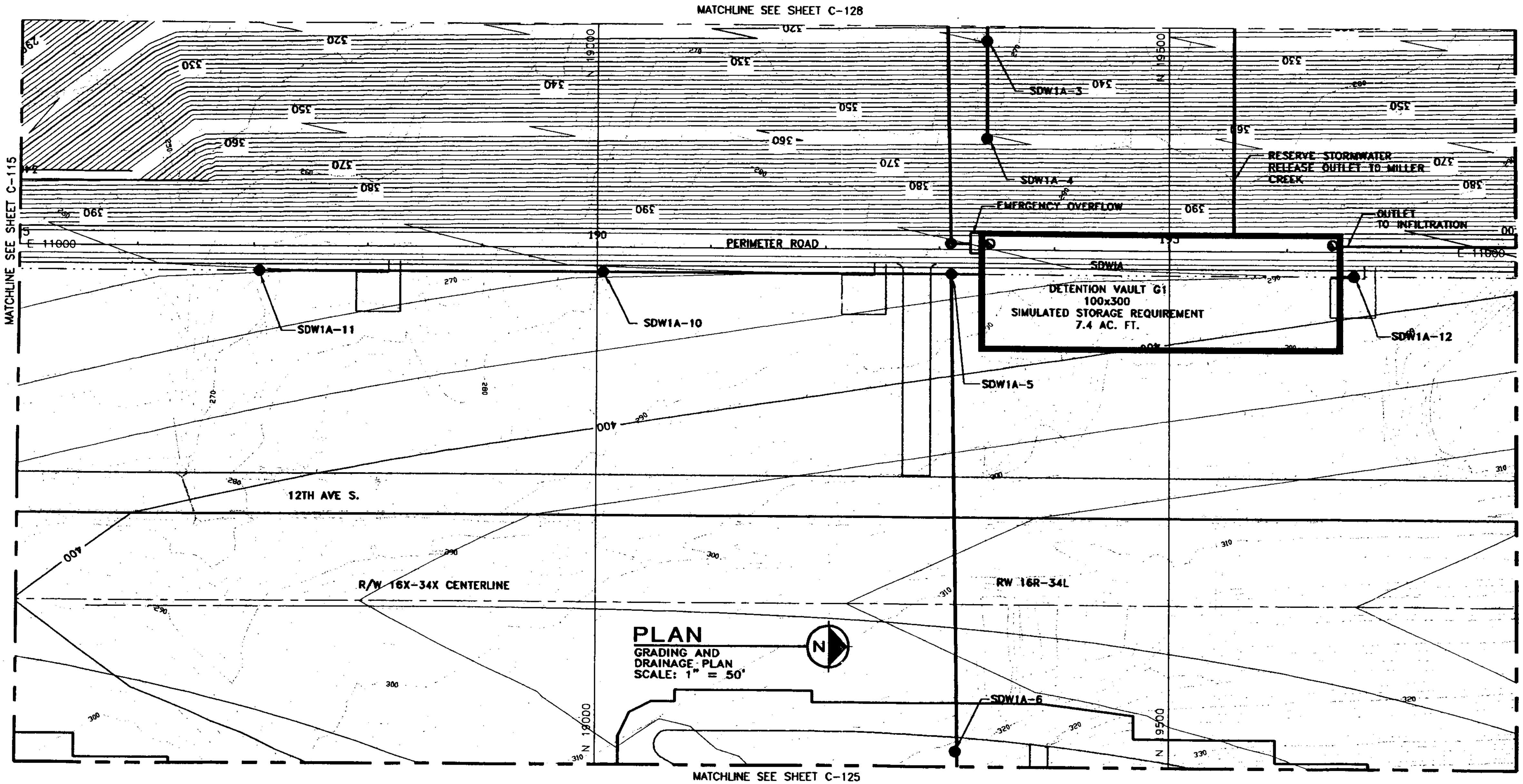
DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C115

NOTES:



LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011190

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

July 2001
556-2912-001 (28)

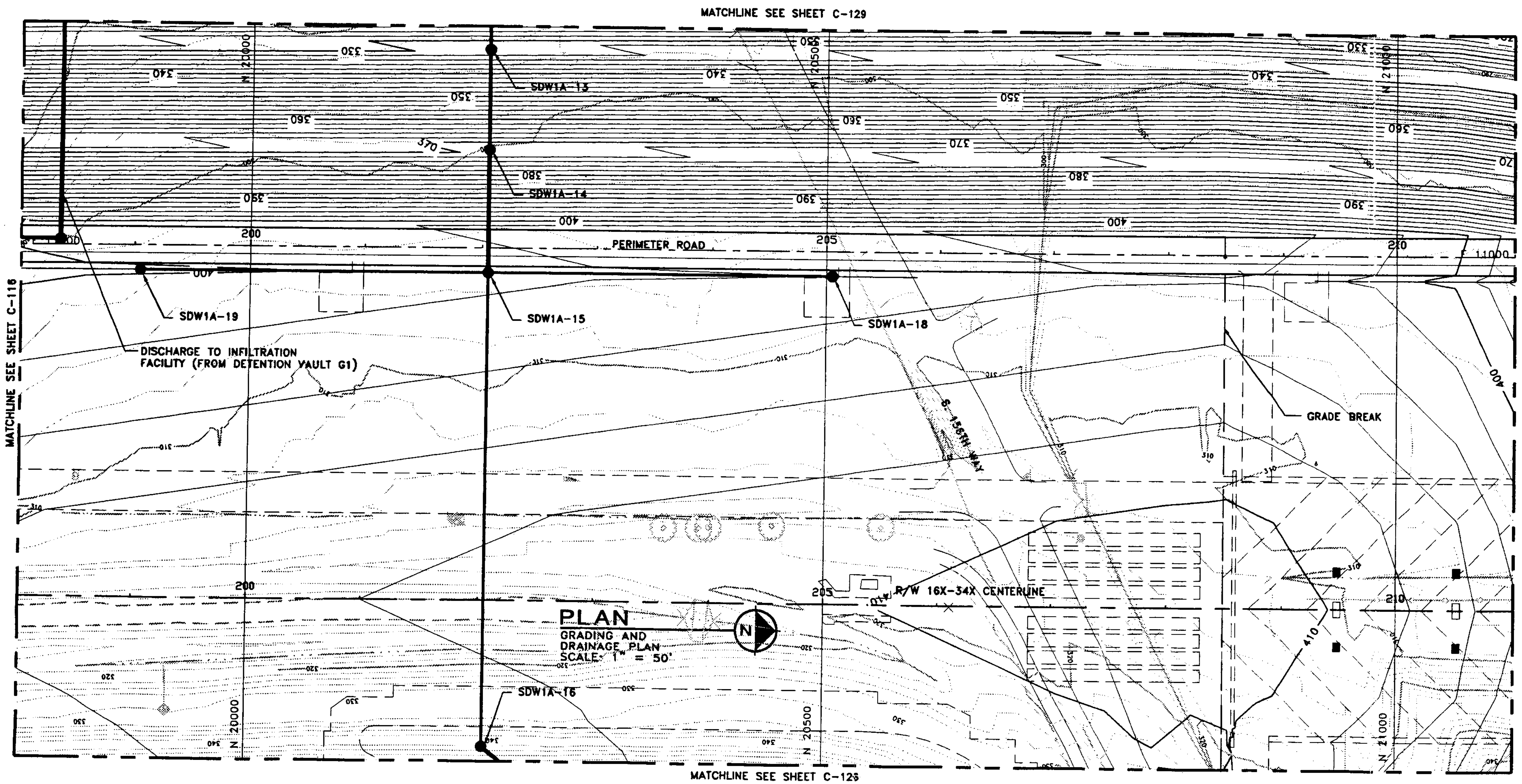
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: JUNE 28, 2001

EXHIBIT_ C116



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011191

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

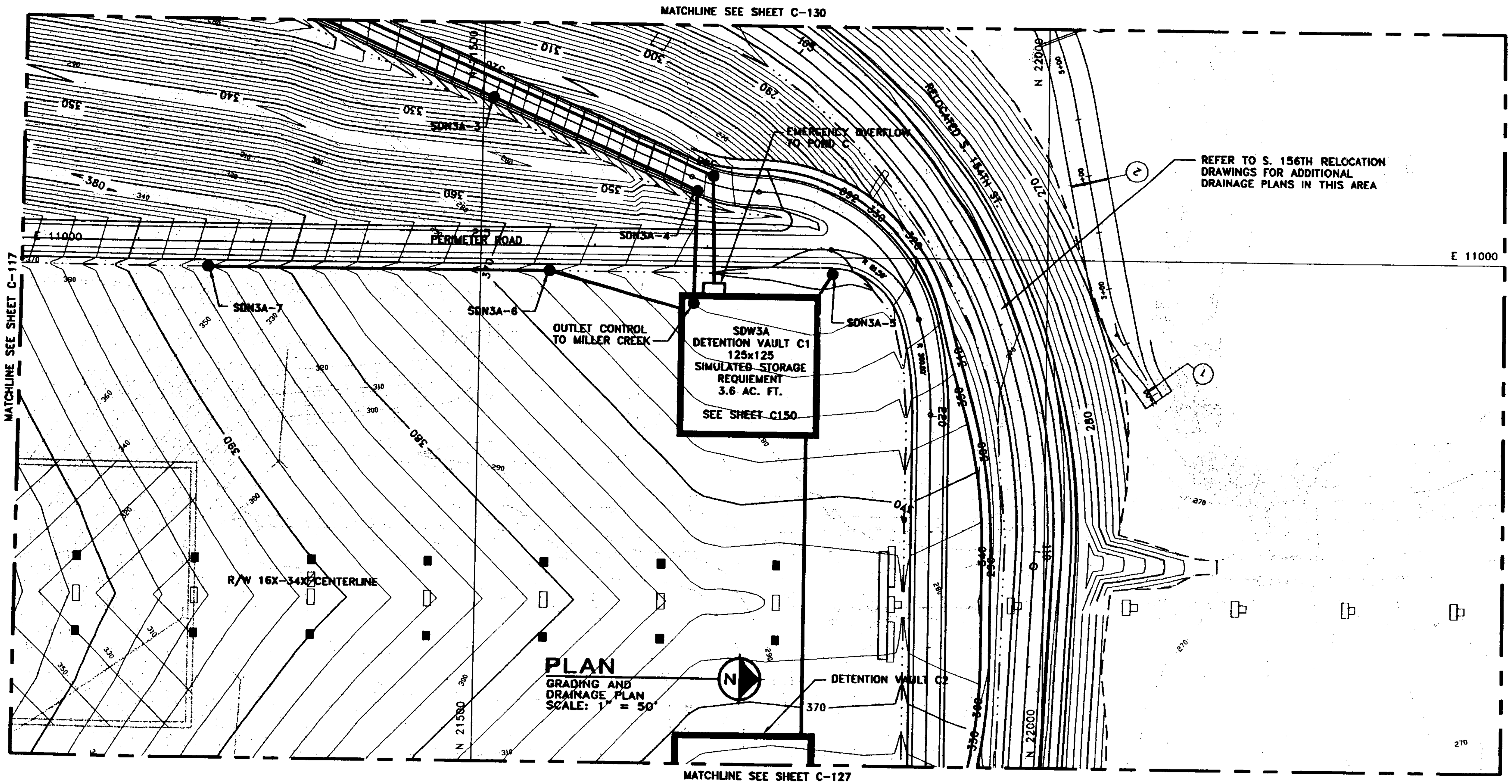
DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C117

NOTES:



LEGEND:

(solid line)	STORM DRAIN PIPE
(dashed box)	WETLANDS

AR 011192

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

July 2001
556-2912-001 (28)

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: **GRADING AND DRAINAGE PLAN**

DATE: JUNE 11, 2001

EXHIBIT_ C118

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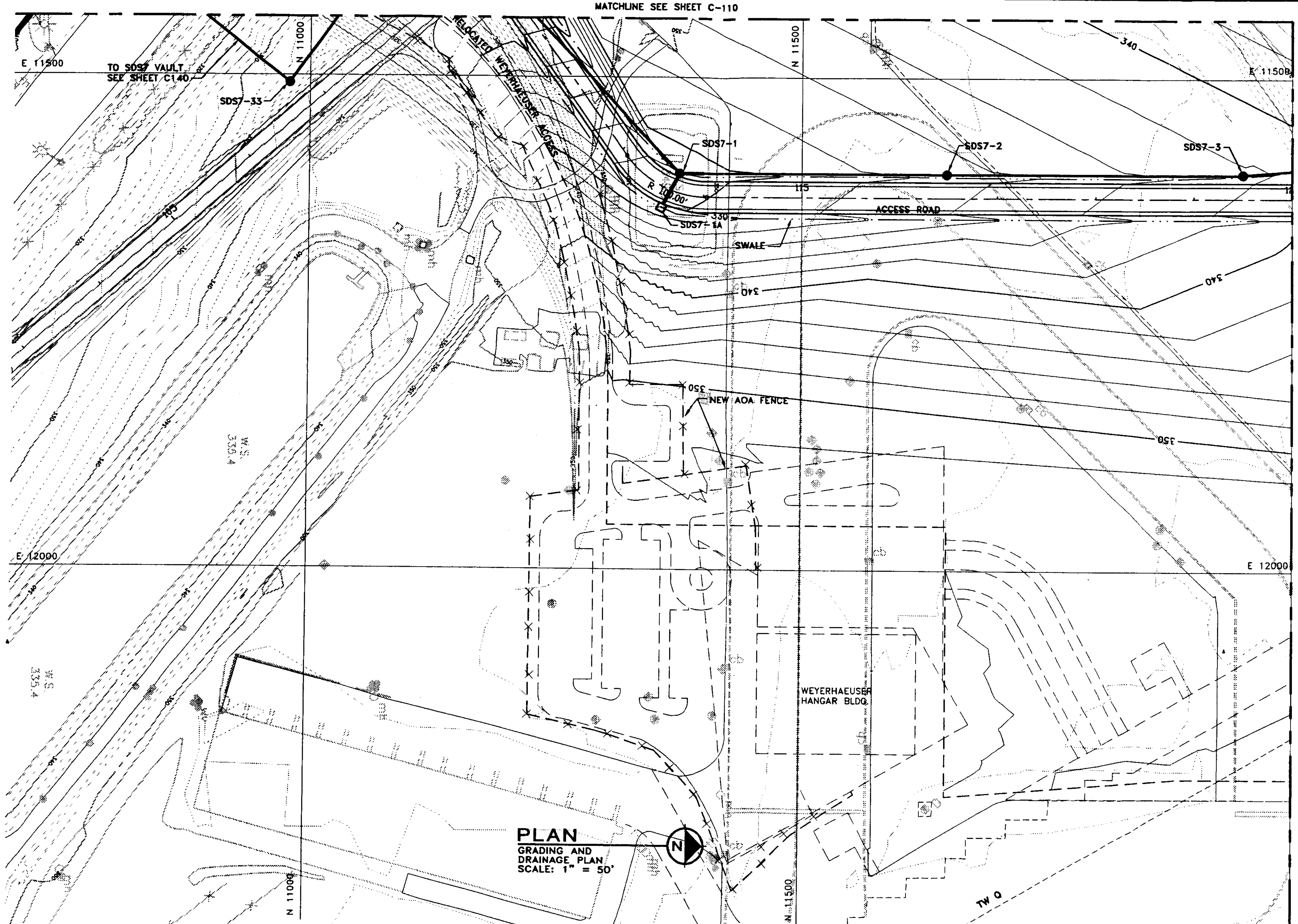


NOTES:

LEGEND:

- STORM DRAIN PIPE
- WETLANDS

AR 011193

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

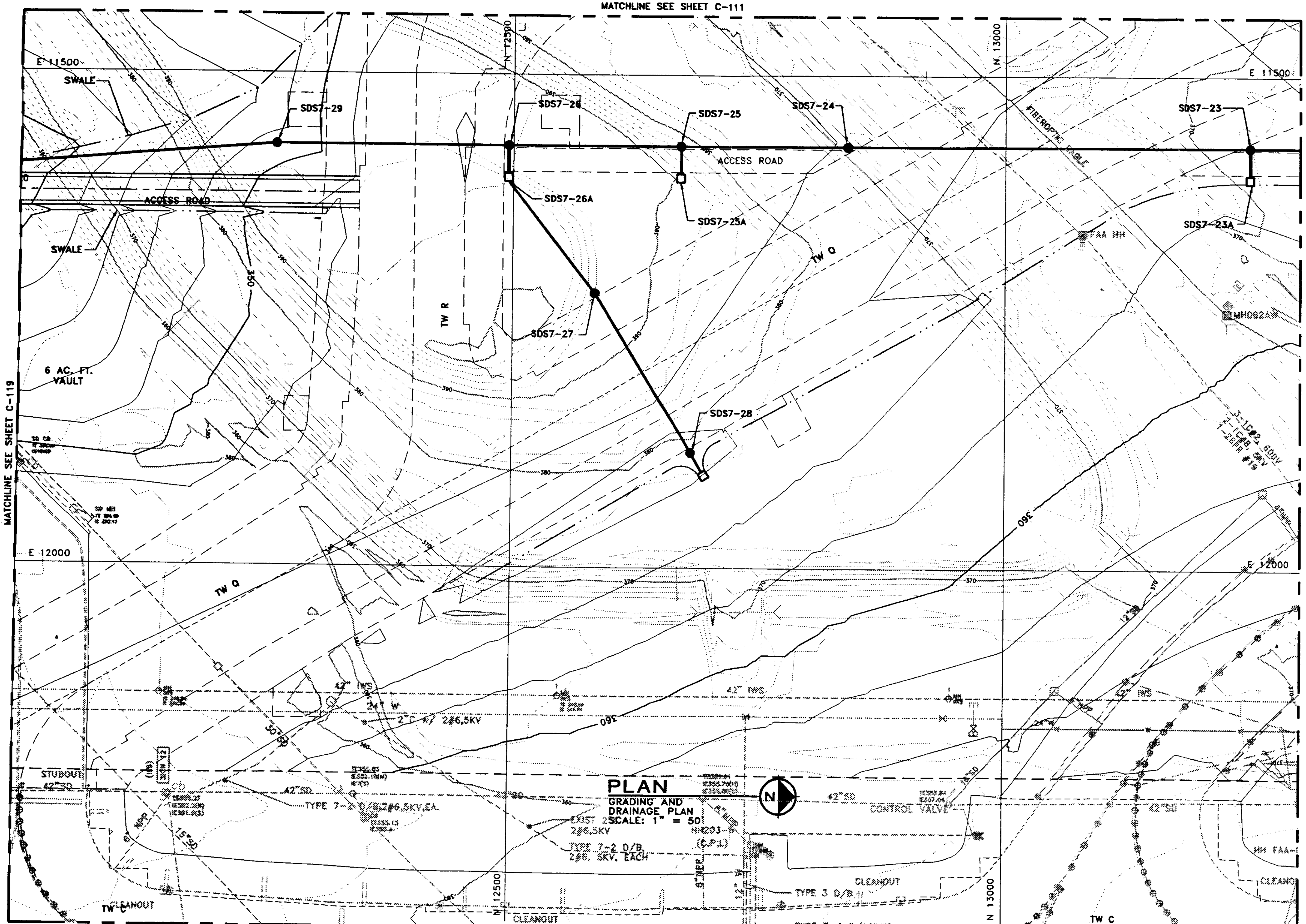
SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C119



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011194

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

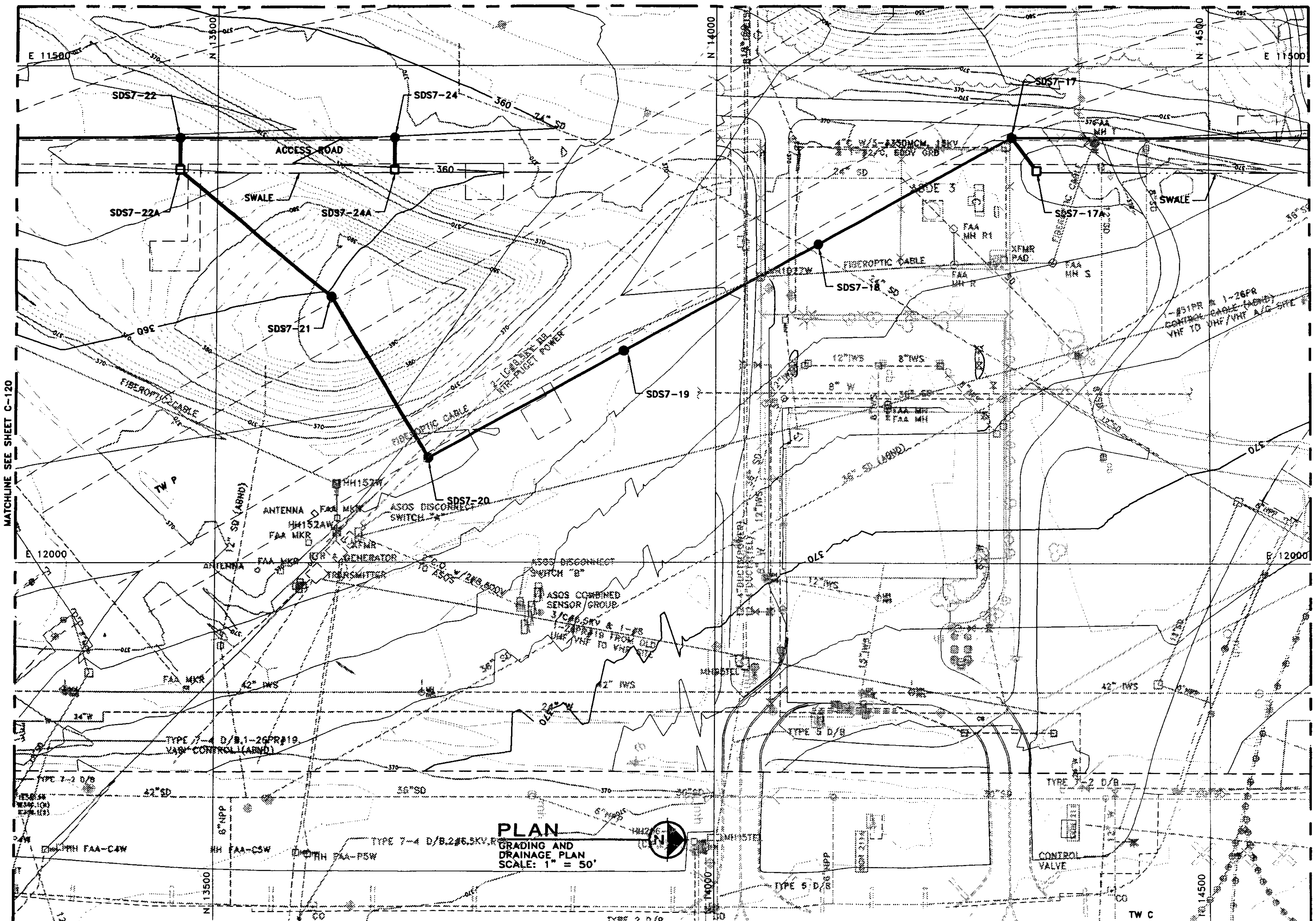
SHEET TITLE: **GRADING AND DRAINAGE PLAN**

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C120



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011195

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

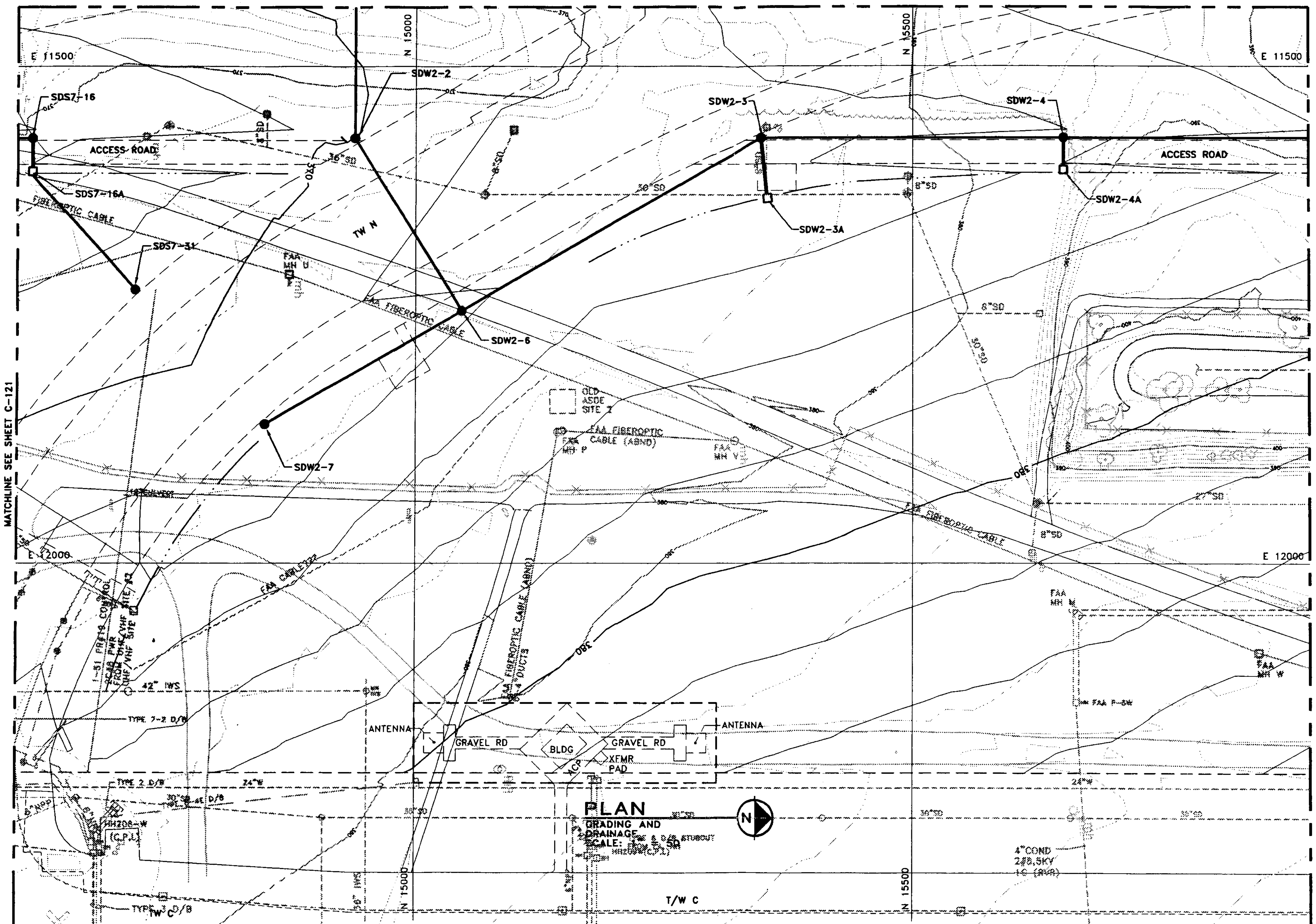
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.: EXHIBIT_ C121



LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011196

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

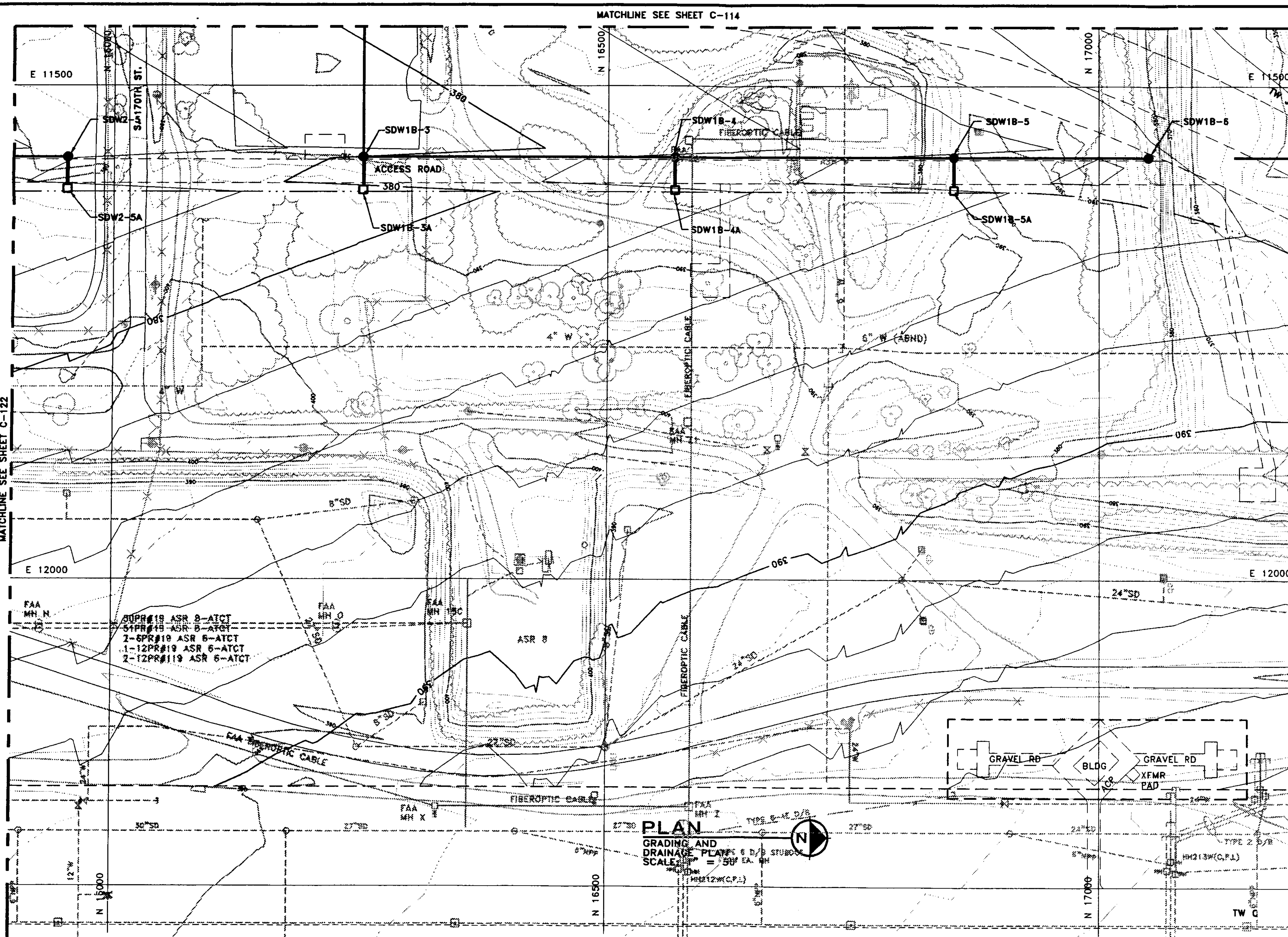
SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C122



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

50' 0 50' 100'
SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

AR 011197

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C123

NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011198

50' 0 50' 100'
SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

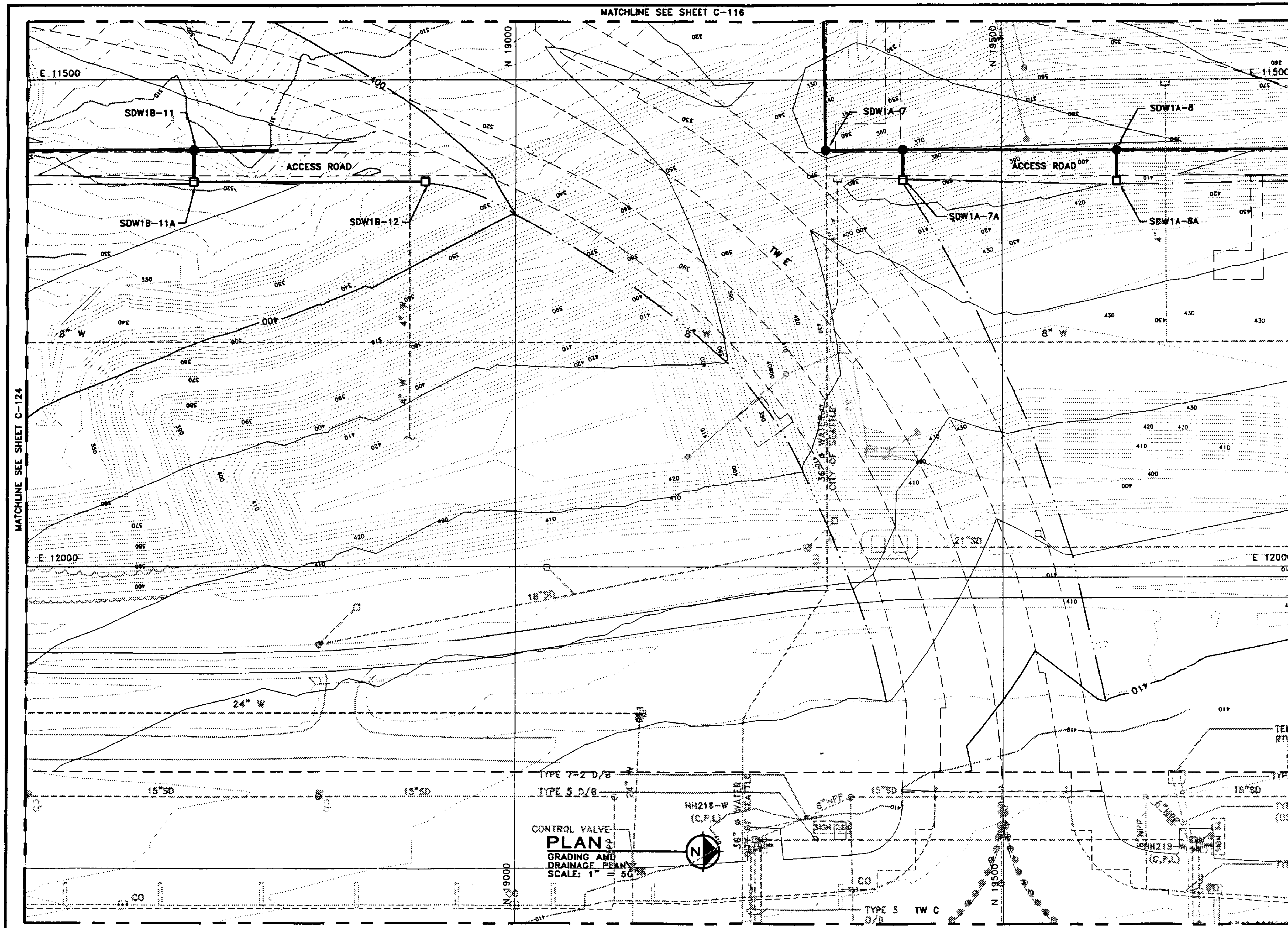
SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C124



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011199

50' 0 50' 100'
SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

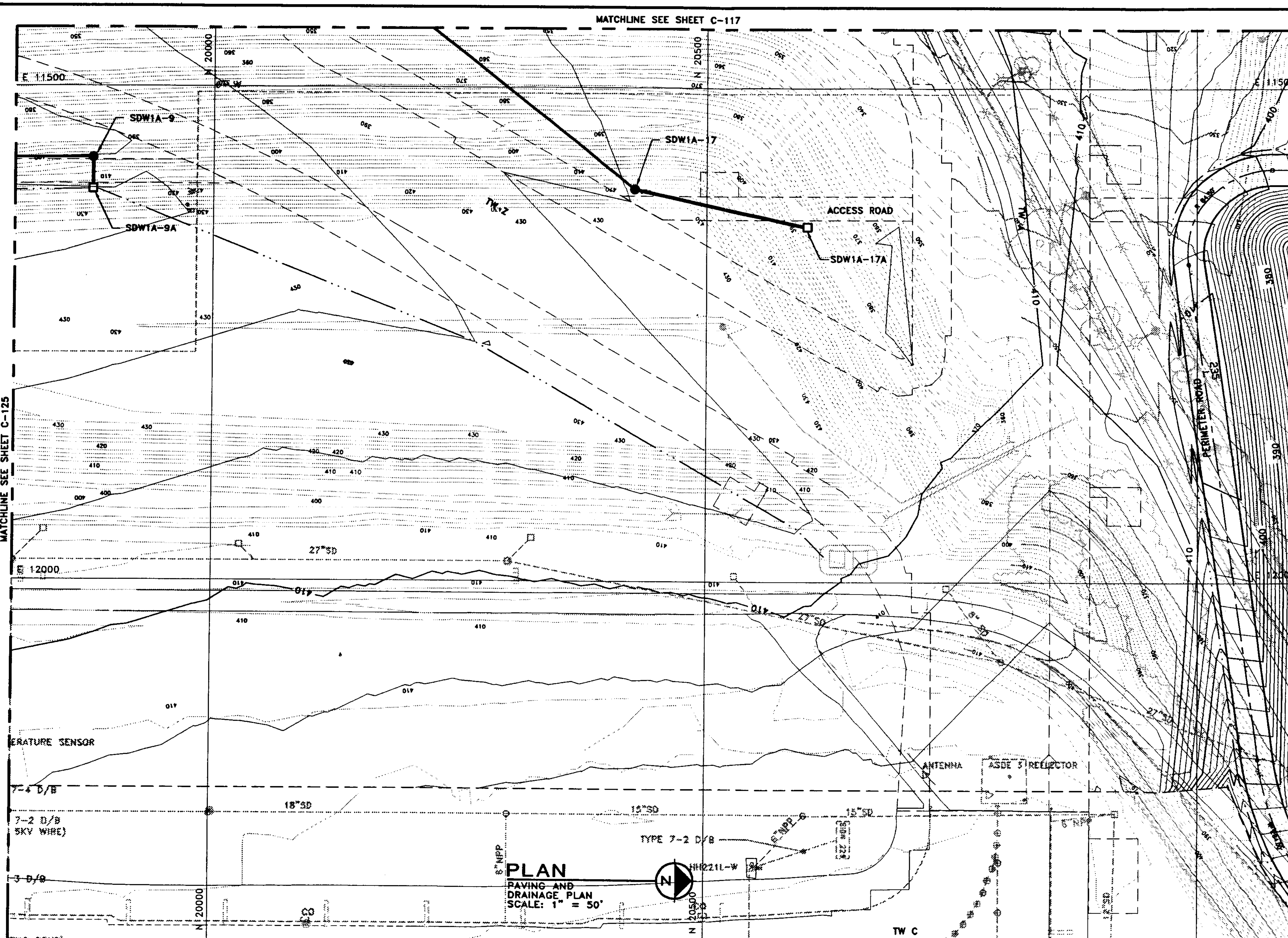
SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C125



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011200

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

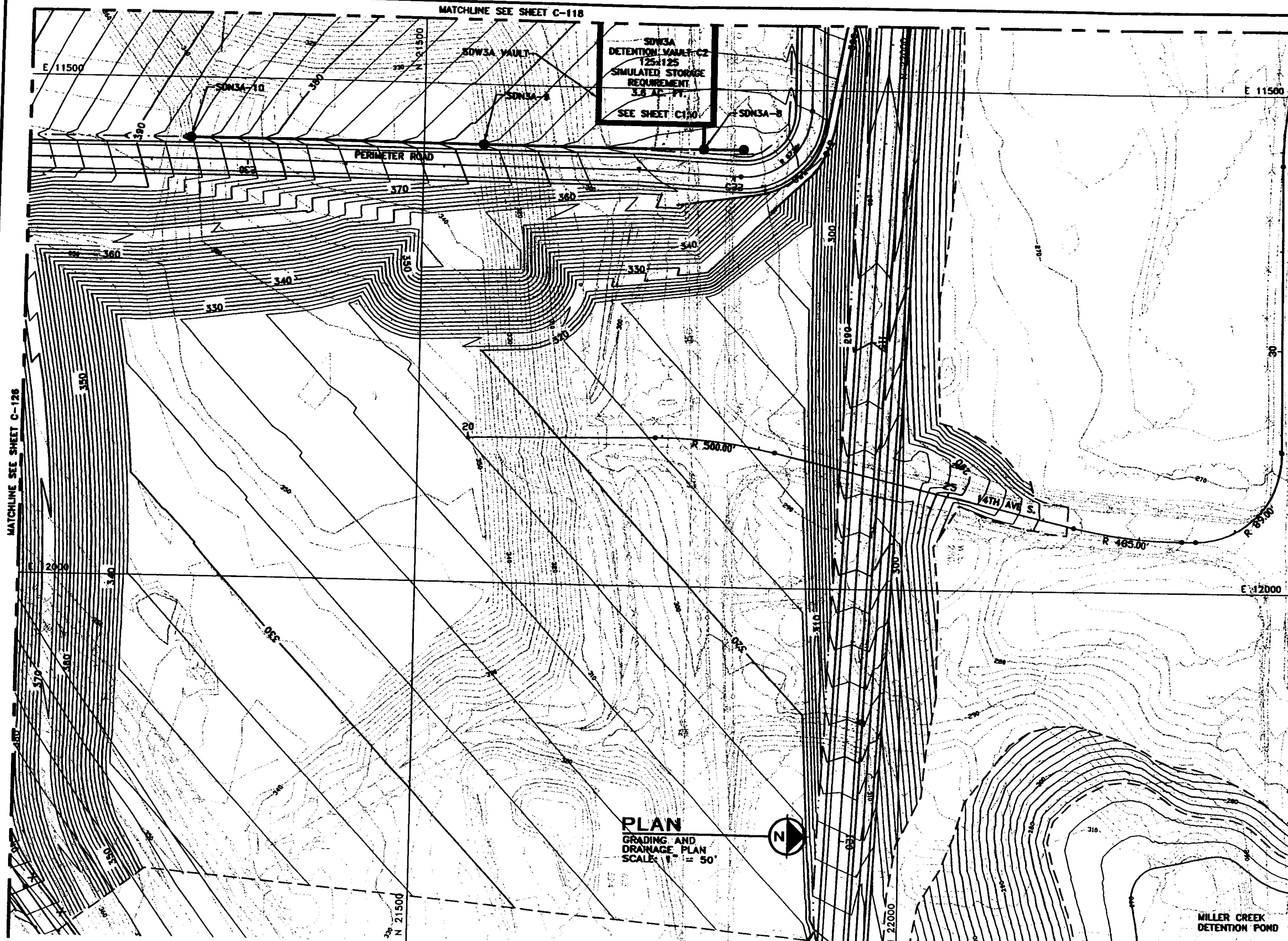
SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: DEC. 15, 2000

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C126



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011201

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

July 2001
556-2912-001 (28)

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

JUNE 11, 2001

EXHIBIT_ C127

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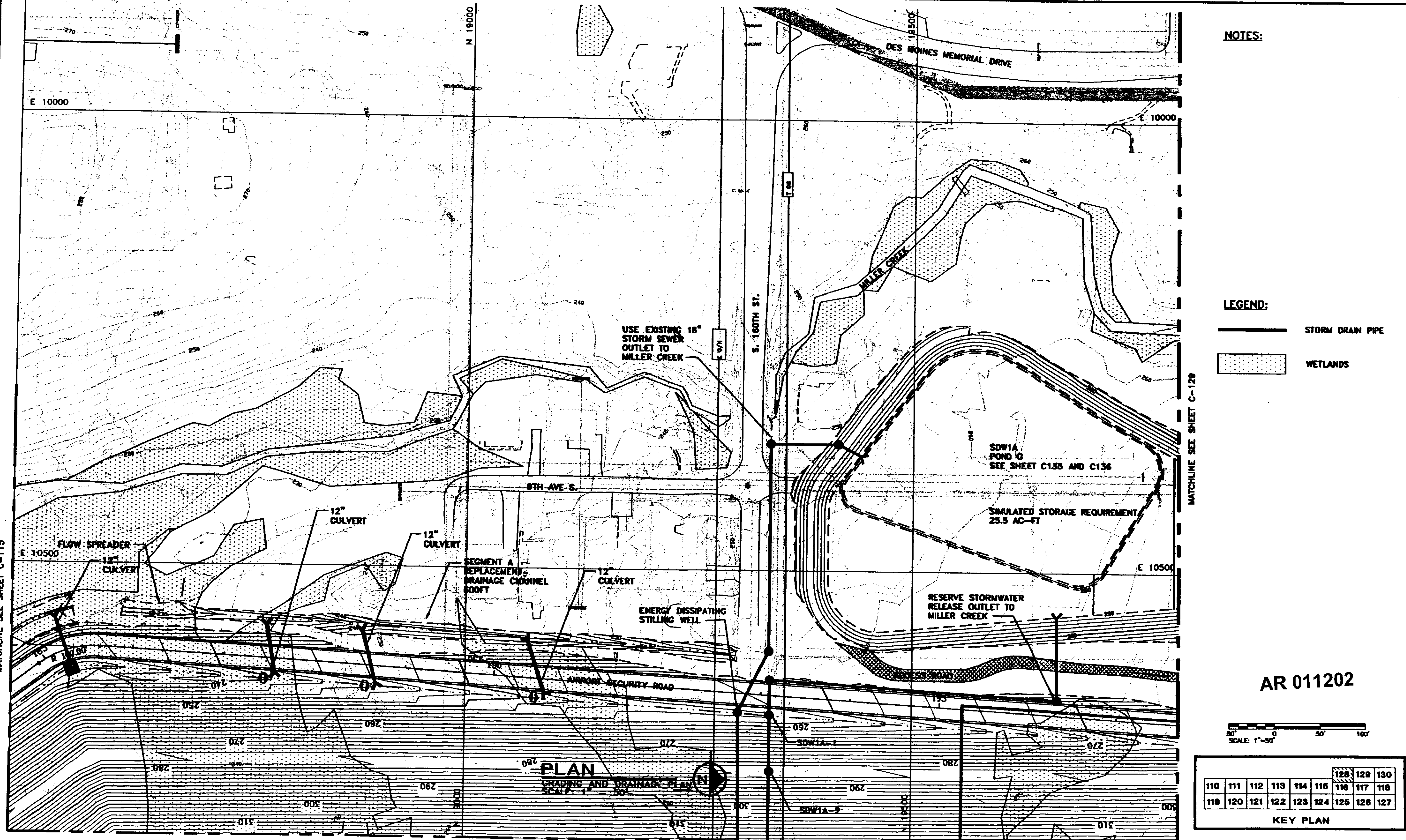


AR 011202

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

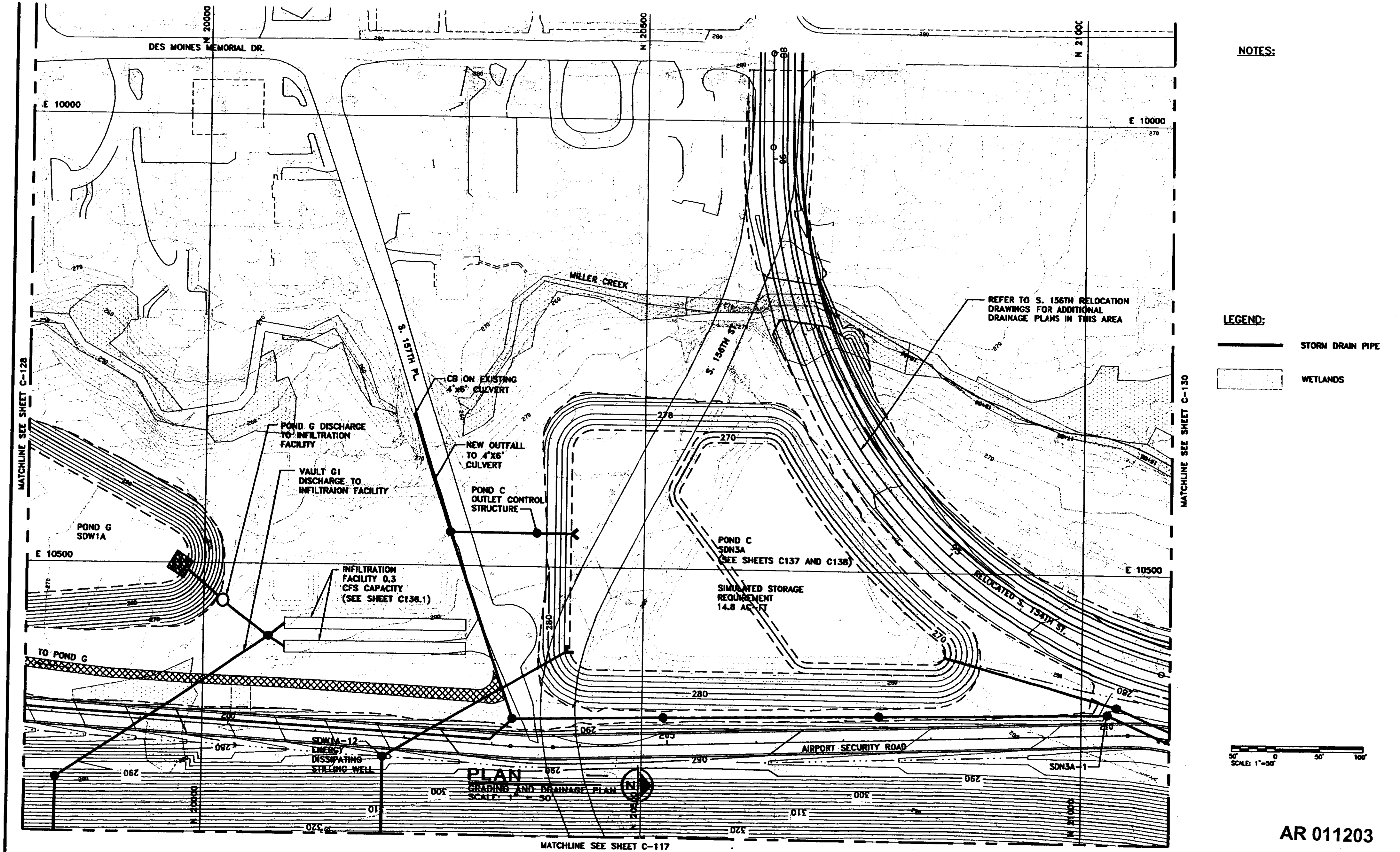
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

JUNE 28, 2001

EXHIBIT_ C128

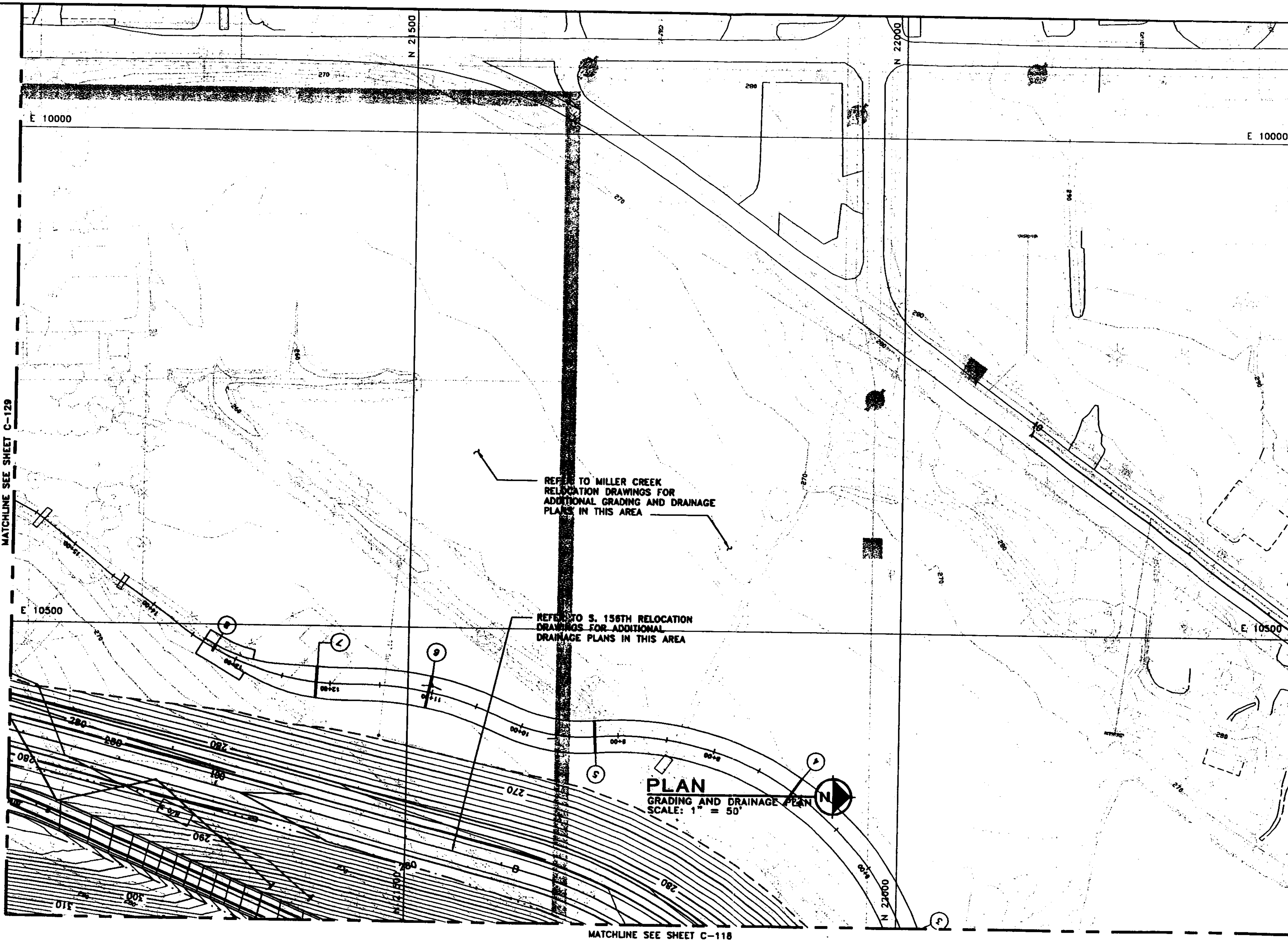
July 2001
556-2912-001 (28)



AR 011203

July 2001
556-2912-001 (28)

Port of Seattle SEA-TAC INTERNATIONAL AIRPORT	DATE: JUNE 11, 2001
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6	CONSULTANT'S NO.
SHEET TITLE: GRADING AND DRAINAGE PLAN	PORT OF SEATTLE NO. EXHIBIT_ C129



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

50' 0 50' 100'
SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

July 2001
556-2912-001 (28)

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

SHEET TITLE: **GRADING AND DRAINAGE PLAN**

DATE: JUNE 11, 2001

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C130

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AR 011204

APPENDIX W

ENERGY DISSIPATION DESIGN CRITERIA AND PARAMETERS

Seattle Tacoma International Airport
Third Dependent Runway
Energy Dissipation

Design Criteria and Parameters

Background and History

The subject of energy dissipation at the bottom of slopes is a very important issue for the Port of Seattle for both the long-term stability and maintenance of the embankment and for protection of the adjacent natural resources. Erosion at the toe of the slope will be avoided through a design approach that is based on national and regional experience with these facilities.

The design has been developed following the guidelines in the U.S. Department of Transportation, Federal Highway Administration, Hydraulic Engineering Circular No 14 titled "Hydraulic Design of Energy Dissipaters for Culverts and Channels" September 1983 (referenced as "Circular No.14" below). This is a current energy dissipation design reference containing 18 possible alternatives to address a wide range of design conditions. These alternatives draw from the wide range of modeling and operation experience of the Corps of Engineers, U.S. Bureau of Reclamation, U.S. Forest Service, Colorado State University, and others around the nation.

Though storm sewer designs are typically based on the peak flow for the 10-year, 24-hour design storm, the design of the permanent energy dissipation will be based on the 100-year, 24-hour design storm.

Phased construction of the runway embankment included provisions for energy dissipation in the form of corrugated, high density polyethylene pipe anchored to the surface of the embankment down to a short run on a flat slope before discharging to a riprap lined ditch. Drops have been down 2 (horizontal) to 1 (vertical) slopes as high as 90 feet. At least one design 10-year recurrent storm event storm was exceeded during the time that those pipes have been in place and demonstrated satisfactory performance of those temporary conveyance systems.

Proposed Measures

Circular No.14 primarily focuses on dissipating energy in culvert to channel transitions and in steep channels. The embankment project has steep slope storm sewer discharges, down the typically 2:1 embankment slopes, either directly to detention facilities or to flat sloped closed systems at the toe of the slope. Refer to the attached table for a summary of the design data relative to the stormwater discharge points.

The general approach has evolved into having a closed stormwater conveyance system that caries the flow down the slope for energy dissipation. The down-slope pipe will meet the guidelines as provided in the 1998 King County Surface Water Design Manual (Table 4.2.1.A Maximum Slopes and Velocities).

Where the storm sewer discharges directly to detention facilities, erosion at the bottom of the earthen pond will be prevented through the following design approaches:

- Natural or Forced Hydraulic Jumps
- Impact Basins
- Stilling Wells
- Riprap
- Roughness Elements to Increase Pipe Resistance Near the Outlet (combined with one of the measures above)

Where the steep storm sewer pipe discharges to flat sloped closed systems, manhole lid blow-off and erosion will be prevented through the following design approaches:

- Impact Basins
- Stilling Wells
- Roughness Elements to Increase Pipe Resistance Near the Outlet (combined with one of the measures above)

Each of these design approaches is feasible and constructable using the Circular No. 14 guidelines. Selection will be based on the physical space available, cost and ease of maintenance for each location.

Hydrology

Peak discharge rates for the 100-year, 24-hour design storm has been calculated based on the proposed pavement, airfield grading, and storm sewer layout. The calculated peak discharge rates are set and not likely to change more than 5 percent in final design. The Governor certified drainage boundaries set the total contributing areas for most of the basins.

Two subbasins in Millar Creek (SDW1A and SDN3A) are combined in the calculations. This is the worst case scenario for the outlet to Pond G. The likely alternate design would have runoff from subbasin SDN3A conveyed to Pond C within a closed stormwater conveyance system that will be located within the Security Road with a slope of 15 percent. If this conveyance alternate is selected the flow rate would reduce in the Pond G system and the slope transition within the Security Road is gradual enough that energy dissipation is not seen a significant issue.

Conclusion

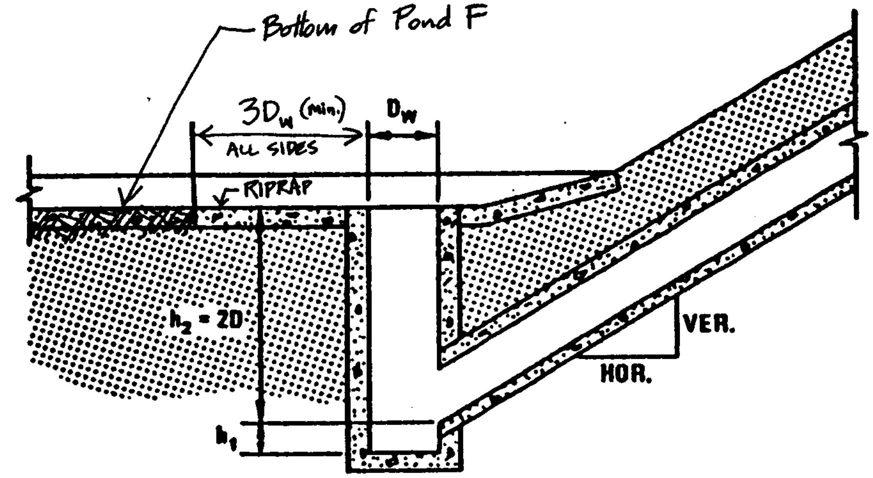
For the purposes of permit review, calculation are attached to demonstrate that the Corp of Engineers Stilling Well, as described in Chapter X-B of Circular No. 14 (attached for the reviewer's convenience), will work in the three locations where energy dissipation is a concern. This approach was selected for its simplicity, satisfactory operation for a wide range of flows (up to $Q/D^{5/2} < 10.0$), and ease of construction. King County has also indicated that they have had good experience with this system in this region. The Port may further refine or substitute another energy dissipation concept during final design to provide an equal or superior energy dissipation system.

Existing construction methods are operating satisfactorily and future construction contracts will include energy dissipation features. Construction staging could potentially place these features earlier to ensure that they are in place at the base of the embankment to enhance the corrugated HDPE pipe and ditch lining provisions for higher slope heights. Circular No. 14 notes that the Corp of Engineers Stilling Well "may also be useful as a temporary erosion control device during construction" and that it "will operate with moderate to high concentrations of sand and silt" (p. X-B-1). This ability for service as a temporary construction device will be a factor in the selection of the energy-dissipating device.

SEA-TAC THIRD RUNWAY EMBANKMENT CONSTRUCTION
STORMWATER DISCHARGE DOWN SLOPE

Basin	Receiving Waters	Pond Name	Runway Basline	Contributing Area (Ac)	100-year Flowrate (cfs)	Height of Drop (ft)	Slope (Ft/Ft)	Downstream Condition
SDS7	**Des Moines Creek**	SDS7	106	91.3	41.7	13	0.155	Closed system (180' flat slope) to detention vault. No energy dissipation issues anticipated.
SDW2	**Walker Creek**	F	153	39.8	17.5	18	0.133	Direct discharge to detention pond. Energy dissipation issues potential addressed at bottom of pond.
SDW1B	**Miller Creek**	D	167	82.2	36.3	26	0.500	Closed system (100' flat slope) to detention pond. Energy dissipation issues potential address at base of 2:1 slope.
SDW1A & SDN3A	**Miller Creek**	G & C	197	64.0	32.8	140	0.500	Closed system (430' flat slope) to detention pond. Energy dissipation issues potential addressed at base of 2:1 slope for worst case scenario single down-slope discharge.

SDWZ **STILLING WELL - Corps of Engineers** **10-B**

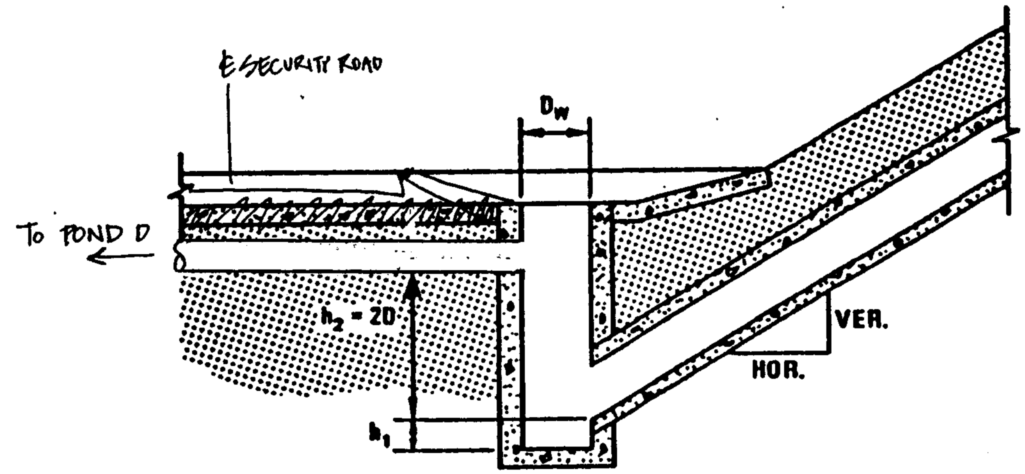


D	Q	Slope	DW	h_1/D_W	h_1	h_2	h_W		
24"	17.5	0.133	2D use 48"	0.15	7" use 12"	48"	5'		

WITH 24"ϕ, ENTRANCE CONTROLS BACKWATER
PER 1998 SWDM FIGURE 4.3.1.B, HW/D = 1.27 ⇒ HW = 2.5 ft.

CHECK $Q/D^{5/2} < 10.0$: $17.5/(2)^{2.5} = 3.09 < 10.0$ ∴ WITHIN DESIGN LIMITS

SDWIB **STILLING WELL - Corps of Engineers** **10-B**



D	Q	Slope	DW	h_1/D_W	h_1	h_2	h_W		
30"	36.3	2:1 0.500	2.5D 6.25' use 6.5'φ	0.42	2.73' use 3'	5'	8'		

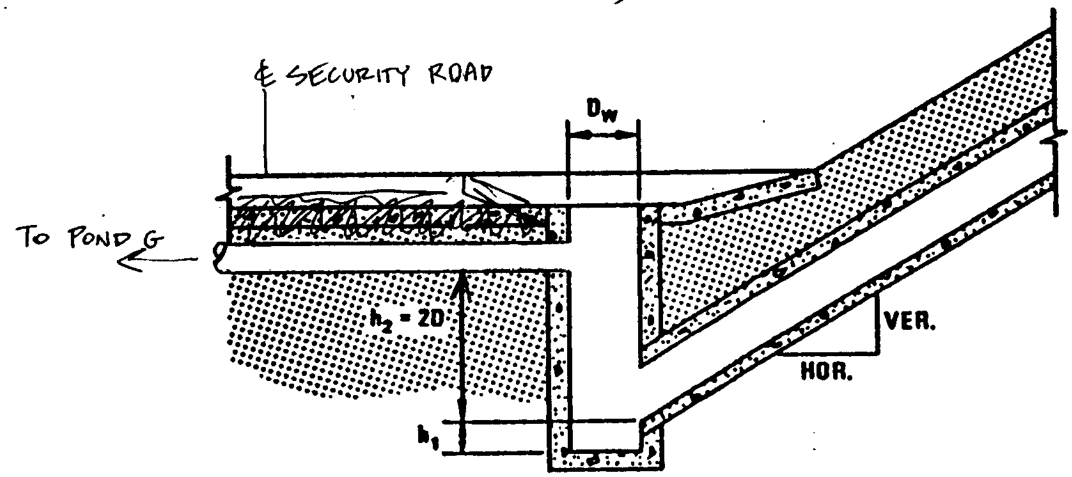
WITH 30"φ, ENTRANCE CONTROLS BACKWATER
PER 1998 SWDM FIGURE 4.3.1.B, HW/D = 1.6 ⇒ HW = 3.75'

CHECK CRITICAL DEPTH IN PIPE : 2.1' < 2.5' ✓

PIPE OUT Q = 36.3 V = 3 fps min.
USE 36" @ S = 0.005: Capacity = 47.2 cfs V = 6.67
USE STANDARD RIPRAP TREATMENT AT DISCHARGE TO POND D

COMBINED SDW1A & SDN3A **STILLING WELL - Corps of Engineers** **10-B**

(INDIVIDUAL DISCHARGES WOULD BE SMALLER)



D	Q	Slope	DW	h_1/D_W	h_1	h_2	h_W		
30"	32.8	2:1 0.500	2D 5'	0.42	2.1'	2.5'	4.6'		

WITH 30"φ, ENTRANCE CONTROLS BACKWATER
PER 1998 SWDM FIGURE 4.3.1.B, HW/D = 1.45 ⇒ HW = 3.63'

CHECK CRITICAL DEPTH IN PIPE: 1.9' < 2.5' ✓

PIPE OUT Q = 32.8 v = 3 fps min.
USE 36" @ S = 0.005 : CAPACITY = 47.2 cfs v = 6.67
USE STANDARD RIP RAP TREATMENT AT DISCHARGE TO POND G

HNTB The HNTB Companies	Made by A.D. Black	Date 8/10/00	Job Number 20764-DS-001
	Checked by RCElslip	Date 8/16/00	Sheet Number 1
Calculations For SEA 3rd Runway	Backchecked by	Date	

SDS7 Total Area = 3975027 sq ft = 91.25 Ac. (CADD measure)

Runway Pavement = 1553770 − 107239 = ~~144653 sq ft = 33.20 Ac.~~
+ 121120 = 1567651 sq. ft.

Perimeter Road Pvmt = [(12400 − 11000) + (14935 − 10900)] 32 = 173920 sq ft.
Access Rd Pvmt 1660' × 24' = 39,840
Total Proposed Impervious = 1567651 + 173920 = ~~174157~~ 1781411 sq ft = ~~40 Ac~~ 40.9 Ac

T_c calculation

Path through inlet SDS7-29A

150'	sheet flow on TW-N	s = 0.01	250
100'	sheet flow on infield	s = 0.0150	370
330'	intermittent on infield	s = 0.0150	
3500'	stm. swr conveyance	s = 0.0077	3250

Path through inlet SDS7-18

160'	sheet flow on runway	s = 0.01
100'	sheet flow on w. grass	s = 0.015
90'	intermittent — " —	s = 0.015
200'	ditch conveyance	s = 0.0077
4150'	stm. swr. conveyance	s = 0.0077

ME111-0793

Seattle Tacoma International Airport

Third Runway Hydrology / Hydraulics

Energy Dissipation

BASIN SUMMARY

```
BASIN ID: SDS7          NAME:
SBUH METHODOLOGY
TOTAL AREA.......:  92.15 Acres     BASEFLOWS:    0.00 cfs
RAINFALL TYPE....:   TYPE1A                   PERV            IMP
PRECIPITATION....:   4.00 inches    AREA..:   51.25 Acres    40.90 Acres
TIME INTERVAL....:     10.00 min    CN....:   85.00           98.00
                                    TC....:   48.22 min      36.61 min
ABSTRACTION COEFF:   0.20
TcReach - Sheet   L: 250.00 ns:0.1500 p2yr: 2.00 s:0.0150
TcReach - Shallow L: 370.00 ks:11.00 s:0.0150
TcReach - Channel L:3250.00 kc:42.00 s:0.0077
impTcReach - Sheet   L: 150.00 ns:0.0110 p2yr: 2.00 s:0.0100
impTcReach - Sheet   L: 100.00 ns:0.1500 p2yr: 2.00 s:0.0150
impTcReach - Shallow L: 330.00 ks:11.00 s:0.0150
impTcReach - Channel L:3500.00 kc:42.00 s:0.0077
PEAK RATE:  41.71 cfs  VOL:  23.33 Ac-ft  TIME:    490 min
```

HNTB The HNTB Companies	Made by A. D. Black	Date 8/10/00	Job Number 20764-DS-001
	Checked by RC Elslip	Date 8/16/00	Sheet Number 2
Calculations For SEA 3rd Runway	Backchecked by	Date / /	

SDW2 Total Area = ~~1942982 sq ft~~ 1735838 sq ft = ~~44.6 Ac.~~ 39.8 Ac (CADD measure)

Runway Pvmt = 412 228 sq ft

Perimeter Rd Pvmt = (15950 - 14935) 32 = 32 480 sq ft.

Total imp. = 412228 + 32 480 = 444 708 sq ft. = ~~10.2 Ac~~

+ Access Rd Pvmt = 900' x 24' = 21,600

466,308 sq ft. = 10.7 Ac.

Tc calculation - through SDW2-5A

Pervious Area

200' sheet flow on infield	s = 0.015
470' intermittent flow on infield	s = 0.015
265' ditch flow e. of access road	s = 0.0077
2030' stm swr conveyance	s = 0.005

Impervious Area

200' sheet flow on runway	s = 0.01
190' intermittent flow on infield	s = 0.015
250' ditch flow w. of access road	s = 0.0077
2000' stm swr conveyance	s = 0.005

ME111-0793

BASIN SUMMARY

```
BASIN ID: SDW2        NAME:
SBUH METHODOLOGY
TOTAL AREA.......:  39.80 Acres    BASEFLOWS:    0.00 cfs
RAINFALL TYPE....:   TYPE1A                  PERV          IMP
PRECIPITATION....:  4.00 inches    AREA..:   29.10 Acres   10.70 Acres
TIME INTERVAL....:    10.00 min    CN....:   85.00          98.00
                                   TC....:   44.38 min     18.94 min
ABSTRACTION COEFF:  0.20
TcReach - Sheet   L: 200.00 ns:0.1500 p2yr: 2.00 s:0.0150
TcReach - Shallow L: 470.00 ks:11.00 s:0.0150
TcReach - Channel L: 265.00 kc:17.00 s:0.0077
TcReach - Channel L:2030.00 kc:42.00 s:0.0050
impTcReach - Sheet   L: 200.00 ns:0.0110 p2yr: 2.00 s:0.0100
impTcReach - Shallow L: 190.00 ks:11.00 s:0.0150
impTcReach - Channel L: 250.00 kc:17.00 s:0.0177
impTcReach - Channel L:2000.00 kc:42.00 s:0.0050
PEAK RATE:  17.51 cfs  VOL:    9.32 Ac-ft  TIME:    480 min
```

HNTB The HNTB Companies	Made by A.D. Black	Date 8/10/00	Job Number 20764-DS-001
	Checked by RC Elsky	Date 8/16/00	Sheet Number 3
Calculations For SEA 3rd Runway	Backchecked by	Date	

SDW1B

Total Area = ~~4,219,143 sq ft~~ = ~~96.9 Ac.~~
3 579 820 sq ft. = 82.2 Ac. (plateau only)

Runway Pvmt. = 242428 + 809733 = 1052 161 sq ft ~~242~~

Perimeter Rd Pvmt = (18720 - 1595) 32 = 88 640 sq ft

~~Total Pvmt~~

Acces Rd Pvmt = (1450 + 820) 24 = 54480

Total Imp. Area = 1,195,281 sq. ft. = 27.4 Ac.

Tc calculation

Pervious Area (through SDW1B-12)

250'	sheet flow on infield	s = 0.015
300'	intermittent shallow on infield	s = 0.015
2720'	stm swr conveyance	s = 0.0077
700	stm swr conveyance	s = 0.005

Impervious Area

300'	sheet flow on TW E	s = 0.02
650'	ditch flow s. of TW E	s = 0.02
2720'	stm swr ~~∥~~ to Runway	s = 0.0077
700'	stm swr @	s = 0.005

ME111-0793

===

BASIN SUMMARY

```
BASIN ID: SDW1B       NAME:
SBUH METHODOLOGY
TOTAL AREA.......:  82.20 Acres     BASEFLOWS:   0.00 cfs
RAINFALL TYPE....:   TYPE1A                    PERV          IMP
PRECIPITATION....:   4.00 inches    AREA..:   54.80 Acres   27.40 Acres
TIME INTERVAL....:    10.00 min     CN....:   85.00          98.00
                                    TC....:   48.88 min     24.43 min
ABSTRACTION COEFF:   0.20
TcReach - Sheet   L: 250.00 ns:0.1500 p2yr: 2.00 s:0.0150
TcReach - Shallow L: 300.00 ks:11.00 s:0.0150
TcReach - Channel L:2720.00 kc:42.00 s:0.0077
TcReach - Channel L: 700.00 kc:42.00 s:0.0050
impTcReach - Sheet   L: 300.00 ns:0.0110 p2yr: 2.00 s:0.0200
impTcReach - Channel L: 650.00 kc:17.00 s:0.0200
impTcReach - Channel L:2720.00 kc:42.00 s:0.0077
impTcReach - Channel L: 700.00 kc:42.00 s:0.0050
PEAK RATE:  36.31 cfs  VOL:  19.82 Ac-ft  TIME:    490 min
```

HNTB The HNTB Companies	Made by A.D. Black	Date 8/10/00	Job Number 20764-DS-001
	Checked by RC Elslip	Date 8/16/00	Sheet Number 4
Calculations For SEA 3rd Runway	Backchecked by	Date	

SDW1A + SDN3A

Total Area = 2073640 + 716341
2 789 981 sq ft = 64.0 Ac

SDW1A Runway Pvmt 945093 - 106818 = 838,275 sq ft
SDN3A Runway Pvmt. 142825 sq.ft.
Perimeter Rd Pvmt. (20850 - 18720) 32 = 68 160 sq ft
(23300 - 20850) 32 = 78 400 sq ft

Access Rd. Pvmt. 1000' × 24' = 24 000 sq.ft.

Total Imp Area = 1,151,660 sq ft = 26.4 Ac.

Tc Calc Path through SDN3A-7

Impervious

210' sheet flow on Blast Pad 8%
40' Sheet flow off Blast Pad on grass 8%
260' Shallow flow on infield 8%
240' Ditch (grass) to SDN3A-7 7%
3,230 pipe flow 0.77%

Pervious

~~300~~ 250 Sheet flow 8%
70 Shallow flow 8%
120 Ditch flow ~~8%~~
1080 Pipe flow 0.5%
2450 Pipe flow 0.77%

ME111-0793

AR 011219

Seattle Tacoma International Airport
Third Runway Hydrology / Hydraulics
Energy Dissipation

BASIN SUMMARY

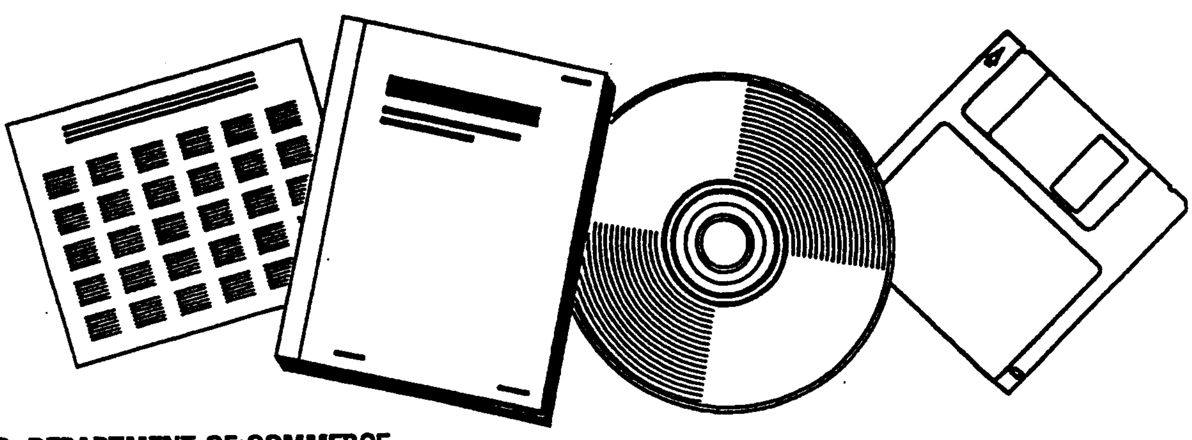
```
BASIN ID: SDW1A         NAME:
SBUH METHODOLOGY
TOTAL AREA.......:   64.00 Acres     BASEFLOWS:    0.00 cfs
RAINFALL TYPE....:     TYPE1A                    PERV           IMP
PRECIPITATION....:    4.00 inches    AREA..:    37.60 Acres   26.40 Acres
TIME INTERVAL....:     10.00 min     CN....:    85.00          98.00
                                     TC....:    32.78 min     21.90 min
ABSTRACTION COEFF:    0.20
TcReach - Sheet   L: 250.00 ns:0.1500 p2yr: 2.00 s:0.0800
TcReach - Shallow L:  70.00 ks:11.00 s:0.0800
TcReach - Channel L: 120.00 kc:17.00 s:0.0700
TcReach - Channel L:1080.00 kc:42.00 s:0.0050
TcReach - Channel L:2450.00 kc:42.00 s:0.0077
impTcReach - Sheet   L: 210.00 ns:0.0110 p2yr: 2.00 s:0.0800
impTcReach - Sheet   L:  40.00 ns:0.1500 p2yr: 2.00 s:0.0800
impTcReach - Shallow L: 260.00 ks:11.00 s:0.0800
impTcReach - Channel L: 240.00 kc:17.00 s:0.0700
impTcReach - Channel L:3230.00 kc:42.00 s:0.0077
PEAK RATE:  32.83 cfs  VOL:  15.98 Ac-ft  TIME:    480 min
```

PB86180205

HYDRAULIC DESIGN OF ENERGY DISSIPATORS FOR CULVERTS AND CHANNELS

FEDERAL HIGHWAY ADMINISTRATION
WASHINGTON, DC

SEP 83



U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

AR 011221

X-B. CORPS OF ENGINEERS STILLING WELL

The design of this type of stilling well energy dissipator is based on model tests conducted by the Corps of Engineers. (X-B-1 and 2)

The dissipator has application where debris is not a serious problem. It will operate with moderate to high concentrations of sand and silt but is not recommended for areas where quantities of large floating or rolling debris is expected unless suitable debris-control structures are utilized. Its greatest potential, as far as highways are concerned, is at the outfalls of storm drains, median, and pipe down drains where little debris is expected. It may also be useful as a temporary erosion control device during construction.

Design Recommendations

The design is straightforward. Once the size and discharge of the incoming pipe are determined, figure X-B-1 is used to select the stilling well diameter (D_W). The model tests indicated that satisfactory performance can be maintained for $Q/D^{5/2}$ ratios as large as 10.0, with stilling well diameters of one, two, three, and five times that of the incoming conduits. These ratios were used to define the curves shown in figure X-B-1.

The tests also indicated that there is an optimum depth of stilling well below the invert of the incoming pipe. This depth is determined by entering figure X-B-2 with the slope of the incoming pipe and using the stilling well diameter (D_W) previously obtained from figure X-B-1.

The height of the stilling well above the invert is fixed at twice the diameter of the incoming pipe (2D). This dimension results in satisfactory operation and is practical from a cost standpoint; however, if increased, greater efficiency will result.

Tailwater also increases the efficiency of the stilling well. Whenever possible, it should be located in a sump or depressed area.

It is recommended that riprap or other types of channel protection be provided around the stilling well outlet and for a distance of at least $3D_W$ downstream.

The outlet may also be covered with a screen or grate for safety. However, the screen or grate should have a clear opening area of at least 75 percent of the total stilling well area and be capable of passing small floating debris such as cans and bottles.

Design Procedures

(1) Select approach pipe diameter (D) and discharge (Q).

(2) Obtain well diameter (D_W) from figure X-B-1.

(3) Calculate the culvert slope = (Vertical/horizontal distance). The depth of the well below the culvert invert (h_1) is determined from figure X-B-2.

(4) The depth of the well above the culvert invert (h_2) is equal to 2(D) as a minimum but may be greater if the site permits.

(5) The total height of the well (h_W) = h_1+h_2.

Example Problem

Given: 24" CMP downdrain on a 2:1 slope carrying a Q = 15 cfs

Find: Stilling well dimensions

Solution:

(1) D=2 ft., Q=15 cfs
(2) From figure X-B-1 D_W=1.5D=3 ft.
(3) Slope=1/2=.5, h_1/D_W=.42 from figure X-B-2
h_1=.42(3.0)=1.26 ft., Use h_1=1.3 ft.
(4) h_2=2(D)=2(2)=4 ft.
(5) h_W= h_1+h_2=1.3+4=5.3 ft.

X-B-1. IMPACT-TYPE ENERGY DISSIPATOR FOR STORM-DRAINAGE OUTFALLS STILLING WELL DESIGN, U. S. Army Corps of Engineers, Technical Report No. 2-620 March 1963, WES, Vicksburg, Mississippi.

X-B-2. Grace, J. L., Pickering, G. A., EVALUATION OF THREE ENERGY DISSIPATORS FOR STORM DRAIN OUTLETS, U.S. Army WES, HRB 1971, Washington, D.C.

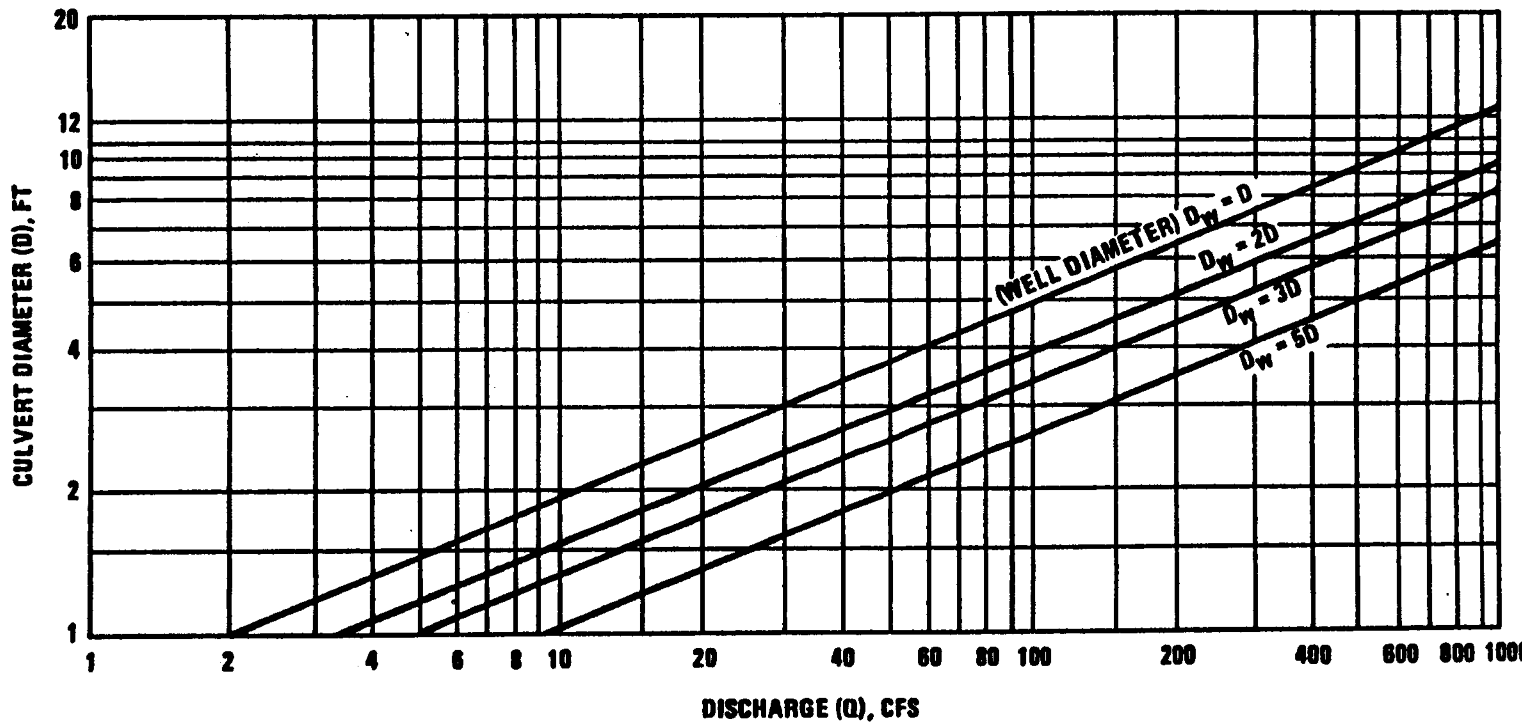


FIGURE X-B-1. STILLING WELL DIAMETER (D_W) FROM REFERENCE X-B-1

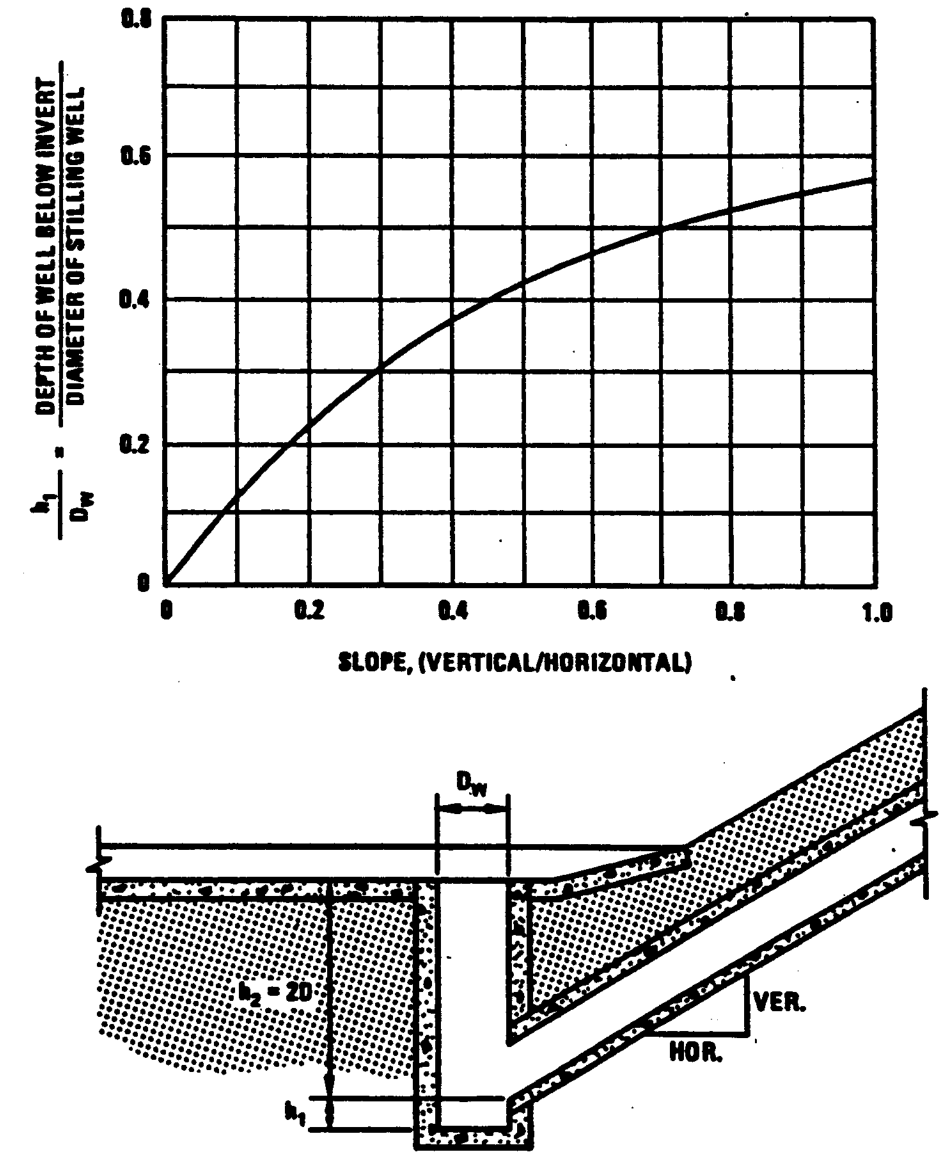


FIGURE X-B-2. STILLING WELL HEIGHT FROM REFERENCE X-B-1

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APPENDIX Z

IWS LAGOON STORAGE CAPACITY MODELING

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1. IWS CONTINUOUS SIMULATION

1.1 INTRODUCTION

A continuous simulation of the Industrial Waste System (IWS) was performed using the King County Runoff Time Series (KCRTS) to:

- Confirm that overflows will not occur under the future configuration of the IWS (simulated over the 50-year KCRTS period of record);
- Estimate the treatment rate at which one overflow would occur when the 50-year KCRTS period of record is simulated; and
- Estimate the treatment rate at which two overflows would occur.

1.2 APPROACH AND ASSUMPTIONS

The following assumptions were used for the analyses:

- With recent improvements to the Industrial Waste Water Treatment Plant (IWTP), the maximum IWS treatment and discharge rate exceeds 4.0 mgd (6.2 cfs).
- The total lagoon storage (for Lagoons 1, 2, and 3) will be increased to approximately 76.9 million gallons by the end of 2001. Lagoon 3 is currently being enlarged as an element of the All Known Available and Reasonable Treatment (AKART) alternative, which is required the Port's National Pollutant Discharge Elimination System (NPDES) Permit. The final storage of Lagoon 3 will be no less than the design volume of 72 million gallons. Upon completion, the effective volume is expected to exceed the design volume, with a final volume of 72 to 76 million gallons. The design volume of 72 million gallons was used for this analysis.
- The hydraulic capacity of the existing 18-inch outfall was determined to be at least 6.3 mgd (see Appendix O, Case 1). This exceeds the current and proposed future maximum treatment rate of 4 mgd. Additionally, approximately 75 feet of effluent line upstream of the effluent manhole was replaced in 1996 (Kennedy/Jenks 1998) and a portion of the 18-inch effluent line under Lagoon 3 is scheduled to be replaced in 2001. These improvements will increase the capacity of the outfall to 7.1 mgd (see Appendix O, Case 2).
- Land use for the IWS in 2006 is summarized in Table Z-1. This land use is conservative because pump stations were modeled to direct 100 percent of flows to the IWS; flows greater than the 6-month flow rate actually overflow from some of these facilities to the Storm Drain System (SDS). Although this analysis accounts for all major planned additions to the IWS, approximately 16 acres of additional impervious area were included in this analysis to allow for future unplanned area additions.

Table Z-1. IWS configuration (land use, storage, treatment rate, and discharge rate).

Parameter	Value
Land Use	
Till Grass	16.53 acres
Outwash Grass	8.16 acres
Airport Fill	0.01 acres
Wetland	0.01 acres
Impervious Area	410.00 acres
TOTAL	**434.71 acres**
Storage Volume	
Lagoon 1	1.6 mg
Lagoon 2	3.3 mg
Lagoon 3	72.0 mg
TOTAL	**76.9 mg = 236.0 ac-ft**
Treatment Rate	**4.0 mgd**
Outfall Discharge Capacity	**7.1 mgd**

2. IWS LAGOON STORAGE CAPACITY MODELING

2.1 CONFIRMATION OF ZERO OVERFLOWS

A single-outlet reservoir file was set up in KCRTS representing the total lagoon storage and treatment rate. In the reservoir file, the processing rate linearly increases to the maximum of 6.2 cfs, at which time Lagoon 1 is full (this assumption is conservative, as the maximum treatment rate is normally attained as soon as the treatment facility is started, when Lagoon 1 is less than full). After Lagoon 1 is full, the maximum processing rate was held constant at 6.2 cfs.

The IWS 2006 time series was routed through the reservoir to confirm that the peak reservoir storage was not exceeded. As shown in the attached KCRTS reservoir setup, the peak storage attained for the 50-year KCRTS period of record (208 ac-ft) does not exceed the total IWS lagoon storage capacity of 236 ac-ft, thus no overflows occur.

2.2 TREATMENT RATE AT WHICH ONE OVERFLOW OCCURS

To determine the treatment rate at which one overflow would occur, a double-outlet reservoir was used. The treatment rate was represented as a constant discharge from the first outlet (ramped up as described above). Overflow was represented by the second outlet's discharge, which did not occur until the pond reached full volume. The overflow discharge rate was arbitrarily set at 1.0 cfs to indicate that overflow was occurring (only a positive-negative indicator of overflow was required).

The IWS 2006 time series file was routed through the two-outlet reservoir. A trial-and-error process was performed, examining the KCRTS reservoir routing output (attached) to bracket the flow rate at which overflow would occur. This treatment rate was approximately 3.05 mgd (1.97 cfs), with overflow occurring in water year (WY) 1997.

2.3 TREATMENT RATE AT WHICH TWO OVERFLOWS OCCUR

To determine the treatment rate at which two overflows would occur, a double-outlet reservoir was used. The treatment rate was represented as a constant discharge from the first outlet. Overflow was represented by the second outlet's discharge, which did not occur until the pond reached full volume. Then the overflow discharge rate was arbitrarily set at 1.0 cfs to indicate that overflow was occurring (only a positive-negative indicator of overflow was required). The KCRTS reservoir input and reservoir routing results are attached.

The IWS 2006 time series file was routed through the two-outlet reservoir. A trial-and-error flow-frequency analysis was performed on the second outlet's time series to determine the treatment rate at which overflow would occur in only one year (but not in two or more different years). This treatment rate was approximately 2.68 mgd (4.15 cfs), with overflow occurring only in WY 1956 (see attached KCRTS output and hydrograph). The hydrograph from WY 1956 was extracted and analyzed to determine how many overflows occurred during that year (only one overflow occurred).

Using flow frequency analysis and extracted hydrographs, the trial-and-error process was extended to determine the rate at which two overflows would occur in 1956, or at which overflows would occur in two separate years. Two overflows occurred during the 50-year KCRTS period of record at a treatment rate of approximately 2.35 mgd (4.10 cfs). Both overflows occurred in WY 1956 (see attached KCRTS output and hydrograph).

KCRTS TIME SERIES INPUT: IWS 2006 LAND USE

```
+-Land Use Summary------------------------------------------+
|Till Forest              0.00 acres                        |
|Till Pasture             0.00 acres                        |
|Till Grass              16.53 acres                        |
|Airport Fill             0.01 acres                        |
|Outwash Forest           0.00 acres                        |
|Outwash Pasture          0.00 acres                        |
|Outwash Grass            8.16 acres                        |
|Wetland                  0.01 acres                        |
|Impervious             410.00 acres                        |
|-----------------------------------------------------------|
|         Total Area :  434.71 acres                        |
|       Scale Factor :    1.00      Hourly      Historic    |
|-----------------------------------------------------------|
|                                                           |
|   Time Series: iws2006                                    |
|-----------------------------------------------------------|
```

KCRTS ONE-OUTLET RESERVOIR SETUP AND RESERVOIR ROUTING RESULTS
IWS 2006 LAGOON STORAGE AND TREATMENT RATE

One Outlet Reservoir Routing File

Stage (Ft)	Discharge (CFS)	Storage (Cu-Ft)	Perm-Area (Sq-Ft)
0.00	0.000	0.	0.
0.10	6.190	213875.	0.
10.00	6.190	10279374.	0.

```
     0.00 Ft           : Base Reservoir Elevation
     0.0 Minutes/Inch: Average Perm-Rate


                              KCRTS Command
                              -------------
                   Route through a SINGLE (1) outlet Reservoir
                   -------------------------------------------
                             Loading Reservoir File:iwsres.RS1    :
                          Loading Time Series File:iws2006.tsf  50

                        Reservoir Routing [Single Outlet]
 Computing Series:iws1.tsf
   Years Complete: 50
                            Inflow/Outflow Analysis
                            -----------------------
   Peak Inflow Discharge:     168.40 CFS at  6:00 on Jan  9 in 1990
  Peak Outflow Discharge:       6.19 CFS at  2:00 on Jan  3 in 1997
    Peak Reservoir Stage:       8.81  Ft
     Peak Reservoir Elev:       8.81  Ft
  Peak Reservoir Storage: 9065779.    Cu-Ft
                        :     208.122 Ac-Ft
                             Storing Time Series File:iws1.tsf  50

                               Routing Complete
```

KCRTS TWO-OUTLET RESERVOIR ROUTING RESULTS
TO DETERMINE ONE OVERFLOW
IWS 2006 LAGOON STORAGE WITH 3.03 MGD TREATMENT RATE

```
                              KCRTS Command
                              -------------
                 Route through a DOUBLE (2) outlet Reservoir
                 -------------------------------------------
                                 Loading Reservoir File:iwsres2.RS2    :
                               Loading Time Series File:iws2006.tsf   50

                       Reservoir Routing [Double Outlet]
 Computing Series:iwstreat.tsf
       and Series:iwsover.tsf
   Years Complete: 50
                            Inflow/Outflow Analysis
                            -----------------------
   Peak Inflow Discharge:     168.40 CFS at  6:00 on Jan  9 in 1990
 Peak A-Outflow Discharge:      4.70 CFS at  2:00 on Jan  3 in 1997
 Peak B-Outflow Discharge:      1.00 CFS at  2:00 on Jan  3 in 1997
    Peak Reservoir Stage:     10.02  Ft
     Peak Reservoir Elev:     10.02  Ft
  Peak Reservoir Storage: 9635228.   Cu-Ft
                       :     221.194 Ac-Ft
                              Storing Time Series File:iwstreat.tsf   50
                               Storing Time Series File:iwsover.tsf   50

                              Routing Complete
```

**KCRTS TWO-OUTLET RESERVOIR ROUTING RESULTS
TO DETERMINE ONE OVERFLOW
IWS 2006 LAGOON STORAGE WITH 3.06 MGD TREATMENT RATE**

```
                         KCRTS Command
                         -------------
               Route through a DOUBLE (2) outlet Reservoir
               -------------------------------------------
                              Loading Reservoir File:iwsres2.RS2    :
                            Loading Time Series File:iws2006.tsf   50

                    Reservoir Routing [Double Outlet]
 Computing Series:iwstreat.tsf
       and Series:iwsover.tsf
   Years Complete: 50
                         Inflow/Outflow Analysis
                         -----------------------
   Peak Inflow Discharge:     168.40 CFS at  6:00 on Jan  9 in 1990
 Peak A-Outflow Discharge:       4.75 CFS at  3:00 on Jan  3 in 1997
 Peak B-Outflow Discharge:      0.000 CFS at  3:00 on Jan  3 in 1997
    Peak Reservoir Stage:      10.00  Ft
     Peak Reservoir Elev:      10.00  Ft
  Peak Reservoir Storage: 9620638.    Cu-Ft
                        :     220.859 Ac-Ft
                           Storing Time Series File:iwstreat.tsf   50
                            Storing Time Series File:iwsover.tsf   50

                          Routing Complete
```

KCRTS TWO-OUTLET RESERVOIR SETUP AND RESERVOIR ROUTING RESULTS TO DETERMINE TWO OVERFLOWS IWS 2006 LAGOON STORAGE WITH 2.68 MGD TREATMENT RATE

Two Outlet Reservoir Routing File

Stage (Ft)	Discharge (CFS) A	B	Storage (Cu-Ft)	Perm-Area (Sq-Ft)
0.00	0.000	0.000	0.	0.
0.10	4.150	0.000	213875.	0.
10.00	4.150	0.000	10279374.	0.
10.01	4.150	1.000	10279375.	0.
20.00	4.150	1.000	20000000.	0.

```
     0.00 Ft          : Base Reservoir Elevation
     0.0 Minutes/Inch: Average Perm-Rate
```

```
                              KCRTS Command
                              -------------
                  Route through a DOUBLE (2) outlet Reservoir
                  -------------------------------------------
                                 Loading Reservoir File:iwsres2.RS2   :
                               Loading Time Series File:iws2006.tsf  50

                       Reservoir Routing [Double Outlet]
 Computing Series:iwstreat.tsf
       and Series:iwsover.tsf
   Years Complete: 50
                            Inflow/Outflow Analysis
                            -----------------------
   Peak Inflow Discharge:     168.40 CFS at  6:00 on Jan  9 in 1990
Peak A-Outflow Discharge:       4.15 CFS at 14:00 on Jan  6 in 1956
Peak B-Outflow Discharge:       1.00 CFS at 14:00 on Jan  6 in 1956
    Peak Reservoir Stage:      10.16  Ft
      Peak Reservoir Elev:     10.16  Ft
  Peak Reservoir Storage:10429023.    Cu-Ft
                        :     239.417 Ac-Ft
                               Storing Time Series File:iwstreat.tsf  50
                                Storing Time Series File:iwsover.tsf  50

                              Routing Complete
```

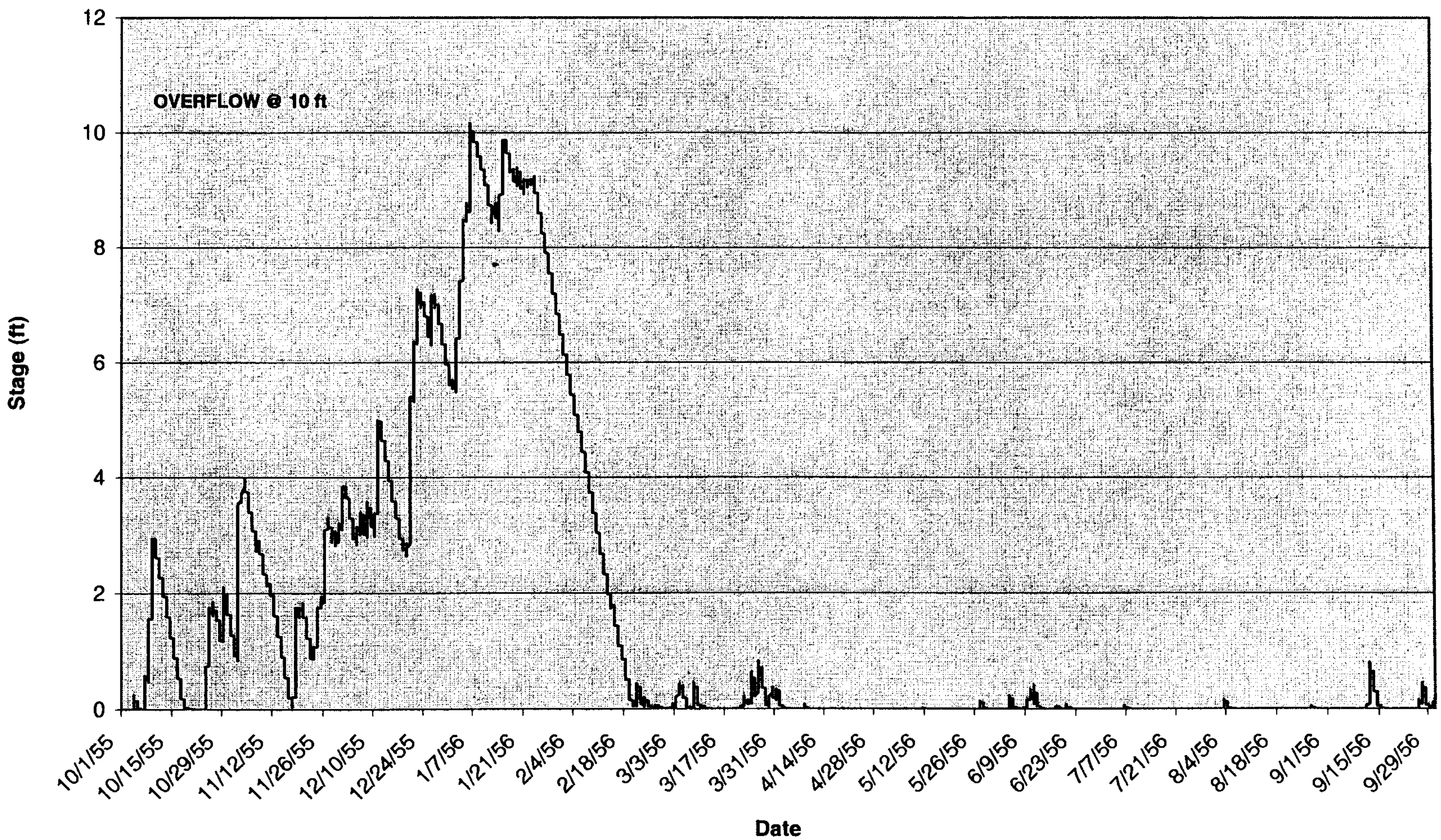
KCRTS FLOW FREQUENCY ANALYSIS
FOR IWS 2006 LAGOON STORAGE WITH 2.68 MGD TREATMENT RATE
OVERFLOW IN YEAR 1956 ONLY
(ONE OVERFLOW IN 1956; SEE THE FOLLOWING STAGE CHART)

Flow Frequency Analysis
Time Series File:iwsover.tsf
Project Location:Sea-Tac DMoines

---Annual Peak Flow Rates---			-----Flow Frequency Analysis-------				
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	(ft)	Rank	Return Period	Prob
0.000	42	2/22/49 22:00	1.00	10.16	1	89.50	0.989
0.000	21	1/27/50 3:00	0.000	9.59	2	32.13	0.969
0.000	4	2/10/51 20:00	0.000	9.18	3	19.58	0.949
0.000	47	2/04/52 7:00	0.000	8.92	4	14.08	0.929
0.000	5	2/07/53 9:00	0.000	8.85	5	10.99	0.909
0.000	36	1/23/54 1:00	0.000	8.69	6	9.01	0.889
0.000	38	2/08/55 7:00	0.000	8.41	7	7.64	0.869
1.00	1	1/06/56 14:00	0.000	8.19	8	6.63	0.849
0.000	31	3/10/57 4:00	0.000	7.10	9	5.86	0.829
0.000	30	1/17/58 9:00	0.000	6.91	10	5.24	0.809
0.000	40	11/24/58 8:00	0.000	6.43	11	4.75	0.789
0.000	9	12/15/59 15:00	0.000	6.31	12	4.34	0.769
0.000	19	11/24/60 18:00	0.000	6.14	13	3.99	0.749
0.000	46	12/24/61 6:00	0.000	5.88	14	3.70	0.729
0.000	26	11/30/62 20:00	0.000	5.75	15	3.44	0.709
0.000	14	11/19/63 19:00	0.000	5.75	16	3.22	0.690
0.000	12	12/01/64 10:00	0.000	5.59	17	3.03	0.670
0.000	23	1/14/66 1:00	0.000	5.44	18	2.85	0.650
0.000	16	1/28/67 8:00	0.000	5.29	19	2.70	0.630
0.000	34	1/20/68 21:00	0.000	5.26	20	2.56	0.610
0.000	33	12/11/68 10:00	0.000	4.90	21	2.44	0.590
0.000	17	1/27/70 5:00	0.000	4.85	22	2.32	0.570
0.000	28	12/10/70 20:00	0.000	4.73	23	2.22	0.550
0.000	7	3/14/72 7:00	0.000	4.73	24	2.13	0.530
0.000	10	12/27/72 21:00	0.000	4.58	25	2.04	0.510
0.000	20	12/27/73 21:00	0.000	4.50	26	1.96	0.490
0.000	41	12/27/74 8:00	0.000	4.07	27	1.89	0.470
0.000	35	12/04/75 3:00	0.000	4.04	28	1.82	0.450
0.000	43	8/26/77 8:00	0.000	4.04	29	1.75	0.430
0.000	24	12/15/77 20:00	0.000	4.04	30	1.70	0.410
0.000	50	11/19/78 10:00	0.000	3.98	31	1.64	0.390
0.000	3	12/22/79 4:00	0.000	3.95	32	1.59	0.370
0.000	27	12/30/80 23:00	0.000	3.82	33	1.54	0.350
0.000	18	10/08/81 22:00	0.000	3.64	34	1.49	0.330
0.000	29	1/08/83 6:00	0.000	3.60	35	1.45	0.310
0.000	45	11/24/83 9:00	0.000	3.55	36	1.41	0.291
0.000	37	11/11/84 9:00	0.000	3.48	37	1.37	0.271
0.000	25	1/19/86 1:00	0.000	3.42	38	1.33	0.251
0.000	13	11/27/86 1:00	0.000	3.36	39	1.30	0.231
0.000	32	12/10/87 8:00	0.000	3.34	40	1.27	0.211
0.000	39	11/25/88 2:00	0.000	3.26	41	1.24	0.191
0.000	11	1/09/90 18:00	0.000	2.93	42	1.21	0.171
0.000	8	11/24/90 19:00	0.000	2.77	43	1.18	0.151

0.000	22	2/01/92	0:00	0.000	2.68	44	1.15	0.131
0.000	48	3/23/93	9:00	0.000	2.57	45	1.12	0.111
0.000	49	2/17/94	22:00	0.000	2.52	46	1.10	0.091
0.000	15	12/27/94	21:00	0.000	2.44	47	1.08	0.071
0.000	6	2/09/96	7:00	0.000	2.33	48	1.05	0.051
0.000	2	1/03/97	3:00	0.000	1.83	49	1.03	0.031
0.000	44	10/30/97	12:00	0.000	1.67	50	1.01	0.011

IWS Overflow Analysis WY 1956
Treatment Rate 2.68 mgd



AR 011238

KCRTS TWO-OUTLET RESERVOIR SETUP AND RESERVOIR ROUTING RESULTS TO DETERMINE TWO OVERFLOWS IWS 2006 LAGOON STORAGE WITH 2.65 MGD TREATMENT RATE

```
Two Outlet Reservoir Routing File

  Stage      Discharge           Storage         Perm-Area
  (Ft)         (CFS)            (Cu-Ft)          (Sq-Ft)
              A         B
   0.00     0.000     0.000           0.                0.
   0.10     4.100     0.000      213875.                0.
  10.00     4.100     0.000    10279374.                0.
  10.01     4.100     1.000    10279375.                0.
  20.00     4.100     1.000    20000000.                0.

      0.00 Ft          : Base Reservoir Elevation
      0.0 Minutes/Inch: Average Perm-Rate

------------------------------------------------------------------------------
                                  KCRTS Command
                                  -------------
                   Route through a DOUBLE (2) outlet Reservoir
                   -----------------------------------------
                                      Loading Reservoir File:iwsres2.RS2    :
                                    Loading Time Series File:iws2006.tsf  50

                         Reservoir Routing [Double Outlet]
 Computing Series:iwstreat.tsf
       and Series:iwsover.tsf
   Years Complete: 50
                              Inflow/Outflow Analysis
                              -----------------------
   Peak Inflow Discharge:     168.40 CFS at  6:00 on Jan  9 in 1990
Peak A-Outflow Discharge:       4.10 CFS at 14:00 on Jan  6 in 1956
Peak B-Outflow Discharge:       1.00 CFS at 14:00 on Jan  6 in 1956
    Peak Reservoir Stage:      10.43  Ft
     Peak Reservoir Elev:      10.43  Ft
  Peak Reservoir Storage:10687904.    Cu-Ft
                        :     245.361 Ac-Ft
                                   Storing Time Series File:iwstreat.tsf  50
                                    Storing Time Series File:iwsover.tsf  50

                                Routing Complete
```

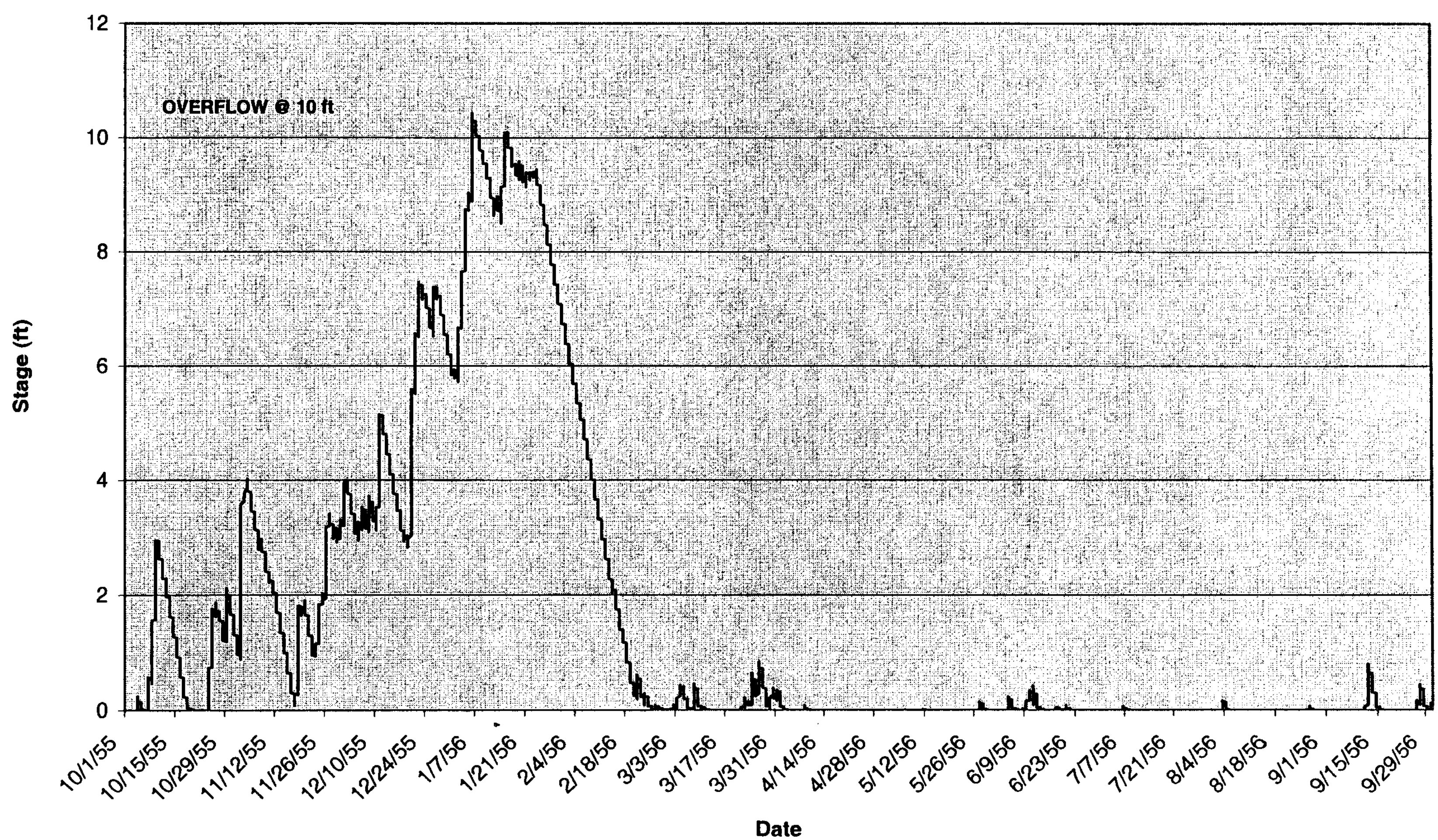
KCRTS FLOW FREQUENCY ANALYSIS
FOR IWS 2006 LAGOON STORAGE WITH 2.65 MGD TREATMENT RATE
OVERFLOW IN YEAR 1956 ONLY
(TWO OVERFLOWS IN 1956; SEE THE FOLLOWING STAGE CHART)

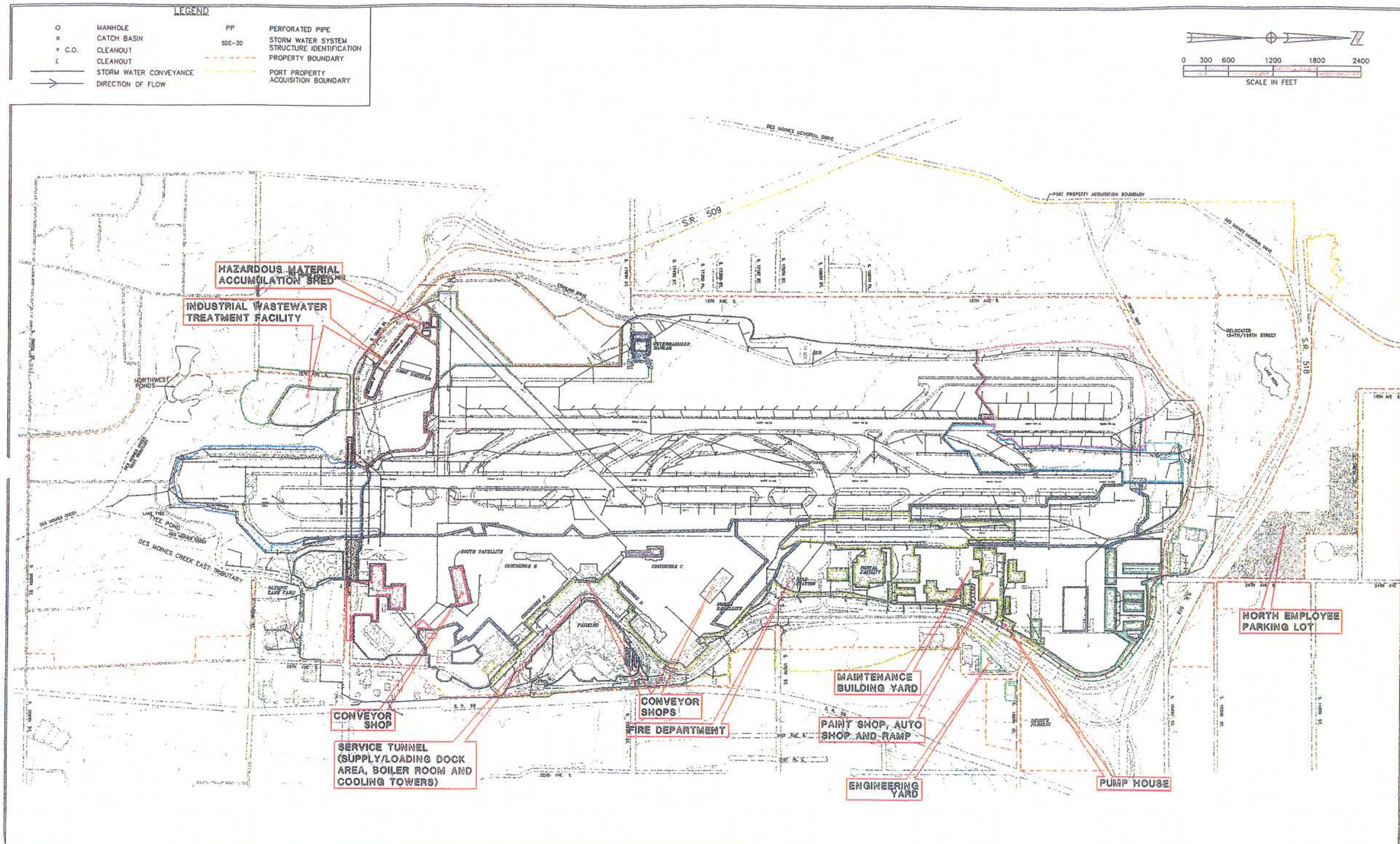
Flow Frequency Analysis
Time Series File:iwsover.tsf
Project Location:Sea-Tac DMoines

---Annual Peak Flow Rates---			-----Flow Frequency Analysis-------				
Flow Rate (CFS)	Rank	Time of Peak	- - Peaks - - (CFS)	(ft)	Rank	Return Period	Prob
0.000	42	2/22/49 22:00	1.00	10.43	1	89.50	0.989
0.000	21	1/27/50 3:00	0.000	9.61	2	32.13	0.969
0.000	3	2/10/51 20:00	0.000	9.28	3	19.58	0.949
0.000	47	2/04/52 7:00	0.000	9.22	4	14.08	0.929
0.000	6	2/07/53 9:00	0.000	9.09	5	10.99	0.909
0.000	35	1/23/54 1:00	0.000	9.01	6	9.01	0.889
0.000	39	2/08/55 7:00	0.000	8.48	7	7.64	0.869
1.00	1	1/06/56 14:00	0.000	8.26	8	6.63	0.849
0.000	31	3/10/57 4:00	0.000	7.22	9	5.86	0.829
0.000	28	1/17/58 9:00	0.000	6.96	10	5.24	0.809
0.000	40	11/24/58 8:00	0.000	6.45	11	4.75	0.789
0.000	9	12/15/59 15:00	0.000	6.35	12	4.34	0.769
0.000	20	2/25/61 3:00	0.000	6.18	13	3.99	0.749
0.000	46	12/24/61 6:00	0.000	6.08	14	3.70	0.729
0.000	26	11/30/62 20:00	0.000	6.01	15	3.44	0.709
0.000	15	11/19/63 19:00	0.000	5.80	16	3.22	0.690
0.000	12	12/01/64 10:00	0.000	5.65	17	3.03	0.670
0.000	23	1/14/66 1:00	0.000	5.49	18	2.85	0.650
0.000	14	1/28/67 8:00	0.000	5.47	19	2.70	0.630
0.000	34	1/20/68 21:00	0.000	5.37	20	2.56	0.610
0.000	33	12/11/68 10:00	0.000	5.05	21	2.44	0.590
0.000	17	1/27/70 5:00	0.000	4.88	22	2.32	0.570
0.000	29	12/10/70 21:00	0.000	4.82	23	2.22	0.550
0.000	7	3/14/72 7:00	0.000	4.75	24	2.13	0.530
0.000	10	12/27/72 21:00	0.000	4.59	25	2.04	0.510
0.000	19	12/27/73 21:00	0.000	4.56	26	1.96	0.490
0.000	41	12/27/74 8:00	0.000	4.11	27	1.89	0.470
0.000	36	12/04/75 3:00	0.000	4.07	28	1.82	0.450
0.000	43	8/26/77 8:00	0.000	4.07	29	1.75	0.430
0.000	24	12/15/77 20:00	0.000	4.06	30	1.70	0.410
0.000	50	11/19/78 10:00	0.000	4.04	31	1.64	0.390
0.000	4	12/22/79 4:00	0.000	3.99	32	1.59	0.370
0.000	27	12/30/80 23:00	0.000	3.87	33	1.54	0.350
0.000	18	10/08/81 22:00	0.000	3.69	34	1.49	0.330
0.000	30	1/08/83 6:00	0.000	3.63	35	1.45	0.310
0.000	45	11/24/83 9:00	0.000	3.62	36	1.41	0.291
0.000	37	11/11/84 9:00	0.000	3.53	37	1.37	0.271
0.000	25	1/19/86 1:00	0.000	3.46	38	1.33	0.251
0.000	13	11/27/86 1:00	0.000	3.43	39	1.30	0.231
0.000	32	12/10/87 8:00	0.000	3.43	40	1.27	0.211
0.000	38	11/25/88 2:00	0.000	3.26	41	1.24	0.191
0.000	11	1/09/90 18:00	0.000	2.96	42	1.21	0.171
0.000	8	11/24/90 19:00	0.000	2.78	43	1.18	0.151

0.000	22	2/01/92	0:00	0.000	2.69	44	1.15	0.131
0.000	48	3/23/93	9:00	0.000	2.67	45	1.12	0.111
0.000	49	2/17/94	22:00	0.000	2.55	46	1.10	0.091
0.000	16	12/27/94	21:00	0.000	2.46	47	1.08	0.071
0.000	5	2/09/96	7:00	0.000	2.34	48	1.05	0.051
0.000	2	1/03/97	3:00	0.000	1.85	49	1.03	0.031
0.000	44	10/30/97	12:00	0.000	1.68	50	1.01	0.011

IWS Overflow Analysis: WY 1956
Treatment Rate 2.65 mgd





PROJECT ENGR./ARCH.	
DESIGNER:	
DRAWN BY:	
SCALE:	
DATE:	1/99
FILE NAME:	P9SK002

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D
	1/99	K/J	UPDATE FIGURE	
	11/98	K/J	UPDATE FIGURE	
	10/98	K/J	UPDATE FIGURE	
	2/98	K/J	UPDATE FIGURE	
	12/97	K/J	UPDATE FIGURE	
	7/97	K/J	RELOCATED AND ADDED OUTFALL LOCATIONS	

PROJECT ENGINEER: SCALE:
DESIGNED: DATE:
DRAWN BY: CHECKED BY:
APPROVED BY:

PORT OF SEATTLE

SEA-TAC INTERNATIONAL AIRPORT

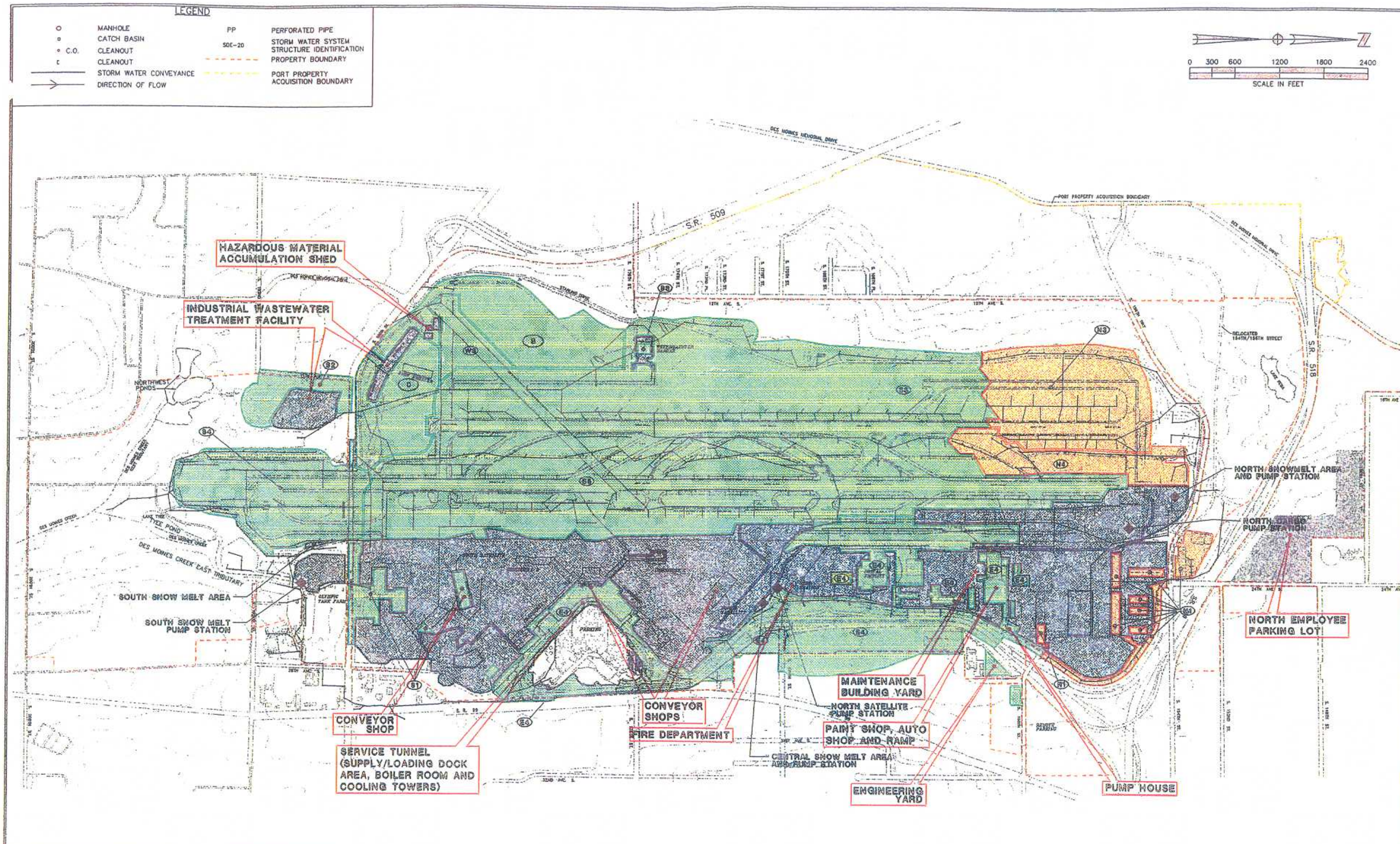
PORT OF SEATTLE
INDUSTRIAL ACTIVITY AREAS

WORK ORDER NO.

CONSULTANT'S NO. 976079.24

FIGURE NO. FIGURE II.1

AR 011243



LEGEND

- IWS DRAINAGE BASINS
- MILLER CREEK DRAINAGE BASINS
- DES MOINES CREEK DRAINAGE BASINS
- ◇ PUMPSTATION LOCATION

NO.	DATE	BY	REVISIONS DESCRIPTION	APP'D
6	1/99	K/J	UPDATE FIGURE	
5	11/98	K/J	UPDATE FIGURE	
4	10/98	K/J	UPDATE FIGURE	
3	2/98	K/J	UPDATE FIGURE	
2	12/97	K/J	UPDATE FIGURE	
1	7/97	K/J	RELOCATED AND ADDED OUTFALL LOCATIONS	

PROJECT ENGR./ARCH.	
DESIGNER:	
DRAWN BY:	
SCALE:	
DATE:	1/99
FILE NAME:	P9SK004

PORT OF SEATTLE

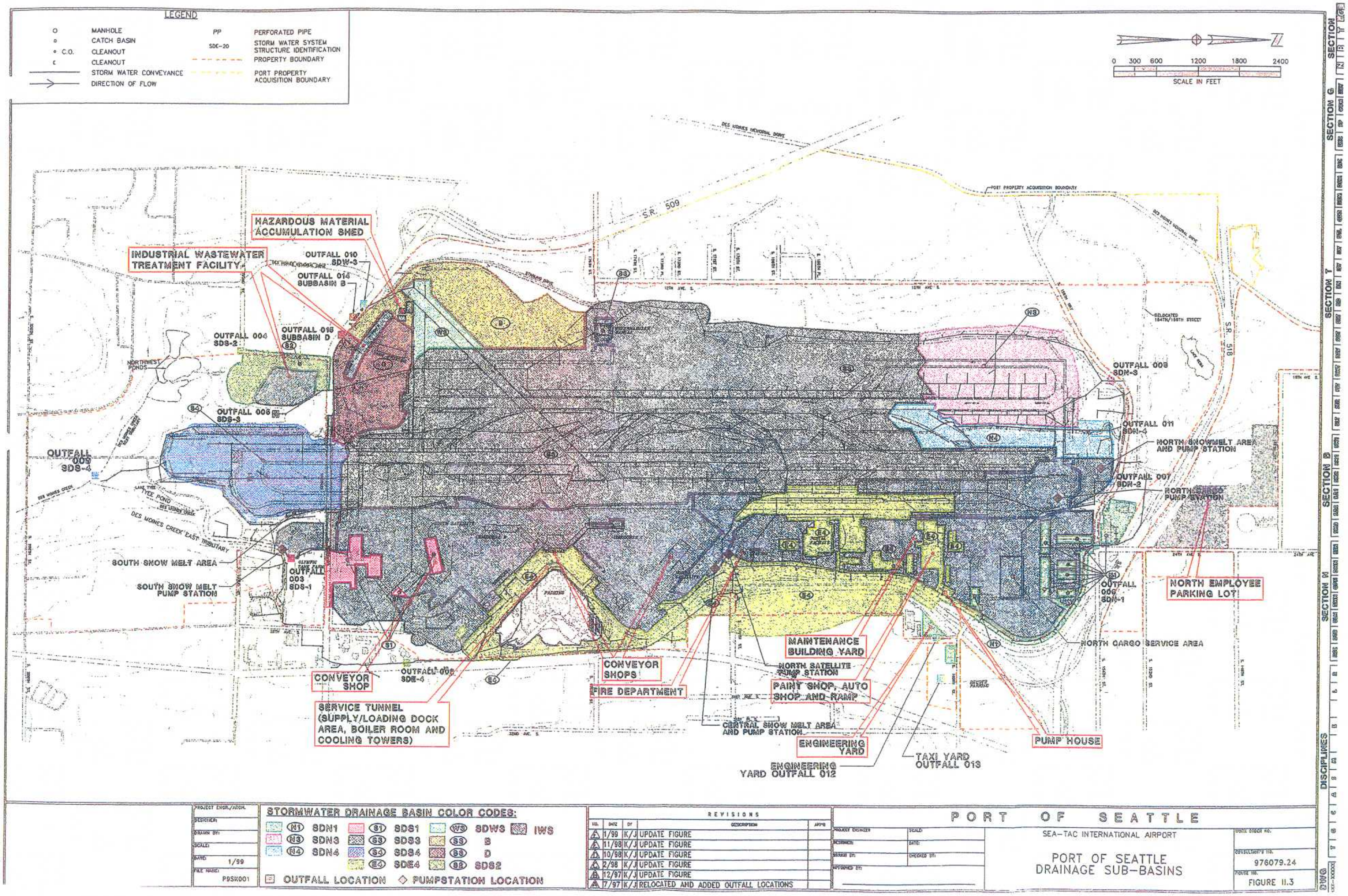
SEA-TAC INTERNATIONAL AIRPORT

PORT OF SEATTLE INDUSTRIAL WASTEWATER SYSTEM SERVICE AREA AND MAJOR DRAINAGE BASINS

CONSULTANT'S NO. 976079.24

FIGURE NO. FIGURE II.2

AR 011244


LEGEND
MANHOLE
CATCH BASIN
C.O. CLEANOUT
CLEANOUT
STORM WATER CONVEYANCE
DIRECTION OF FLOW
PP PERFORATED PIPE
SDE-20 STORM WATER SYSTEM STRUCTURE IDENTIFICATION
PROPERTY BOUNDARY
PORT PROPERTY ACQUISITION BOUNDARY
0 300 600 1200 1800 2400
SCALE IN FEET
S.R. 509
S.R. 518
HAZARDOUS MATERIAL ACCUMULATION SHED
INDUSTRIAL WASTEWATER TREATMENT FACILITY
OUTFALL 010 SDW-3
OUTFALL 014 SUBBASIN B
OUTFALL 004 SDS-2
OUTFALL 015 SUBBASIN D
OUTFALL 005 SDS-3
OUTFALL 009 SDS-4
NORTHWEST PONDS
DES MOINES CREEK
DES MOINES CREEK EAST TRIBUTARY
SOUTH SNOW MELT AREA
SOUTH SNOW MELT PUMP STATION
OUTFALL 003 SDS-1
CONVEYOR SHOP
OUTFALL 002 SDE-4
SERVICE TUNNEL (SUPPLY/LOADING DOCK AREA, BOILER ROOM AND COOLING TOWERS)
CONVEYOR SHOPS
FIRE DEPARTMENT
NORTH SATELLITE PUMP STATION
CENTRAL SNOW MELT AREA AND PUMP STATION
MAINTENANCE BUILDING YARD
PAINT SHOP, AUTO SHOP AND RAMP
ENGINEERING YARD
ENGINEERING YARD OUTFALL 012
TAXI YARD OUTFALL 013
PUMP HOUSE
NORTH CARGO SERVICE AREA
OUTFALL 006 SDN-1
NORTH EMPLOYEE PARKING LOT
OUTFALL 007 SDN-2
NORTH SNOWMELT AREA AND PUMP STATION
OUTFALL 011 SDN-4
OUTFALL 008 SDN-3
RELOCATED 154TH/156TH STREET
STORMWATER DRAINAGE BASIN COLOR CODES:
N1 SDN1
N3 SDN3
N4 SDN4
S1 SDS1
S3 SDS3
S4 SDS4
E4 SDE4
W3 SDW3
B B
D D
S2 SDS2
IWS
OUTFALL LOCATION
PUMPSTATION LOCATION
REVISIONS
1/99 K/J UPDATE FIGURE
11/98 K/J UPDATE FIGURE
10/98 K/J UPDATE FIGURE
2/98 K/J UPDATE FIGURE
12/97 K/J UPDATE FIGURE
7/97 K/J RELOCATED AND ADDED OUTFALL LOCATIONS
DATED 1/99
FILE NAME: P9SK001
PORT OF SEATTLE
SEA-TAC INTERNATIONAL AIRPORT
PORT OF SEATTLE DRAINAGE SUB-BASINS
976079.24
FIGURE II.3

C

Low Flow Analysis
Flow Impact Offset Facility Proposal

Port of Seattle

July 2001

Parametrix, Inc.

Port of Seattle

July 23, 2001

Ann E. Kenny
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

Dear Ms. Kenny:

SUBJECT: Low Streamflow Analysis, Summer Low Flow Impact Offset Facility Proposal, Seattle–Tacoma International Airport

This letter summarizes the Port of Seattle's evaluation of summer low streamflow impacts in Des Moines, Miller, and Walker Creeks calculated to result from proposed airport Master Plan Update projects. This letter also summarizes the Port's proposal to offset these impacts to maintain existing summer low streamflow conditions in these creeks post project. The methodology used to determine the effects and the plan to offset the impacts was developed and discussed in a series of meetings between the Port of Seattle (Port), Department of Ecology (Ecology), and King County, with staff from Floyd Snider McCarthy, Inc., acting as facilitators.

The evaluation and low streamflow impact offset proposal is final, subject to potential conditions associated with your review during 401 permit deliberations. The Port plans to submit final documentation of the low streamflow evaluation and operational plan for mitigation facilities in the form of a detailed Low Streamflow Analysis Report and Summer Low Flow Impact Offset Facility Operational Plan, outlines of which are included as an attachment to this letter.

Summary

The Port's proposal is to detain stormwater in underground vaults and release the detained water continuously into each creek during the summer low streamflow period at a rate equal to the calculated summer low streamflow impact to that creek from planned Port projects. The summer low streamflow impacts in each creek were determined through detailed modeling analysis. The summer low streamflow periods were determined through statistical analyses of modeled streamflow from the calibrated HSPF models and discussions with biologists on the effects of low streamflow periods on stream biology. Details of the analysis used to arrive at the proposed summer low streamflow offset periods, low streamflow magnitudes, impacts to summer low streamflows from Port projects, and sizing of the vaults are included as attachments to this letter A summary of the calculated summer low streamflow impacts and flow impact-offset proposal is listed below:

Seattle-Tacoma International Airport
P.O. Box 68727
Seattle, WA 98168 U.S.A.
TELEX 703433
FAX (206) 431-5912

	Des Moines Creek	Miller Creek	Walker Creek
Summer low flow period	July 24-October 24	August 1-October 31	August 1-October 31
2-year 7-day low flow (1994)	0.35 cfs	0.74 cfs	0.79 cfs
Port impact on streamflow[1]	0.10 cfs	0.13 cfs	0.09 cfs
Vault size needed	12.2 acre-feet	18.8 acre-feet	15.0 acre-feet
Maximum vault fill time	32 days[2]	58[3] days	282 days[3]

1 Difference between 1994 and 2006 2-year, 7-day low flow, including non-hydrologic impacts.
2 Vault filling starts January 1.
3 Vault starts filling November 30.

Vaults to detain stormwater for release during summer low streamflow periods were sized based on the duration within which summer low streamflows have historically occurred (generally +/- 90 days from late July through late October), the modeled impact to streamflow in each creek, and an allowance for precipitation events during the summer low streamflow periods that will partially refill the vaults. The resulting storage volumes (12.2 acre-feet in Des Moines Creek, 18.8 acre-feet in Miller Creek, 15.0 acre-feet in Walker Creek) will provide enough water every year to offset the impacts to streamflow throughout the historic summer low streamflow period. For two years within the period of record (1977 and 1979), the Walker Creek vault does not fill up entirely by the start of the summer low streamflow period. However, in these two years, rainfall that occurs during the summer low streamflow period provides enough water so that offset flows are provided throughout the entire summer low streamflow period. The vaults will include features (both structural and operational) for managing water quality to ensure there are no adverse impacts from discharges from the flow impact offset facility. Additional details on all these issues are presented in this letter.

Determination of the Duration of Summer Low Streamflow Periods

Determination of the summer low streamflow period for each creek was done by analyzing modeled streamflow from the calibrated HSPF model for each creek, which used 1994 (existing) land use conditions. The HSPF models for each watershed were calibrated by comparing model output with streamgauge data and adjusting model parameters until a satisfactory match was obtained. Additional low streamflow calibration information is provided in the attachments. Assumptions of model parameters (land use, basin delineations, impervious areas, etc.) are the same as detailed in the Comprehensive Stormwater Management Plan. The seven-day low flow period for each year (using 1994 flow conditions) in the 47-year period (1949-1995) for each creek was determined at points of compliance near the airport (200th Street in Des Moines Creek, SR 509 in Miller Creek, and at the outlet of the wetland near Des Moines Memorial Drive in Walker Creek). The seven-day low flow was selected as an indicator of persistent dry season flow. For example, a longer low streamflow would have the same or higher flow, since flows tend to have a downward trend (flows become gradually lower) before a storm increases flow. In addition, summer low streamflows tend to decrease gradually, therefore, a shorter low streamflow period is unlikely to result in significantly lower average flows or target flows. Finally, consultation with biologists concludes that summer low flows with durations of less than two weeks do not affect the carrying capacity of the creeks or cause behavioral changes to salmonids (see attachment).

The occurrences of the annual seven-day low flow periods were plotted and a histogram showing the distribution of the summer low flow periods was developed for each creek. The summer low streamflow period for each creek was selected to include all the historical seven-day low flow occurrences, with the exception of three specific occurrences during the forty-seven year record that occurred during November and December – periods typically associated with two of the three wettest months of the rainy season. The summer low streamflow periods for each creek are:

Des Moines Creek	July 24 through October 24
Miller Creek	August 1 through October 31
Walker Creek	August 1 through October 31

The Port's proposal is to provide water to offset the impacts to summer low streamflows throughout these time periods in each creek.

Determination of Streamflow Magnitudes (Target Streamflows)

The magnitude of existing summer low streamflow (target streamflow) in each creek was determined through analysis of the seven-day low flow periods under existing (1994) conditions described above. The annual seven-day low flows for each creek were ranked and recurrence intervals were determined based on this ranking. The seven-day low flow with a two-year (50 percent) recurrence interval was selected as the streamflow target in each creek. The two-year seven-day low flow was selected because the magnitude of the estimated impact to seven-day low flows decreases with greater recurrence interval; i.e., the estimated reduction in the seven-day two-year frequency low flow rate is greater than that for the seven-day, ten-year frequency low flow rate. Therefore, providing mitigation equivalent to the seven-day, two-year frequency impact will provide mitigation sufficient to mitigate all of the more extreme summer low streamflow events. Based on this analysis, the existing summer low streamflows (two-year, seven-day pre-project conditions) are determined to be:

Des Moines Creek	0.35 cfs
Miller Creek	0.74 cfs
Walker Creek	0.79 cfs

Determination of Impacts to Streamflow

The effects to flow during the summer low streamflow periods were determined by comparing modeled streamflows before project construction to modeled streamflows after project construction. Each creek has different post-development conditions that potentially affect low streamflow; therefore each has a different approach for determining impacts. In Des Moines Creek, 2006 land use conditions ("post-project") were modeled for the full 1949-1995 period of record. The seven-day low flow for each year was selected, ranked, and the streamflow with a two-year recurrence interval was determined. In Des Moines Creek, the two-year post project summer low streamflow is 0.25 cfs. The impact to streamflow from proposed Port projects is the difference between this flow and the existing pre-project summer low streamflow described above, as determined from the modeled 1994 ("existing") land use conditions (0.35 cfs). Therefore, the impact to summer low streamflows in Des Moines Creek from proposed Port projects is the difference between the post project and existing condition flows, or 0.10 cfs. The flow rate is the magnitude of offset that will be provided during the summer low streamflow period for Des Moines Creek described above (July 24 through October 24).

In Miller Creek, a different approach was applied because of the need to model the effect of the proposed runway embankment on streamflows. In areas where the embankment is proposed, recharge entering the embankment was calculated using the post-project HSPF model. The recharge was then input to the Hydrus-2D model, which simulated the spreading of recharge fronts through the unsaturated zone of the embankment fill. Output from the Hydrus-2D model were input to the "slice" model, which is a finite-difference groundwater model used to simulate flow through the proposed embankment underdrain layer. Output from the "slice" model was then input back into the HSPF model to determine the quantity and timing of discharge from the embankment, and the groundwater effects on Miller Creek. This approach was selected to accurately simulate the flow of groundwater through the proposed embankment. The analysis was a more discrete application of the Hydrus-2D and "slice" modeling approaches used in the Runway Fill Hydrologic Studies Report (Pacific Groundwater Group, June 19, 2000), prepared for Ecology.

For the post-project conditions in Miller Creek, the four-year period from 1991 through 1994 was modeled. This period was chosen as a representative dry period in the precipitation record. Output from the HSPF model was analyzed to determine the annual seven-day low streamflows for each of the four years. To determine the impact between 1994 (existing) low streamflow and 2006 (post-project) flows, the impact during 1991 was used. This year was selected because it was the only year in the four years of detailed embankment flow analysis that low streamflows were greater than the two-year flow. In Miller Creek, the estimated summer low streamflow impact due to the project is 0.11 cfs.

In addition to hydrologic impacts in Miller Creek, additional impacts, both positive and negative, will result from removal of septic tank flows (negative impact) and cessation of water uses for residential and agricultural uses (positive impact). The impact of these "non-hydrologic" changes in Miller Creek is an additional net -0.02 cfs (-0.08 cfs for septic tanks which is then adjusted by 0.7 for loss to DEEPFR; water use withdrawals are +0.04 cfs). The total Miller Creek impact (both hydrologic and non-hydrologic) is 0.13 cfs.

For the post-project conditions in Walker Creek, the entire record from 1949 through 1995 was used. To determine hydrologic impacts, it was assumed in the post-project (2006) model that new impervious areas and new fill area is simply removed from the model and can no longer contribute to low streamflow. This is a conservative assumption, since some precipitation will undoubtedly contribute to groundwater flow. This approach was chosen to allow for the largest impervious area possible to refill the Walker Creek low streamflow vault. The Port proposes to line the filter strips with impermeable material to collect infiltrated stormwater that will be directed to the low streamflow vault. The lined area (approximately six acres) does not exceed the effective impervious area used in the Comprehensive Stormwater Management Plan.

In Walker Creek, much of the groundwater that supports summer low streamflows comes from areas where surface water drains to Des Moines Creek or Miller Creek. Under existing (1994) conditions, approximately 630 acres of pervious land is included in the Walker Creek groundwater basin, which contributes to Walker Creek summer streamflows. Thirty-eight acres of new impervious area is proposed in the approximate area of the 630 acres pervious acre area. The thirty-eight acre area is adjusted (multiplied) by 0.86 to reduce the area to effective impervious area. The result (32.7 acres) is deducted from the 630-acre pervious area in the existing conditions model to determine the post project (2006) contribution to the Walker Creek groundwater basin.

To determine the magnitude of the hydrologic impact in Walker Creek, the seven-day low flow for each year was selected, ranked, and the streamflow with a two-year recurrence interval was determined for existing (1994) and post-project (2006) conditions. The two-year 1994 seven-day low streamflow is 0.79 cfs; the 2006 summer low streamflow is 0.71 cfs. Therefore, the impact to summer low streamflow in Walker creek from proposed Port projects is the difference between the post-project and existing conditions flow, or 0.08 cfs.

In addition to hydrologic impacts in Walker creek, additional impacts will result from the removal of septic tanks. The impact of this change in Walker Creek is an additional 0.01 cfs (0.014 cfs for septic tanks which is then adjusted by 0.7 for loss to DEEPFR). The total Walker Creek impact (both hydrologic and non-hydrologic) is 0.09cfs.

Based on the analyses described above, total net summer low streamflow impacts that the Port proposes to offset throughout the summer low streamflow periods in each creek are:

Des Moines Creek	0.10 cfs
Miller Creek	0.13 cfs
Walker Creek	0.09 cfs

Sizing/Filling of Vaults and Vault Release

Several of the stormwater vaults proposed in the Comprehensive Stormwater Management Plan will have storage areas sized and designed to detain the volume of water needed to continuously release a flow equivalent to the calculated summer low streamflow impacts throughout the summer low streamflow duration in each creek. The vault sizes were calculated in the following manner: the offset flow rate was multiplied by the duration of the summer low streamflow period. Analysis of precipitation records show that some amount of rainfall always occurs during the summer low streamflow period. Rainfall amounts during the summer low streamflow period from the worst (driest) year on record were converted into a volume based on the amount of impervious area that drains to each vault. This water was subtracted from the total volume to arrive at the final volume. These calculations were done on a daily basis to account for the dynamics of filling and draining the vaults throughout the summer low streamflow period in each creek. This conservative approach assures that the volume of water needed to offset the impacts to summer low streamflow will be available in a range of extreme conditions such as those found in the 47-year period of record. The net storage volumes of water needed for each creek are:

Des Moines Creek	12.2 acre-feet
Miller Creek	18.8 acre-feet
Walker Creek	15.0 acre-feet

The vaults will be filled each year during the winter, by closing the flow offset discharge outlet no later than January 1 each year, allowing stormwater to accumulate in the vaults. Analysis of historical rainfall records and the amount of impervious area that drains to each vault were used to determine the length of time required to fill the vaults. This length of time was applied to the beginning of the summer low streamflow period in each creek (the date the flow impact offset would start each year) to determine when to begin accumulating water. Based on this analysis, the maximum time needed to fill the vaults during the period of record are:

Creek	Closure Date	Longest Fill Time in Record
Des Moines Creek	January 1	32 days
Miller Creek	January 1	58 days
Walker Creek	December 1	282 days

The impervious area in each basin used to fill the vaults is as follows:

Des Moines Creek	234 acres impervious area
Miller Creek	82 acres impervious area
Walker Creek	3.5 acres impervious area
	6 acres lined pervious area
	2 acres Pond F cover

It is important to note that using the period of record (except for the worst (driest) year on record), the vaults will always have water remaining in them at the end of the summer low streamflow period. The Port proposes to continue releasing this water at the determined flow rate for as long as possible before the vault outlets are actually closed (after the end of the summer low streamflow periods). The operational plan will call for the vaults' outlets to be closed no later than January 1 each year to allow the filling of the vaults to take place when precipitation is generally most abundant.

Water Quality Considerations

The Summer Low Streamflow Impact Offset Facilities will be designed and operated to avoid in-stream water quality violations. Class AA water quality standards are used as the applicable in-stream standards. Water quality parameters of concern include dissolved oxygen, temperature, turbidity, copper, lead, and zinc. A variety of best management practices (BMPs), facility designs, and monitoring programs are proposed (or already in place) to ensure that in-stream water quality violations will not result from operation of the flow offset facility.

Structural features of the vaults include sediment traps, settling areas, and special placement of inflow and outflow pipes to reduce turbidity, vents to allow air circulation to enhance aeration, placement of inlets to facilitate periodic flushing with "fresh" stormwater, and discharge pipes configured to enhance passive aeration. The underground configuration of the vaults will facilitate temperature management. Provisions are included to allow for additional filtration and aeration of discharges, as needed. BMPs in place in the drainage areas on the airfield will minimize the amount of sediment that will enter the vaults. An extensive water quality monitoring program is proposed to characterize the water discharged from the offset facility, and to ensure that the facilities can be managed and operated without causing in-stream water quality violations.

Operational Plan

A detailed operation, maintenance, and monitoring plan will be completed for the summer low streamflow impact offset facilities. The operational plan proposes an annual schedule of activities to ensure that the facilities are meeting performance goals. An adaptive management system is proposed to allow the operation of the facilities to be refined as experience is gained. The vaults will be monitored as they are filled and as water is released. Periodic monitoring of water quality will be completed, both of the discharge water and in the creeks, to ensure that water quality criteria are not violated in the creeks. Biological monitoring is proposed as part of the Natural Resources Mitigation Plan. This monitoring will evaluate changes in the Benthic Index of Biotic Integrity (BIBI) over a ten-year period.

Information provided for review attached to this letter include:

- Outline of Summer Low Streamflow Flow Analysis and Summer Low Streamflow Impact Offset Facility Operations Plan
- Selected Draft sections of Summer Low Streamflow Impact Offset Facility Operations Plan
- Technical backup material for low flow impact evaluation and impact offset proposal including the following
  - Des Moines Creek
  - Miller Creek
  - Walker Creek
  - Stream Biology Information
  - Embankment Modeling Information
  - Non-Hydrologic Analysis
    - Methodology
    - Data (electronic only)
  - Daily Average Creek Flows (electronic only)

In addition, selected model data files have been electronically sent to Kelly Whiting for his review.

Please contact me at 206/988-5528 if you have any questions.

Sincerely,

Keith R. Smith
Water Resources Manager

C: Kelly Whiting, KCDNR

AR 011254

Draft Low Flow Analysis/Flow Effect Offset Facility Report

- **Executive Summary**
  - Report summarizes effects to streamflow in Miller, Walker, and Des Moines Creeks caused by proposed Port projects and associated "non-hydrologic" effects (buyouts, displaced water use/irrigation/septics/etc.) and provides a flow offset facility/plan
  - Impacts of embankment seepage were modeled using a combination of tools (HSPF, Hydrus, Slice) for an agreed upon dry period (1991-1994)
  - Non-hydrologic effects were combined with modeled effect to determine net effects to streamflow
  - Result was the effect on streamflow from the project (CFS)
  - That impact was used to calculate the amount of stormwater needed to be detained for release during summer low flow periods
  - This calculation was based on release rates, refilling (precip), and vaults not going dry
  - Seven vaults will provide reserved storage and release at appropriate rates to offset impacts
  - Vaults will include design considerations for water quality treatment
  - Operational plan will include test releases and monitoring to ensure water quality meets standards
  - Regular maintenance will be performed to ensure proper function
  - Performance standards will be (have been) developed
    - Water always available to discharge at needed Q throughout summer low streamflow period
    - In-stream WQ standards met throughout operation
  - Refinements can be made based on observed performance

- **Introduction**
  - Purpose of Report
  - Organization of Report
  - Relationship to other documents (SMP)
  - Project description
    - Master Plan, Third Runway Embankment
    - Impacts to Streamflow
    - Low Flow Analysis
    - Mitigation Plan
    - Objectives of flow offset plan

- **Determination of impacts to streamflow**
  - Brief description of overall approach
    - Compare modeling of existing conditions to modeling of post project conditions to determine effect to streamflow
    - Existing condition determined by HSPF modeling in SMP
    - Post project condition (embankment) determined by slice, hydrus, and HSPF modeling to determine flow and timing impacts of embankment

- Post project condition modeling uses 1991-1994 precipitation (dry period)
- Non-hydrologic effects conservatively estimated, converted into daily time series, and input to model of built condition
- Result of post project condition modeling gives (total) impact to streamflow of Port's projects
- This results is applied to a spreadsheet analysis and used to size storage to provide offset water throughout summer

- o Modeling of Existing (Pre-embankment) Conditions -HSPF approach – pull language from SMP and frame for low flow
- o Modeling of Proposed (Built embankment) Conditions
  - Summary of HSPF/Hydrus/Slice Modeling Approach
  - Results of Embankment Modeling
- o Non-hydrologic effects on flows
  - Changes/revisions based on SMP
  - Conversion to time series for inclusion in HSPF modeling
- o Results of all impacts to streamflow/net effect to streamflow

- **Mitigation of Impacts (Reserved Stormwater Release)**
  - o Methodology used to size/design stormwater vaults
    - Criteria
    - Spreadsheet analysis based on discharge rates and periodic refilling from rainfall
    - Refilling based on rainfall in driest year in period of record (1949-1995)
  - o Performance standards
    - Always able to meet flow offset requirements (vaults never go dry during summer low streamflow periods)
    - Instream water quality standards met
  - o Water Quality Design Aspects
    - ▪ Sediments/Turbidity
      - Discussion of water quality standards for turbidity
      - Airfield BMPs minimize sediments/turbidity getting into vaults (typical)
      - Compartmentalized dead storage (typical)
      - Floor sloped away from outlet (typical)
      - Allow for installation/operation of filters if test releases show turbidity of reserved releases won't meet standards (reserved outlets only)
    - ▪ Temperature
      - Discussion of water quality standards for temperature
      - No special design considerations for temperature

- Nature of underground vaults ensures that water will be relatively cool compared to typical summer stream temperatures
- Port collecting temperature data from existing vaults starting summer 2001 to provide baseline data

▪ Dissolved Oxygen
  - Discussion of water quality standards for DO
  - No oxygen consumption in vaults (low BOD, no solar radiation driving biological activity that would consume oxygen)
  - Inlet to vaults positioned to allow flushing of reserved area to prevent accumulation of stagnant (potential low DO) water
  - Passive aeration provided by turbulent flow in steep discharge pipes and energy dissipaters at/near outlets
  - Air vents provided to allow supply of fresh air for passive aeration
  - Provide for (portable) aerators if DO still too low or if slopes not sufficient to aerate water
    - o List possible/applicable technologies (microbubble diffusers, gas injection, air injection, aeration hose)
    - o Discuss each reserved stormwater outlet
    - o Selection will be made as part of final design

▪ Nutrients
  - No water quality standards to meet, but possibility of algae blooms in summer has been raised as a concern
  - Usually a concern in lakes and ponds, none in creeks downstream of airport, residence time of water in creek only a few hours
  - No special design considerations proposed for nutrients
  - No fertilizers used on airfield
  - Bioswales provide treatment
  - No solar radiation in vaults to stimulate algae growth

▪ Metals
  - Discussion of water quality standards for metals
  - Airport water quality data show that (total recoverable) metals in airfield runoff lower than typical urban stormwater
  - Higher metals in airport runoff associated with non-airfield basins, which won't be providing water to reserved stormwater vaults
  - Most metals associated with particulates, data shows low dissolved metals in discharges
  - Vault design and BMPs for turbidity will be effective in reducing total metals (list again)

o Other

▪ Reserved stormwater discharge points will be the same as normal stormwater discharge points – no additional HPAs needed

- Discussion of valve/outlet location for each proposed reserved stormwater vault relative to creeks
- Security – facilities and controls located inside airport fence to minimize vandalism potential
- Performance – POS will continue to operate/inspect/monitor/report/maintain system throughout its life; adjustments/refinements can be made based on observed performance

- **Operational Plan/Annual schedule of activities**
  - Before initial operation port will submit to Ecology a operations/maintenance/monitoring plan containing:
    - Monitoring/sampling protocols (follow NPDES permit requirements) and schedule
    - Specific monitoring locations (discharge and in-stream)
    - Recording/reporting plan
    - Detailed operation plan based on proposal below
    - Inspection/maintenance plan
    - Summary of characterization of discharge and creeks' water quality during summer seasons, based on existing data or data collected prior to implementing facilities
  - Calendar Year Operating Schedule
    - Jan – June (varies by vault)– operate as normal stormwater vaults, flow offset outlet closed to accumulate water
    - June/July – small test release from each vault
      - Confirm discharge rate (gage/measure flow)
      - Sample specified in monitoring plan
      - Compare samples to existing or collected data from creeks from summer (when reserved stormwater discharges would be occurring)
      - Review existing data to see if summer low flow water quality is adequately characterized by data. If not, collect during next few summers (prior to facilities going on-line) to characterize. This work will be included/discussed in final monitoring plan submitted to Ecology prior to implementation.
      - If potential water quality violations are indicated, take appropriate actions prior to initiating operational discharge, such as:
        - Install/maintain filters for sediments/turbidity/metals
        - Install portable aerators for DO
        - No actions proposed for temperature and nutrients
    - July/August - Open each flow offset outlet on date specified in analysis
    - July – October – inspect/monitor operation of each discharge
      - Sample per monitoring plan
      - Any water quality violations will be immediately investigated and corrected

            - If data show water quality standards are consistently being met after (at least) one year of operation, Port may submit/modify monitoring plan.
        - November – December – Drain, inspect, maintain, operate as normal stormwater vault
        - December/January – close flow offset outlet to begin accumulating water

    - Monitoring Plan
        - Characterization of expected water quality
        - Monitoring of Test Discharges
        - Operational Monitoring
        - NRMP BIBI monitoring
        - Reporting
        - Monitoring/Analysis Protocols

    - Maintenance Plan
        - Refer to Port's stormwater maintenance plans for typical vault maintenance
        - Each reserved stormwater vault will have an operational manual/maintenance plan and schedule developed for it as part of final design which will be submitted to Ecology prior to implementation
        - Typical maintenance includes periodic inspection of vaults, discharge structures, valves, discharge points, etc.
        - At least annual removal of sediments, etc.

- **Summary**
    - Effects to streamflows calculated based on modeling and spreadsheet analysis, both based on selected period (1991-1994) representing dry period
    - Design, operation, and monitoring plan will ensure that system operates as designed and water quality standards are met
    - Airport/POS staff will be managing facility in perpetuity.
    - Adjustments/refinements to system can be made based on observed performance

- Appendices
    - Non-Hydrologic Impacts
    - Modeling
        - Existing Conditions (HSPF)
        - Built Conditions (Slice/Hydrus/HSPF)
    - Design Considerations
        - Aerators
        - Filters (media?)
    - Sample O&M Plan
- Other Appendices?

Executive Summary

This report presents the analyses performed to estimate the timing and volume of discharges to local receiving streams and wetlands during low flow periods from Seattle-Tacoma International Airport (STIA) considering improvements defined in the Port of Seattle's Master Plan Update. This report also presents a Flow Impact Offset Facility Plan, which is the Port's proposal to offset impacts to flows in the receiving waters during annual low streamflow periods, typically experienced in late summer/early fall. The plan is based on a detailed evaluation of the hydrologic impacts of the proposed third runway embankment and associated non-hydrologic impacts on streamflow in Miller, Walker, and Des Moines Creeks. This report, an update of the Low Flow Analysis prepared by Earth Tech in December 2000, is submitted for consideration by the Washington State Department of Ecology in reviewing permit applications related to the proposed Third Runway project. This report builds upon previous reports by Earth Tech and Pacific Groundwater Group. Analyses presented in this report were prepared by Earth Tech, Pacific Groundwater Group, AquaTerra, and Parametrix. The Washington Department of Ecology was consulted throughout the development of the plan to ensure that agency concerns are addressed in this report.

Impacts to streamflow in the three creeks were evaluated using a suite of modeling tools. The Hydrologic Simulation Program – FORTRAN (HSPF) was used to develop overall stormwater models of STIA (existing conditions and proposed conditions), as described in the Comprehensive Stormwater Management Plan (CSMP) (Parametrix 2000). These models were also used to evaluate stormwater flows and volumes in the low flow analysis. The hydrologic properties of the proposed third runway embankment were modeled using a combination of

Hydrus-2D and a finite-difference "slice" model. Hydrus-2D was used to simulate the movement of water between the root zone and water table in the proposed embankment, and the slice model was used to simulate the movement of water through the saturated portion of the proposed embankment. Results of the Hydrus and Slice modeling, along with the associated non-hydrologic impacts, were incorporated back into the HSPF model to estimate the post construction flows. By comparing these model results to the pre-project conditions model, the impacts of the proposed embankment on streamflows were determined. Statistical analyses of model output, precipitation and streamflow data for the available period of record predicted a net low-flow impact to Miller Creek of 0.19 cubic feet per second (cfs) 0.08 cfs in Walker Creek, and 0.10 cfs in Des Moines Creek..

The Port's proposal to offset effects to low streamflow is to detain stormwater runoff and release it to the impacted creeks during the predicted annual low streamflow period. The volume of water required to offset the predicted impacts was determined by multiplying the predicted impact for each creek by the duration of the summer low streamflow period (+/- 90 days from late July through late October). The resulting volumes of stormwater (__ acre-feet for Miller Creek, __ acre-feet for __ Creek) were incorporated into selected proposed stormwater vaults in each watershed. Several considerations are proposed to be included in the design of these vaults to allow the management of stormwater discharges to offset the predicted low-flow impacts. Additional considerations in the design and operation of the proposed stormwater vaults to improve the water quality of discharges will also be included. In addition, an analysis of the availability of stormwater required to fill the vaults showed that even during the driest years in the period of record, enough water can be collected and stored to offset the impacts to streamflow during the annual low streamflow period.

Key goals and objectives (performance standards) of the proposed Flow Impact Offset Facility include:

- Always being able to provide flow at the rate required to offset the predicted impacts of the proposed embankment for the entire 92-day annual low streamflow period each year.
- Operate the facility to prevent in-stream water quality violations during the annual low streamflow periods.
- To design the facility and its operation, monitoring, and maintenance plan so that an adaptive management strategy can be applied.

As stated in Ecology's draft Stormwater Management Manual for Western Washington, the objective of stormwater management is to "control the quantity and quality of stormwater produced by new development and redevelopment such that they comply with water quality standards and protect beneficial uses of the receiving water." The Department of Ecology has determined that stormwater management activities in Washington state do not require a water right. Since the Port's proposal to offset flow impacts to the receiving waters consists of stormwater management activities, a water right is not required for the flow Impact Offset Facility.

Introduction

The purpose of this report is to evaluate the impacts to streamflows in Miller, Walker, and Des Moines Creeks resulting from construction projects included in the Master Plan Update for Seattle-Tacoma International Airport, and to propose a Flow Impact Offset Facility to mitigate the impacts during low streamflow periods. The principal projected expected to impact streamflows in the creeks is the third runway embankment.

Section not complete

Water Quality Design Aspects

The Washington State Department of Ecology (Ecology) has defined standards for water quality related to stormwater release, including periods of low flow. Ecology has jurisdiction to monitor and enforce these standards through their National Pollution Discharge Elimination System (NPDES) Permit. These standards include turbidity, dissolved oxygen, temperature, and dissolved metals. The Port's current stormwater design plans for the third runway expansion include a stormwater system and operational procedures to provide the storage and managed release of stormwater during low flow periods. These stormwater storage facilities employ biofiltration strips, catchbasins, detention ponds and vaults to meet current King County water quality requirements. In addition, the facilities are designed to be retrofit according to the Ecology water quality measures if specific water quality concerns are identified during post construction monitoring. The Port's monitoring and reporting program (see Section XX) is proposed to assess the performance of the facilities, allowing adaptive management to be used in the implementation of additional water quality measures to ensure that standards will continue to be met.

Des Moines, Miller, and Walker Creeks are all assumed to be Class AA (extraordinary) waters (WAC 173-201A-030). As such, the water quality standards discussed in this report are those listed for Class AA water bodies, which are the most stringent standards. Water quality standards for metals are based on toxicity, are independent of the receiving water classification, and are listed in WAC 173-201A-040 (Toxic substances). Although Ecology's proposed revisions to water quality standards from a class-based system to a use-based system is not expected to impact the design and operation of the proposed facility, the Port will further evaluate the proposed changes as part of the final design process and make any needed changes to the facility.

The state water quality standards applicable to the managed release of stormwater to offset flow impacts are discussed below. Specific design features, assumptions and other information considered in the design of the facility are included. Operational and monitoring proposals are presented in section xxxx. References to stormwater vaults refer only to those vaults proposed to detain stormwater to offset impacts to streamflows. Likewise, references to stormwater and stormwater discharges refer only to the managed release of stormwater to offset flow impacts.

Turbidity

The state water quality standard for turbidity in class AA waters is a two tier standard. For receiving water with turbidity less than or equal to 50 NTU (background flow), discharged water may not increase the receiving waters more than 5 NTU over background. For receiving water with turbidity greater than 50 NTU, discharged water may not increase turbidity of the receiving waters more than 10 percent. Turbidity levels in the creeks vary between less than 5 NTU to over 1,000 NTU. The lowest turbidity levels in the creeks generally occur during low streamflow (baseflow) conditions, which correspond to the majority of periods when the stormwater would be released to the creeks to offset flow impacts. It is assumed that the releases of stormwater to offset flow impacts would have to meet the 5 NTU standard most, if not all of the time. To minimize the need to provide constant background level monitoring of the creek above and below the release locations, releases can be limited to 5 NTU or less in order to be in compliance at all times.

There are several operational considerations and water quality Best Management Practices (BMPs) on the airfield to reduce the sediment and turbidity levels in runoff water going into stormwater storage. The Port uses catchbasins, the Industrial Wastewater System (IWS) system, and biofiltration strips as BMPs on the existing airfield, and the SMP proposes to retrofit the existing airfield with additional sediment trap BMPs in the bottom of each new detention vault facility. The new airfield surface will incorporate similar BMP's to minimize the amount of sediment and suspended solids that get into the stormwater vaults. The primary BMP consists of the construction of biofiltration strips in the new and existing airfield areas that treat stormwater as it drains directly from impervious areas of runways and taxiways. The Port will also maintain catch basins to ensure they continue to trap sediments. Filter strips are already in place in the existing Taxiway "C" airfield area that drains to the stormwater vault (SDS3) located in the Des Moines Creek watershed (see Section 7 in the Comprehensive Stormwater Management Plan). In addition, the airfield is a controlled area subject to very low levels of travel by ground vehicles and frequent cleaning and inspection for debris that could be harmful to aircraft. Consequently, the airfield is generally much cleaner than most urban areas that generate stormwater runoff.

There are also operational procedures outlined in the airport's Stormwater Pollution Prevention Plan (SWPPP) that will minimize opportunities for sediment and suspended solids to enter the stormwater vaults. These include:

- Sweeping ramp areas several times per week.

- Annual inspection of catch basins and cleaning if the depth of sediment equals or exceeds one-third the depth from bottom of the basin to the invert of the lowest pipe.

- Proper storage and disposal of sediment removed from catch basins.

- Hydroblasting of runway skid-mark rubber. Water and removed rubber is vacuumed by the same machine, drained, and deposited at the decant station until disposed as solid waste.

All of these BMPs will limit the amount of sediments and suspended solids that enter the stormwater vaults, and therefore will reduce the turbidity of the water stored in the vaults and discharged to the creeks.

All of the proposed stormwater vaults, including those associated with the Flow Impact Offset Facility, employ features designed to provide treatment (settling and removal) of suspended solids and turbidity. These features include:

- Dividing the dead storage area (similar to the areas in the vaults where the stormwater detained to offset flow impacts will be held) into several compartments by constructing short walls within the dead storage area of each vault. The compartments allow areas for suspended solids to settle out and be contained. Each compartment's outlet will be configured so that the suspended solids are captured in the compartments during low flow release periods. Design considerations of this type are typically included in stormwater vaults. Details will be provided at final design of the stormwater vaults.

- The vaults will include an extra 6-inch depth for the first third of the bottom (minimum) to facilitate trapping sediment that reaches the vault.

- Maintenance of the vaults will remove and properly dispose of collected sediments prior to the anticipated low flow release periods.

- The vaults will be designed to allow installation of additional water quality measures, if needed. Additional water quality features may include filtration of the discharges.

The design of the stormwater vaults, in combination with the operational and monitoring considerations discussed below, will assure that release of stormwater will not cause violations in the turbidity standards. The Port is currently investigating filtration of stormwater associated with discharges from a landside drainage basin. This research includes determining the effectiveness of several filtration media in treating the stormwater. The results of this study will be completed before final design of the flow offset facilities, and the data will be used to select the filtration method most appropriate to treat the stormwater discharge, if needed.

Operational and monitoring considerations for the Flow Impact Offset Facility for turbidity are discussed in Section xxxx.

Temperature

The state water quality standard for temperature in class AA waters is not to raise the temperature of the receiving water to over 16 degrees Celsius. If the baseline temperature of the receiving water is greater or equal to 16°C discharges cannot raise the temperature more than 0.3 ° C. To date, Ecology has not applied these requirements to stormwater discharges, although they have required temperature monitoring of certain stormwater discharges. Ecology could apply the temperature standard to future stormwater discharges.

The highest annual temperatures in the creeks are usually reached during the summer months, which is the period when the Flow Impact Offset Facility is expected to be in operation. Solar radiation is the primary mechanism by which stormwater temperatures increase in detention ponds. Since the stormwater vaults are typically underground structures (although some be partially exposed), there will be no direct solar warming. Underground storage provides a constant temperature that will be lower than open storage facilities, more closely matching a native seep temperature. Water release from the Flow Impact Offset Facility is not expected to increase the in-stream water temperature at all. Since the proposed underground stormwater vaults will result in relatively cool water being discharged, no special design considerations are proposed to manage water temperatures in the vaults associated with the Flow Impact Offset Facility.

The Port is collecting water temperature data from existing stormwater vaults in order to characterize the expected temperatures of the reserved stormwater discharges. Commencing in the summer of 2001, average daily water temperature data is being collected from the North

Employee Parking Lot vault and the SDS3 vault located near the south end of the airfield. Data will be collected from June though October of each year from the dead storage area of each vault. These existing vaults were selected because they are similar in size to the proposed stormwater volumes associated with the Flow Impact Offset Facility. The NEPL vault is partially exposed to sunlight (on its west side and top) while the SDS3 vault is completely underground. By collecting temperature data from both vaults, a range of expected temperatures can be established. Temperature data will be collected from the dead storage zone in each vault in order to approximate the vaults associated with the Flow Impact Offset Facility. This data will be compared to stream temperature data also being collected by the Port to characterize any cooling effects of stormwater releases on water temperatures in the creeks.

Operational and monitoring procedures for the Flow Impact Offset Facility for temperature are discussed in Section xxxx.

Dissolved Oxygen

The state water quality standard for dissolved oxygen (DO) in Class AA waters is 9.5 milligrams per liter (mg/l). Low DO levels in creeks during summer low flow periods is a potential water quality concern. The Flow Impact Offset Facility will be designed and operated in a manner that will not decrease the DO levels in the creeks, and under typical conditions, may actually increase DO levels.

Dissolved oxygen levels in the stormwater vaults will not be significantly reduced while the water is stored. There will be little, if any, biological activity in the vaults that could consume oxygen as a result of the lack of sunlight and the low biological oxygen demand (BOD) typically seen in stormwater runoff from the airfield (Annual Stormwater Monitoring Report, September 2000). The infrequent and short-lived episodes of elevated BOD due to runway deicing activities are not expected to impact the DO concentrations of the stormwater detained in the Flow impact Offset Facility because the stormwater associated with these events moves through the stormwater management system in a matter of hours, is replaced with runoff with the low BOD concentrations more typical of airport runoff (Deicing/DO Study Report, November 2000), and typically happens during the early winter months when reserved stormwater releases from the Flow Impact Offset Facility would not take place. In addition, the Port operates BMPs to remove snow containing deicing chemicals (a potential source of BOD) to snowmelt areas that drain to the Industrial Wastewater System, further reducing the BOD in water that drains to stormwater vaults.

Vents will be included in the stormwater vaults associated with the Flow Impact Offset Facility to allow for the circulation of fresh air to occur. This will help maintain the dissolved oxygen concentration of the stormwater.

An additional design consideration is the positioning of the inlet(s) to the stormwater vaults associated with the Flow Impact Offset Facility. The inlet(s) will be placed lower in the vault in order to facilitate flushing of the vault each time there is sufficient rainfall to generate stormwater runoff. Typically, stormwater inlets in vaults are placed at higher elevations within the vault. As a result, water in the lower or dead storage areas may not be circulated and may stagnate. By placing the inlet at a lower elevation, water already in the lower portions of the vault will be displaced by the incoming water and will not have the opportunity to stagnate. By continually replacing the water in the stormwater vaults, the dissolved oxygen levels in the stormwater in the vaults will benefit. Each stormwater vault associated with the Flow Impact Offset Facility will have its inlet position carefully considered during the final design phase, and placed to enhance this circulating effect.

Passive aeration of stormwater can be achieved through natural turbulence or agitation of the discharges. Steeply sloped pipes with periodic drop structures will be required to move the water from the vault outlets to the creek elevation. An energy dissipating structure will be required near the release point at creek level to slow the velocity adequately for entering the creek safely, without causing scour or erosion. Both the steeply sloped discharge pipes and the energy dissipating structures will provide the turbulence or agitation needed to provide passive aeration. The Pond G storage vault is located within the runway embankment and has adequate fall from the vault outlet to the creek discharge location to provide aeration.

Where insufficient fall is available for this natural aeration process, the installation and operation of aeration devices may be necessary. Other vaults are located near the level of the creek discharge elevation such that active aeration measures may be required through the installation of some type of aeration device. Active aeration systems that could be utilized include microbubble diffusers, gas injection, air injection, mechanical aerators, or aeration hoses. Microbubble diffusers consist of a porous ceramic plate (similar to aquarium aeration stones) and a pump to inject air through the plate. Gas and air injection systems inject a controlled amount of gas or air under pressure into the discharge water pipe. Mechanical aerators physically agitate water and allow air to become mixed with the water. Aeration hoses are flexible porous rubber hose, and have air pumped through them similar to the microbubble diffusers. Information on each of these devices is included in Appendix xx. Although the selection of the device(s) to be installed will be made during the final design of the Flow Impact Offset Facility, it is likely that the microbubble diffuser will be selected and installed because of their simplicity, effectiveness, cost, and ability to be installed in the discharge pipes. Other attractive features of the microbubble diffuser include low maintenance requirements, their use of a small compressor or pump to provide air instead of the use of compressed gas tanks, and their ability to be automated to function anytime the reserved stormwater discharge valve is open. Currently, the Flow Impact Offset Facility vaults associated with SDN3X, SDN2X/4X, SDN1, Cargo, NEPL, SDS4, SDW3A, and SDW2 may require aeration of their discharges through the installation of aeration devices.***(need to update this section based on final selection of vaults in facility)***

Operational and monitoring considerations for the Flow Impact Offset Facility related to managing dissolved oxygen are discussed in Section xxxx.

Nutrients

There are no water quality standards for nutrients in the current water quality standards. However, nutrients typically found in stormwater could be of potential concern. If nutrient-rich stormwater is stored for long periods of time, exposure to solar radiation can cause algae blooms. However, it is expected that there will be no adverse water quality impacts associated with nutrients in the release of stormwater for the following reasons:

- There is no significant source of nutrients associated with the airfield areas (i.e., sources of water for the Flow Impact Offset Facility). Primary sources for nutrients in urban stormwater are fertilizers applied to lawns and landscaped areas. However, the grass infield areas of the airfield are not fertilized or irrigated because lush growth could become a wildlife attractant concern. Any landscaped areas to which fertilizers are applied are located near the terminal, and drain to stormwater basins that do not contribute flow to the Flow Impact Offset Facility. The Port's use of fertilizers includes applying the BMPs listed in the airport's Stormwater Pollution Prevention Plan, which further reduces the amount of fertilizers and nutrients that enter stormwater. With careful management of fertilizer use at the airport, there is no major source of nutrients for the drainage areas that contribute stormwater to the Flow Impact Offset Facility.

- The operation of BMPs on the airfield (biofiltration swales) would reduce the opportunity and concentrations of any nutrients that exist prior to the stormwater entering the vaults.

- Since the vaults are underground facilities, there is no sunlight that would stimulate the growth of algae often associated with elevated nutrient levels.

- In-stream residence time for the stormwater discharged from the Flow Impact Offset Facility is only a matter of hours (the time it takes water to flow from the discharge points in the airport vicinity to the creeks' discharge points in Puget Sound). Therefore, there will be minimal opportunity for biological activity (algae blooms) in the creeks. Such water quality impacts from nutrients are typically associated with lakes and ponds, where long residence time would provide the opportunity for excess algae growth to occur. Since no lakes or ponds occur in the creeks between the airport and Puget Sound, this is not an issue.

Given the above, the Port does not propose any monitoring for nutrients in the discharges from the Flow Impact Offset Facility. Through continued implementation of the SWPPP, the BMPs currently in place that manage the use of fertilizers will continue to minimize the opportunities for nutrients to enter stormwater runoff.

Metals

Metals of concern include copper, lead, and zinc. Water quality standards for metals are based on the dissolved fraction, are dependant of the hardness of the water, and are applicable to the receiving waters. Chemistry data from existing airfield stormwater discharges (which are typical of the stormwater that would be reserved for release during low flow periods) have been reported in the Annual Stormwater Monitoring Reports. Metal concentrations in these discharges are reported as total recoverable metals, which are not directly comparable to the dissolved fraction listed in the water quality standards. However, this data does serve as an indication of metal concentrations to be expected in the discharges of stormwater from the Flow Impact Offset Facility. Median metals concentrations from airfield stormwater range from 0.014 – 0.031 mg/l copper, 0.001 – 0.002 mg/l lead, and 0.020 – 0.052 mg/l zinc. Note that these values are for end-of-pipe or within-pipe discharges, not the receiving waters. These metal concentrations are also less than typical urban runoff, as discussed in the Annual Stormwater Monitoring Reports. In addition, the Port has conducted Whole Effluent Toxicity testing of stormwater discharges, as required by its NPDES permit, as discussed in the Annual Monitoring Reports. Stormwater associated with airfield sub-basins met the performance standards for whole effluent toxicity according to Ecology guidelines. All this information indicates that the Flow impact Offset Facility can be managed to meet the water quality standards for metals in the receiving waters

The following items should be considered in the management of the Flow Impact Offset Facility for compliance with state water quality standards:

- A large portion of metals in urban stormwater is attributed to motor vehicle activity. This is illustrated in the Annual Stormwater Monitoring Reports that show higher metal concentrations are associated with the landside basins where motor vehicle activity is concentrated. Since access to the airfield is strictly controlled, motor vehicle activity is kept to a minimum, therefore, metal concentrations in stormwater runoff is minimized. The airfield basins are the areas that will be providing stormwater to the Flow Impact Offset Facility, and these areas typically have the lowest lead and zinc concentrations of all airport stormwater discharges (copper concentrations are more consistent in all airport stormwater discharges, but are still relatively low in airfield stormwater).

- Data collected by the Port show that a large fraction of the metal concentrations are associated with particulates, i.e., the metal ions are bound to particulate matter. Therefore, the design and management practices proposed to minimize or reduce particulates and turbidity will also reduce total metal concentrations in the stormwater discharges. Biofiltration swales, settling in vaults, and (additional) filtration are all effective in reducing particulates, and therefore total metal concentrations will be reduced as well. Although these BMPs are not effective in removing dissolved metals, the majority of the metals are bound to particulates and will be removed. The design features proposed for the reserved stormwater vaults (compartmentalized storage, sloping the vault floor away from the stormwater outlets, careful placement of the stormwater outlets, and the provision for installation of filters) will ensure that the discharge of sediments and metals bound to particles will be minimized.

- The Port is currently investigating filtration of stormwater associated with discharges from a landside basin. This research includes determining the effectiveness of several filtration media in treating the stormwater. The results of this study will be completed before final design of the flow offset facilities, and the data will be used to select the filtration method most appropriate to treat the discharge from the Flow Impact Offset Facility, if needed.

Operational and monitoring considerations for the Flow Impact Offset Facility related to managing metals are discussed in Section xxxx.

Other Considerations

There are several other considerations relating to the design and operation of the Flow Impact Offset Facility. They include:

- The discharge points for Flow Impact Offset Facility will be the same as the typical ("live") discharge point for each vault or pond they are associated with. This eliminates the need to permit and construct additional discharge points to the creeks. The proposed location of each stormwater discharge point for the Flow Impact Offset Facility are illustrated in the drawings in Appendix xx.

- All stormwater management facilities, including those associated with the Flow impact Offset facility, will be located within the airport's perimeter fencing, thereby controlling access to the facilities and reducing the potential for damage to the facilities from vandalism.

- The Port will operate, inspect, monitor, and maintain the Flow impact Offset Facility as long as there is an airport at the site. In addition, the Port will provide annual monitoring reports to ensure that the Flow Impact Offset Facility is meeting its performance goals. An adaptive management method will be used to allow for needed adjustments in the operation of the facilities, and to allow for the installation of new management/monitoring technology, if needed.

Operation and Monitoring Plan/Annual Schedule of Activities

This section discusses details of the Port's proposed Operation and Monitoring Plan for the Flow Impact Offset Facility. The Operation and Monitoring Plan will be finalized and submitted to Ecology after final design of the facility is competed and before operation commences. The final plan will be based on the proposal discussed in this section and will include:

- A detailed annual schedule of operation for each stormwater vault associated with the Flow Impact Offset Facility
- A monitoring plan, including specific monitoring locations, sampling protocols, etc.
- A reporting plan
- An inspection/maintenance plan
- Characterization of the stormwater quality associated with the Flow Impact Offset Facility, based on existing data and data currently being collected.

The proposal discussed in this section includes information on all the points listed above. However, slight changes in configurations of vaults and conveyance may take place during final design of the facilities, and data currently being collected by the Port may suggest other modifications to the proposed facilities. The Final Plan will include the details and specificity that is not available at the present time.

Annual Operating Schedule

This section contains the proposed annual operating schedule for the Flow Impact Offset Facility. The schedule is based on a calendar year for ease of presentation. The proposed schedule also combines the four proposed stormwater vaults associated with the Flow Impact Offset Facility into a common schedule. It is envisioned that each vault may have a specific operating schedule once final design details are available. The specific operating schedule for an individual vault may be determined based on the final size of the vault, the contributing drainage area to the vault, the time required to fill the vault, and the hydrologic regime of the stream system to which it discharges. Specific operating schedules for each vault will be submitted to Ecology in the Final plan.

Following is the proposed general operating schedule for the Flow impact Offset Facility:

- January through May
  - Operate as "normal" stormwater detention vaults
    - Flow Impact Offset outlet closed to accumulate water
    - Placement of inlet will allow stormwater to be flushed with "fresh" water
    - Monitor filling of stormwater vault (see monitoring plan for details)

- June/July
  - Continue to accumulate stormwater
  - Conduct small test release from each vault associated with the Flow Impact Offset Facility
    - Confirm/adjust discharge rates for Flow Impact Offset Facility (gauge/measure flow)

- Collect water quality samples from each discharge (see monitoring section for details)
- Compare test discharge water quality samples to existing water quality collected data from creeks during summer periods (corresponding to the periods when the Flow Impact Offset Facility would be discharging)
- If potential water quality violations are indicated, take appropriate actions prior to initiating operational discharge, such as:
  - Install/maintain filters for sediments/turbidity/metals
  - Install portable aerators for DO
  - No actions proposed for temperature and nutrients
- Continue to monitor filling of vaults associated with the Flow Impact Offset Facility

- July/August
  - Open each outlets associated with the Flow Impact Offset Facility
    - July 24th for Des Moines Creek facility
    - August 1 for Miller and Walker Creek Facilities
  - Conduct sampling as described in monitoring plan

- August through October
  - Operation of Flow Impact Offset Facility
    - Inspection/monitoring of each discharge

- Inspect/monitor (sample) weekly throughout duration of operation
- Any water quality violations will be immediately investigated and corrected
- Continue to monitor water levels in reserved stormwater storage areas

- November 1 (or later, upon commencement of seasonal rains)
  - Close outlets associated with the Flow Impact Offset Facility
    - If water remains in vaults and seasonal rains have not commenced, allow discharge to continue until water is exhausted or rains begin
  - Inspect vaults/complete annual maintenance
  - Compile collected data
  - Begin accumulating water in vaults associated with the Flow Impact Offset Facility
    - Close outlets associated with Flow Impact Offset Facility upon completion of inspection/maintenance, but no later that January 1
  - Continue monitoring water levels in vaults associated with the Flow Impact Offset Facility
- December 31
  - Submit annual data report to Ecology by December 31

Monitoring Plan

The Port is proposing a comprehensive monitoring plan for the Flow Impact Offset Facility to ensure that the water quality performance standards are met and no violations of state water quality standards occur in the receiving waters. Monitoring consists of three elements: characterization of existing/expected water quality, monitoring of annual test releases from the Flow Impact Offset Facility, and monitoring of the discharges and receiving waters during operation of the facility. Each element is discussed below.

Characterization of existing/expected water quality

A great deal of water quality data already exists on the Port's stormwater discharges and on the creeks. This data has been collected for a variety of purposes including satisfying the Port's NPDES permit requirements, basin planning activities, and other studies done in the area by the Port and others. The data set includes water quality measurements within the stream systems during the summer periods when the Flow Impact Offset Facility will be scheduled to discharge to the streams. In addition, the Port has started to collect data to characterize the discharges from the Flow impact Offset Facility. Temperature data is being collected starting in 2001 from the NEPL vault and the SDS3 vault in order to characterize the expected temperatures of the Flow Impact Offset Facility. The Port has collected temperature data in the creeks since September 2000, so comparisons can be made. The NEPL vault is partially exposed to sunlight (on its west side and top), while the SDS3 vault is completely underground. By collecting temperature data from both vaults, a range of expected temperatures can be established for each type of vault (buried and partially exposed). Temperature data will be collected from the dead storage zone in each vault in order to approximate the Flow impact Offset Facility. Other data may be collected, as needed, prior to the operation of the Flow Impact Offset Facility, that can be used to characterize the proposed discharges and expected water quality within the creeks during the summer months, when the facility will be discharging. All of this data will be analyzed and presented in the Final Operation and Monitoring Plan, which will be submitted to Ecology prior to the initial operation of the Flow Impact Offset Facility.

Monitoring of annual test releases from the Flow Impact Offset Facility:

Each year, in May or June, prior to the operation of the Flow Impact Offset Facility, the Port proposes to conduct small test discharges from each outlet. The test discharges are intended to confirm the operation of each discharge, and to detect and respond to potential problems prior to the annual operation of the Flow Impact Offset Facility. For example, because of the small orifices needed to control discharges to the required rate, small amount of debris in the orifice could significantly impact the discharge rates. Debris can be removed at this time to prevent impacts to the annual operation of the facility. Any other problems that may occur within the facility can be detected and corrected at this time.

Water quality sampling of small-volume test discharges is proposed. By conducting this sampling, potential water quality problems can be detected and corrective measures taken prior to scheduled annual releases to the stream systems. Water quality data obtained from the test discharges will be compared to the characterization data in the creeks to determine the potential for water quality violations. If any are indicated, the Port will take corrective action prior to the annual operation of the facility, such as installing portable aerators or additional filtration in the discharges prior to their entry into the creeks.

Water quality sampling of the test discharges will include:

- Flow (measured/gauged in the field)
- Turbidity (field measurement)
- Dissolved Oxygen (field measurement)
- Temperature (field measurement)
- Metals (copper, lead, and zinc, (grab samples)

Operational Monitoring

The Port is proposing to monitor the operation of the Flow Impact Offset Facility to provide assurance that the facility is achieving its performance goals and not causing any water quality violations in the receiving waters. This will be accomplished by periodic monitoring of both the discharge and receiving waters during the annual operation of the facility. The specific monitoring proposal for the Flow Impact Offset Facility includes:

- Water levels within the stormwater vaults
    - Installation of a pressure transducer and datalogger in each vault will allow daily water levels to be collected
    - This data can be applied to the vault geometry to calculate the volume of water in the stormwater vaults
    - Vault filling and emptying (average daily water levels) will be monitored throughout the year

- Flow
    - Measured/gauged in the field
    - Taken upon opening of the Flow Impact Offset Facility outlets
    - Taken weekly throughout annual operation of facility

- Turbidity
    - Field Measurements
    - Measured in discharges, upstream in receiving waters, downstream in receiving waters after thorough mixing
    - Taken upon opening of Flow impact Offset Facility outlets
    - Taken weekly throughout operation of facility

- Dissolved Oxygen
    - Field Measurements
    - Measured in discharges and downstream in receiving waters after thorough mixing
    - Taken upon opening of Flow Impact Offset Facility outlets
    - Taken weekly throughout operation of facility

- Temperature
    - Field Measurements

- Measured in discharges, upstream in receiving waters, downstream in receiving waters after thorough mixing
- Taken upon opening of Flow Impact Offset Facility outlets
- Taken weekly throughout operation of facility

- Metals
  - Grab samples analyzed for copper, lead, and zinc
  - Measured in discharges and receiving waters downstream after thorough mixing
  - Measured upon opening of Flow impact Offset Facility outlets
  - Measured monthly throughout operation of facility

Weekly monitoring of the discharges for the quality parameters (except metals) is sufficient because the facility will be discharging from a stored volume of water, i.e., the water quality of the discharges is not expected to change. In the event of a significant rainfall event during the operation of the facility (greater than 0.5 inches in a 24-hour period), the Port will conduct additional sampling to ensure that the rainfall did not substantially change the character of the water within the Flow Impact Offset Facility that could potentially cause a violation of in-stream water quality standards. Monthly sampling for metals is sufficient because existing data shows that the metals concentrations in stormwater runoff from the airfield is relatively consistent and low compared to stormwater discharges from other urban areas.

Specific monitoring locations, both of the discharges and in-stream, will be included in the Final Operation and Monitoring Plan to be submitted to Ecology prior to the initial operation of the

Flow impact Offset Facility. All water quality data will be recorded and reported in an annual monitoring report to be submitted to Ecology by December 31 of each year. If the monitoring data show that the discharges from the Flow Impact Offset Facility consistently meet water quality standards within the receiving waters, the Port may propose a modified monitoring plan for subsequent operation of the facility. If any water quality problems were encountered during operation of the facilities, the Annual Report will include a discussion of the immediate actions taken to address the problem, and actions taken or proposed to prevent a reoccurrence of the problem in the future. All sampling and analytical methods used to monitor the Flow Impact Offset Facility will conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 or to the latest revision of *Standard Methods for the Examination of Water and Wastewater* (APHA). This will make the monitoring methods for the Flow Impact Offset Facility consistent with other water quality monitoring done under the NPDES permit for the airport.

Biological Monitoring

Biological monitoring is proposed as part of the Natural Resources Mitigation Plan. This monitoring will evaluate changes in the Benthic Index of Biotic Integrity (BIBI) over a ten-year period. This monitoring will be able to be used in assessing any biological effects of the flow offset facility in the receiving waters.

Maintenance Plan

The Port develops operation and maintenance manuals for all of its stormwater facilities. While the manuals follow the same generalized schedule for inspection and maintenance, each facility has its own specific manual to address the unique features of each facility. Following is an outline of what is contained in existing operation and maintenance plans for facilities including the Tyee Pond Detention Facility, the Miller Creek Detention Facility, the North Employee Parking Lot, the North Cargo Area Pump Station, the North End Snow Melt Facility, the North Satellite Snow Melt Facility, and the South End Snow Melt Facility. Typical inspection/maintenance activities occur on monthly, quarterly, semi-annual, or annual intervals, depending on the facility and activity. Operation and maintenance manuals developed for the stormwater vaults associated with the Flow Impact Offset Facility will contain similar elements and at least the same frequency of activities.

General Operation and Maintenance Manual Outline

- Purpose of Facility/Purpose of Manual
- Description of Facility and Operation
    - General Description
    - Hydraulic Properties
    - Water Quality Properties
    - Monitoring Systems/Alarms
- Historical Maintenance Operations (as applicable)
- Site/Facility Access
- Personnel and Emergency Contacts

- Inspection and Maintenance Procedures (items included as applicable to each facility)
  - Culverts
  - Ponds
  - Vegetation
  - Inlet Structure(s)
  - Outlet Structure(s)
  - Sensors and Alarms
  - Pumps and Valves
  - Filters/other water quality facilities
  - Access Roads/Hatches
  - Berms/Dikes/Levees
  - Spillways/Slopes
  - Creek/Stream Protection
  - Photographs
- Inspection and Maintenance Schedule
- Sediment/Waste Disposal Requirements
- Inspection Forms and Maintenance Checklist
- Maintenance Work Order Request Form
- Maintenance Crew/Shop Crew Responsibilities
- Health and Safety Plan
- Combined Space Entry Program
- Drawings/As Built Diagrams
- Process Diagrams

- References/Equipment Manuals

A sample operation and maintenance manual is included in Appendix XX. Each stormwater vault associated with the Flow Impact Offset Facility will have its own operation and maintenance manual developed as part of the final design process. The operation and maintenance manual for these stormwater vaults will be included in the overall operation and maintenance manual for the Flow Impact Offset Facility to be submitted to Ecology prior to initial operation of the facility.

DES MOINES CREEK

7-DAY LOW FLOW OCCURRENCES IN DES MOINES CREEK (1994)

HISTOGRAM LOW FLOW OCCURRENCES IN DES MOINES CREEK (1994)

7-DAY LOW FLOW OCCURRENCES IN DES MOINES CREEK (2006)

HISTOGRAM LOW FLOW OCCURRENCES IN DES MOINES CREEK (2006)

7-DAY LOW FLOW OCCURRENCES IN DES MOINES CREEK (WITH MITIGATION)

HISTOGRAM LOW FLOW OCCURRENCES IN DES MOINES CREEK (WITH MITIGATION)

COMPARISON OF 7-DAY LOW FLOW BY YEAR

COMPARISON OF 7-DAY LOW FLOW BY RANK

PLOTTED 7-DAY LOW FLOWS BY PERCENT RETURN FREQUENCY

SUMMARY OF LOW STREAM FLOW MITIGATION VAULT STORAGE AND FILLING

LOW FLOW HYDROGRAPHS WITH MITIGATION (1991-1994)

DES MOINES CREEK

7-DAY LOW FLOW OCCURRENCES IN DES MOINES CREEK (1994)

Start of 7-Day Low Flows with Average Flow Rates			1994 HSPF Des Moines Creek at 200th St. / Flow cfs Average 7-Day Low Flow	Statistical Ranking of Average 7-Day Low Flows Period of Record: 1949-1995				
	Date			Date	Average 7-Day Lows Ordered	Rank	Rank/47+1	Return Frequency
1949	SEP	7	0.19	1977	0.15	1	0.02	2.1
1950	SEP	17	0.40	1949	0.19	2	0.04	4.2
1951	AUG	20	0.36	1952	0.22	3	0.06	6.3
1952	OCT	13	0.22	1979	0.23	4	0.08	8.3
1953	SEP	15	0.35	1994	0.23	5	0.10	10.4
1954	AUG	7	0.48	1988	0.26	6	0.13	12.5
1955	SEP	6	0.35	1985	0.27	7	0.15	14.6
1956	SEP	3	0.44	1986	0.27	8	0.17	16.7
1957	SEP	20	0.33	1973	0.28	9	0.19	18.8
1958	SEP	2	0.29	1993	0.28	10	0.21	20.8
1959	AUG	24	0.40	1958	0.29	11	0.23	22.9
1960	AUG	7	0.40	1981	0.30	12	0.25	25.0
1961	AUG	23	0.42	1987	0.30	13	0.27	27.1
1962	SEP	2	0.34	1990	0.31	14	0.29	29.2
1963	SEP	27	0.37	1992	0.31	15	0.31	31.3
1964	AUG	31	0.48	1974	0.32	16	0.33	33.3
1965	AUG	3	0.39	1957	0.33	17	0.35	35.4
1966	AUG	19	0.33	1966	0.33	18	0.38	37.5
1967	AUG	25	0.35	1970	0.33	19	0.40	39.6
1968	AUG	6	0.47	1962	0.34	20	0.42	41.7
1969	SEP	6	0.39	1975	0.34	21	0.44	43.8
1970	AUG	27	0.33	1976	0.34	22	0.46	45.8
1971	AUG	14	0.42	1991	0.34	23	0.48	47.9
1972	AUG	8	0.53	1953	0.35	24	0.50	50.0
1973	SEP	11	0.28	1955	0.35	25	0.52	52.1
1974	OCT	13	0.32	1967	0.35	26	0.54	54.2
1975	AUG	11	0.34	1980	0.35	27	0.56	56.3
1976	OCT	17	0.34	1995	0.35	28	0.58	58.3
1977	AUG	16	0.15	1951	0.36	29	0.60	60.4
1978	OCT	16	0.42	1963	0.37	30	0.63	62.5
1979	AUG	7	0.23	1984	0.37	31	0.65	64.6
1980	AUG	23	0.35	1989	0.37	32	0.67	66.7
1981	SEP	11	0.30	1965	0.39	33	0.69	68.8
1982	AUG	6	0.42	1969	0.39	34	0.71	70.8
1983	OCT	10	0.48	1950	0.40	35	0.73	72.9
1984	AUG	29	0.37	1959	0.40	36	0.75	75.0
1985	AUG	29	0.27	1960	0.40	37	0.77	77.1
1986	SEP	5	0.27	1961	0.42	38	0.79	79.2
1987	SEP	7	0.30	1971	0.42	39	0.81	81.3
1988	SEP	11	0.26	1978	0.42	40	0.83	83.3
1989	OCT	3	0.37	1982	0.42	41	0.85	85.4
1990	SEP	25	0.31	1956	0.44	42	0.88	87.5
1991	OCT	9	0.34	1968	0.47	43	0.90	89.6
1992	SEP	16	0.31	1954	0.48	44	0.92	91.7
1993	SEP	29	0.28	1964	0.48	45	0.94	93.8
1994	AUG	26	0.23	1983	0.48	46	0.96	95.8
1995	SEP	20	0.35	1972	0.53	47	0.98	97.9

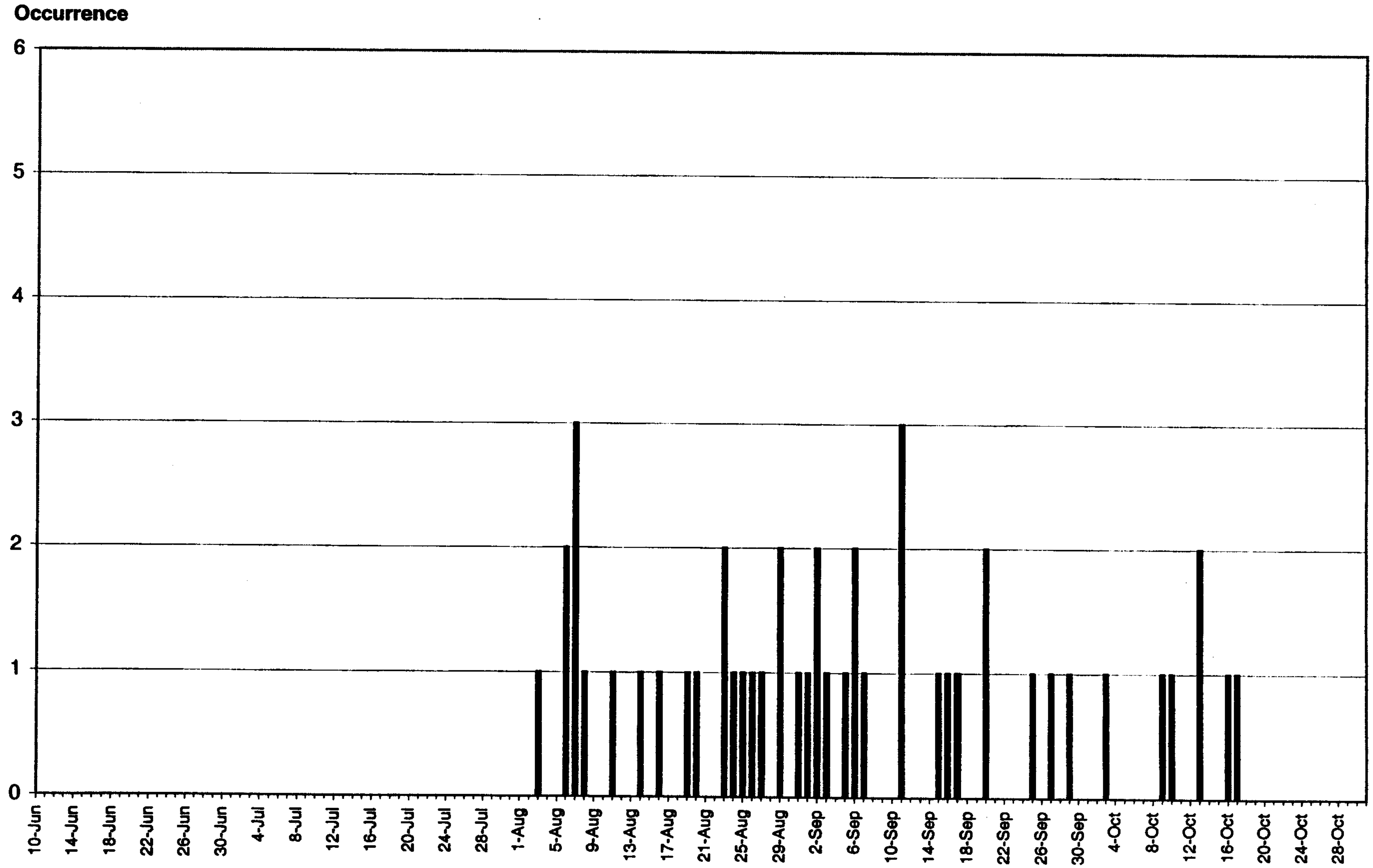
Rank = Numerical position of ordered average 7-day low flow values with the driest year equal to one.

N = 47

DES MOINES CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN DES MOINES CREEK (1994)

7-Day Low Flow Occurences in Des Moines Creek, 1949-1995 (1994 HSPF)



DES MOINES CREEK

7-DAY LOW FLOW OCCURRENCES IN DES MOINES CREEK (2006)

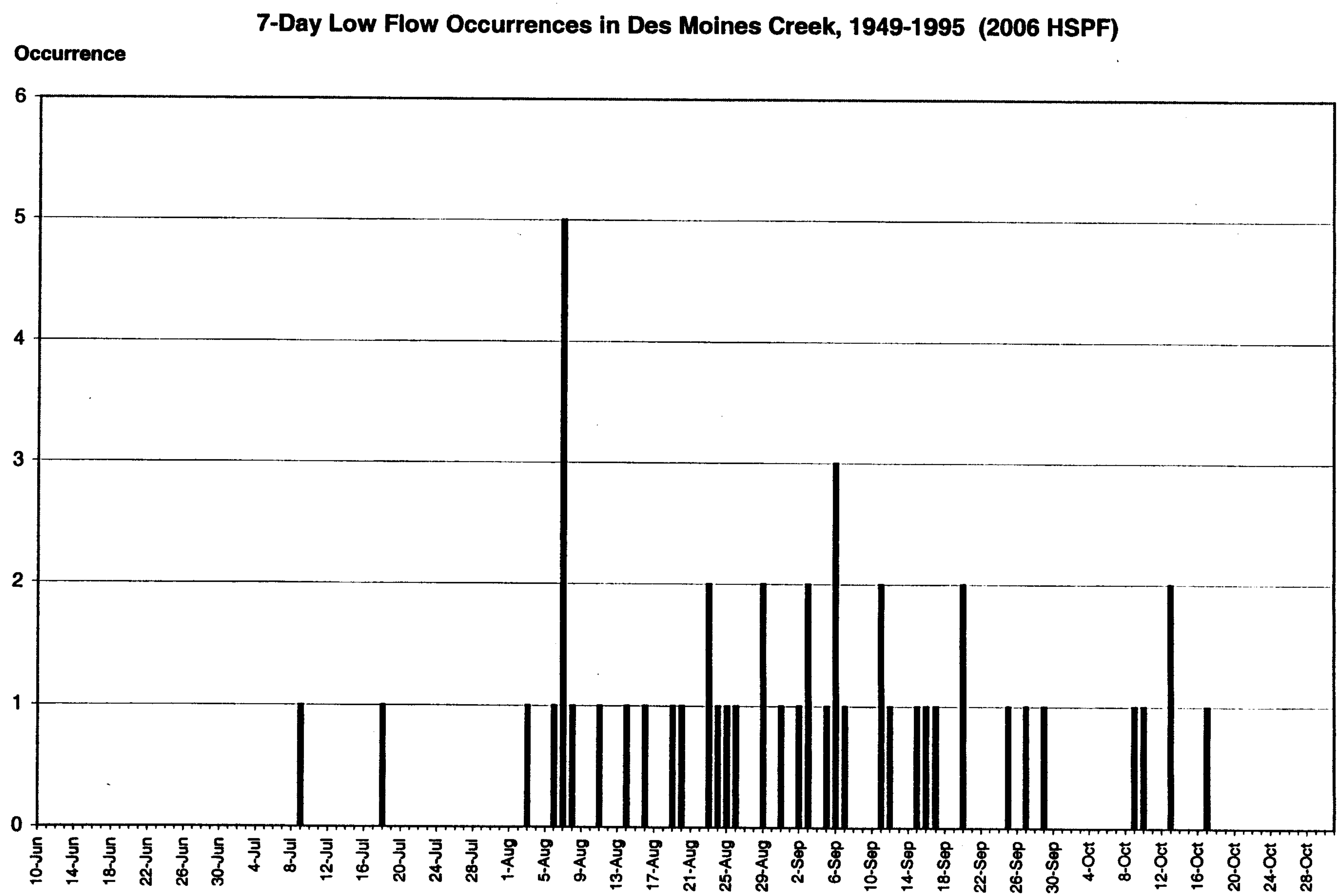
Start of 7-Day Low Flows with Average Flow Rates			2006 HSPF Des Moines Creek at 200th St. / Flow cfs Average 7-Day Low Flow	Statistical Ranking of Average 7-Day Low Flows Period of Record: 1949-1995 Date	Average 7-Day Lows Ordered	Rank	Rank/47+1	Return Frequency
	Date							
1949	SEP	7	0.14	1977	0.12	1	0.02	2.1
1950	SEP	17	0.32	1949	0.14	2	0.04	4.2
1951	AUG	20	0.25	1952	0.15	3	0.06	6.3
1952	OCT	13	0.15	1994	0.16	4	0.08	8.3
1953	SEP	15	0.28	1979	0.17	5	0.10	10.4
1954	AUG	7	0.37	1988	0.18	6	0.13	12.5
1955	SEP	6	0.25	1958	0.19	7	0.15	14.6
1956	SEP	3	0.35	1985	0.19	8	0.17	16.7
1957	SEP	20	0.25	1986	0.19	9	0.19	18.8
1958	SEP	2	0.19	1993	0.19	10	0.21	20.8
1959	AUG	24	0.28	1973	0.20	11	0.23	22.9
1960	AUG	7	0.28	1981	0.21	12	0.25	25.0
1961	AUG	23	0.30	1974	0.22	13	0.27	27.1
1962	SEP	3	0.27	1987	0.22	14	0.29	29.2
1963	SEP	27	0.31	1990	0.23	15	0.31	31.3
1964	AUG	31	0.39	1966	0.24	16	0.33	33.3
1965	AUG	3	0.30	1967	0.24	17	0.35	35.4
1966	AUG	19	0.24	1975	0.24	18	0.38	37.5
1967	AUG	25	0.24	1992	0.24	19	0.40	39.6
1968	AUG	7	0.38	1951	0.25	20	0.42	41.7
1969	SEP	6	0.29	1955	0.25	21	0.44	43.8
1970	JUL	18	0.25	1957	0.25	22	0.46	45.8
1971	AUG	14	0.31	1970	0.25	23	0.48	47.9
1972	AUG	8	0.42	1980	0.25	24	0.50	50.0
1973	SEP	11	0.20	1991	0.25	25	0.52	52.1
1974	OCT	13	0.22	1962	0.27	26	0.54	54.2
1975	AUG	11	0.24	1976	0.27	27	0.56	56.3
1976	OCT	17	0.27	1984	0.27	28	0.58	58.3
1977	AUG	16	0.12	1953	0.28	29	0.60	60.4
1978	JUL	9	0.33	1959	0.28	30	0.63	62.5
1979	AUG	7	0.17	1960	0.28	31	0.65	64.6
1980	AUG	23	0.25	1969	0.29	32	0.67	66.7
1981	SEP	12	0.21	1995	0.29	33	0.69	68.8
1982	AUG	6	0.32	1961	0.30	34	0.71	70.8
1983	OCT	10	0.40	1965	0.30	35	0.73	72.9
1984	AUG	29	0.27	1989	0.30	36	0.75	75.0
1985	AUG	29	0.19	1963	0.31	37	0.77	77.1
1986	SEP	5	0.19	1971	0.31	38	0.79	79.2
1987	SEP	6	0.22	1950	0.32	39	0.81	81.3
1988	SEP	11	0.18	1982	0.32	40	0.83	83.3
1989	AUG	7	0.30	1978	0.33	41	0.85	85.4
1990	SEP	25	0.23	1956	0.35	42	0.88	87.5
1991	OCT	9	0.25	1954	0.37	43	0.90	89.6
1992	SEP	16	0.24	1968	0.38	44	0.92	91.7
1993	SEP	29	0.19	1964	0.39	45	0.94	93.8
1994	AUG	26	0.16	1983	0.40	46	0.96	95.8
1995	SEP	20	0.29	1972	0.42	47	0.98	97.9

Rank = Numerical position of ordered average 7-day low flow values with the driest year equal to one.

N = 47

DES MOINES CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN DES MOINES CREEK (2006)



7-Day Low Flow Occurrences in Des Moines Creek, 1949-1995 (2006 HSPF)
Occurrence
6
5
4
3
2
1
0
10-Jun
14-Jun
18-Jun
22-Jun
26-Jun
30-Jun
4-Jul
8-Jul
12-Jul
16-Jul
20-Jul
24-Jul
28-Jul
1-Aug
5-Aug
9-Aug
13-Aug
17-Aug
21-Aug
25-Aug
29-Aug
2-Sep
6-Sep
10-Sep
14-Sep
18-Sep
22-Sep
26-Sep
30-Sep
4-Oct
8-Oct
12-Oct
16-Oct
20-Oct
24-Oct
28-Oct

AR 011300

DES MOINES CREEK

7-DAY LOW FLOW OCCURRENCES IN DES MOINES CREEK (WITH MITIGATION)

Start of 7-Day Low Flows with Average Flow Rates			2006 HSPF Des Moines Creek at 200th St. / Flow cfs Average 7-Day Low Flow Jul 24 Release 0.10 cfs	Statistical Ranking of Average 7-Day Low Flows Period of Record: 1949-1995				
	Date			Date	Average 7-Day Lows Ordered	Rank	Rank/47+1	Return Frequency
1949	JUL	16	0.22	1977	0.22	1	0.02	2.1
1950	SEP	17	0.42	1949	0.22	2	0.04	4.2
1951	AUG	20	0.35	1979	0.23	3	0.06	6.3
1952	OCT	13	0.25	1994	0.23	4	0.08	8.3
1953	SEP	15	0.38	1985	0.24	5	0.10	10.4
1954	AUG	7	0.47	1952	0.25	6	0.13	12.5
1955	SEP	6	0.35	1970	0.25	7	0.15	14.6
1956	SEP	3	0.45	1987	0.26	8	0.17	16.7
1957	SEP	20	0.35	1988	0.28	9	0.19	18.8
1958	SEP	2	0.29	1986	0.29	10	0.21	20.8
1959	AUG	24	0.38	1958	0.29	11	0.23	22.9
1960	AUG	7	0.38	1993	0.29	12	0.25	25.0
1961	AUG	23	0.40	1973	0.30	13	0.27	27.1
1962	SEP	3	0.37	1981	0.31	14	0.29	29.2
1963	SEP	27	0.41	1974	0.32	15	0.31	31.3
1964	AUG	31	0.49	1978	0.33	16	0.33	33.3
1965	JUL	13	0.35	1990	0.33	17	0.35	35.4
1966	AUG	19	0.34	1976	0.33	18	0.38	37.5
1967	AUG	25	0.34	1966	0.34	19	0.40	39.6
1968	AUG	7	0.48	1992	0.34	20	0.42	41.7
1969	SEP	6	0.39	1967	0.34	21	0.44	43.8
1970	JUL	17	0.25	1975	0.34	22	0.46	45.8
1971	AUG	14	0.41	1957	0.35	23	0.48	47.9
1972	AUG	8	0.52	1951	0.35	24	0.50	50.0
1973	SEP	11	0.30	1991	0.35	25	0.52	52.1
1974	OCT	13	0.32	1955	0.35	26	0.54	54.2
1975	JUL	17	0.34	1965	0.35	27	0.56	56.3
1976	DEC	10	0.33	1980	0.35	28	0.58	58.3
1977	AUG	16	0.22	1982	0.36	29	0.60	60.4
1978	JUL	9	0.33	1984	0.37	30	0.63	62.5
1979	JUN	12	0.23	1962	0.37	31	0.65	64.6
1980	AUG	23	0.35	1959	0.38	32	0.67	66.7
1981	SEP	12	0.31	1953	0.38	33	0.69	68.8
1982	JUN	19	0.36	1960	0.38	34	0.71	70.8
1983	OCT	10	0.50	1969	0.39	35	0.73	72.9
1984	AUG	29	0.37	1995	0.39	36	0.75	75.0
1985	JUL	17	0.24	1961	0.40	37	0.77	77.1
1986	SEP	5	0.29	1989	0.40	38	0.79	79.2
1987	OCT	24	0.26	1971	0.41	39	0.81	81.3
1988	SEP	11	0.28	1963	0.41	40	0.83	83.3
1989	AUG	7	0.40	1950	0.42	41	0.85	85.4
1990	SEP	25	0.33	1956	0.45	42	0.88	87.5
1991	OCT	9	0.35	1954	0.47	43	0.90	89.6
1992	JUN	22	0.34	1968	0.48	44	0.92	91.7
1993	SEP	29	0.29	1964	0.49	45	0.94	93.8
1994	JUL	17	0.23	1983	0.50	46	0.96	95.8
1995	SEP	20	0.39	1972	0.52	47	0.98	97.9

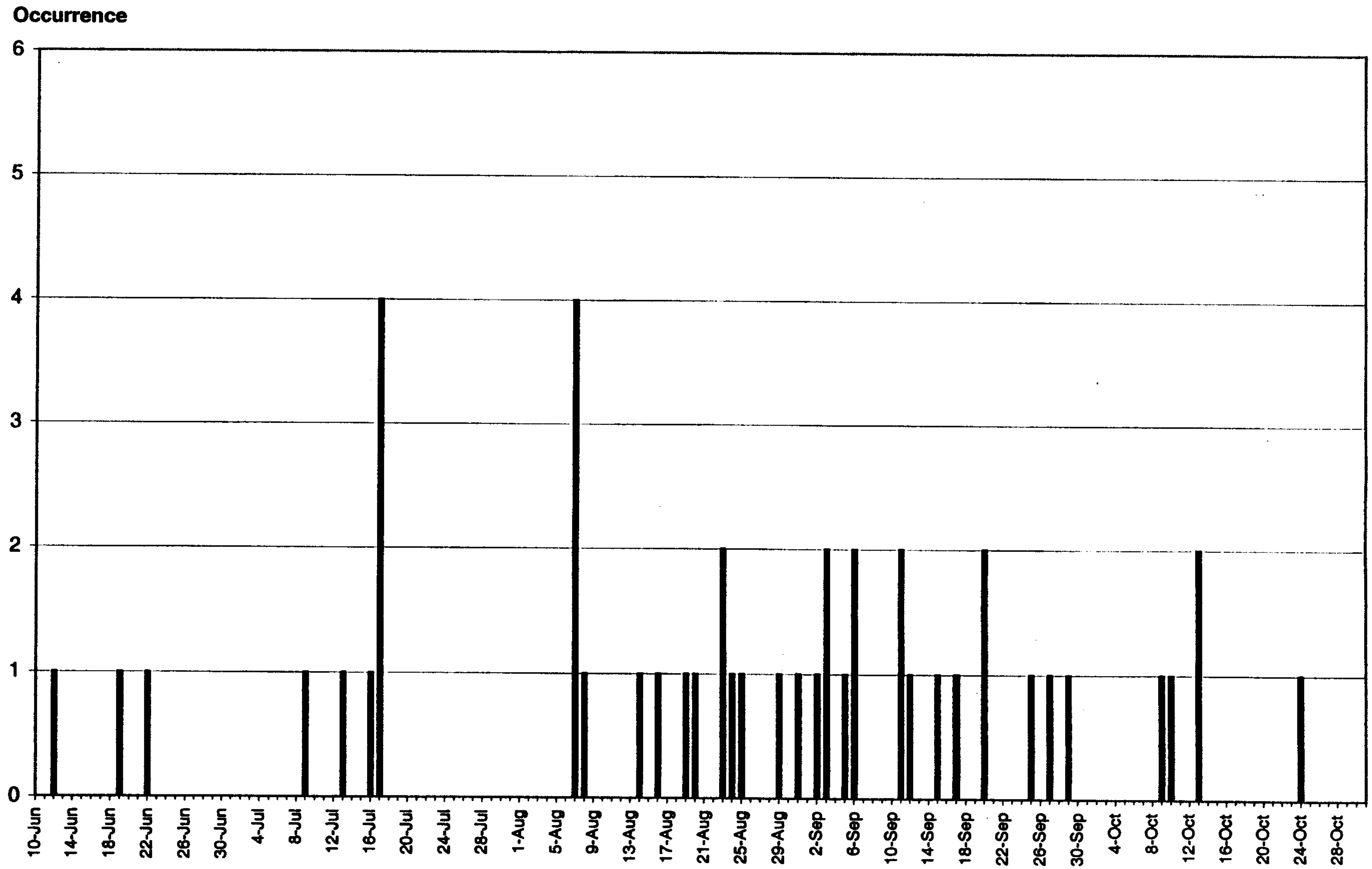
Rank = Numerical position of ordered average 7-day low flow values with the driest year equal to one.

N = 47

DES MOINES CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN DES MOINES CREEK (WITH MITIGATION)

7-Day Low Flow Occurrences in Des Moines Creek 1949-1995 (24 Jul 2006 HSPF + 0.10 cfs)



DES MOINES CREEK

COMPARISON OF 7-DAY LOW FLOW BY YEAR

Comparison o[illegible]ay Low Flow By Year
for Des Moines Creek

	Date		1994 HSPF Des Moines Creek at 200th St. / Flow cfs Average 7-Day Low Flow		Date		2006 HSPF Des Moines Creek at 200th St. / Flow cfs Average 7-Day Low Flow	-1994		Date		2006 HSPF Des Moines Creek at 200th St. / Flow cfs Average 7-Day Low Flow Jul 24 Release 0.10 cfs	-1994
1949	SEP	7	0.19	1949	SEP	7	0.14	-0.05	1949	JUL	16	0.22	0.03
1950	SEP	17	0.40	1950	SEP	17	0.32	-0.08	1950	SEP	17	0.42	0.02
1951	AUG	20	0.36	1951	AUG	20	0.25	-0.11	1951	AUG	20	0.35	-0.01
1952	OCT	13	0.22	1952	OCT	13	0.15	-0.07	1952	OCT	13	0.25	0.03
1953	SEP	15	0.35	1953	SEP	15	0.28	-0.07	1953	SEP	15	0.38	0.03
1954	AUG	7	0.48	1954	AUG	7	0.37	-0.11	1954	AUG	7	0.47	-0.01
1955	SEP	6	0.35	1955	SEP	6	0.25	-0.10	1955	SEP	6	0.35	0.00
1956	SEP	3	0.44	1956	SEP	3	0.35	-0.09	1956	SEP	3	0.45	0.01
1957	SEP	20	0.33	1957	SEP	20	0.25	-0.09	1957	SEP	20	0.35	0.01
1958	SEP	2	0.29	1958	SEP	2	0.19	-0.09	1958	SEP	2	0.29	0.01
1959	AUG	24	0.40	1959	AUG	24	0.28	-0.12	1959	AUG	24	0.38	-0.02
1960	AUG	7	0.40	1960	AUG	7	0.28	-0.12	1960	AUG	7	0.38	-0.02
1961	AUG	23	0.42	1961	AUG	23	0.30	-0.12	1961	AUG	23	0.40	-0.02
1962	SEP	2	0.34	1962	SEP	3	0.27	-0.07	1962	SEP	3	0.37	0.03
1963	SEP	27	0.37	1963	SEP	27	0.31	-0.07	1963	SEP	27	0.41	0.03
1964	AUG	31	0.48	1964	AUG	31	0.39	-0.09	1964	AUG	31	0.49	0.01
1965	AUG	3	0.39	1965	AUG	3	0.30	-0.09	1965	JUL	13	0.35	-0.03
1966	AUG	19	0.33	1966	AUG	19	0.24	-0.10	1966	AUG	19	0.34	0.00
1967	AUG	25	0.35	1967	AUG	25	0.24	-0.11	1967	AUG	25	0.34	-0.01
1968	AUG	6	0.47	1968	AUG	7	0.38	-0.10	1968	AUG	7	0.48	0.00
1969	SEP	6	0.39	1969	SEP	6	0.29	-0.10	1969	SEP	6	0.39	0.00
1970	AUG	27	0.33	1970	JUL	18	0.25	-0.08	1970	JUL	17	0.25	-0.08
1971	AUG	14	0.42	1971	AUG	14	0.31	-0.11	1971	AUG	14	0.41	-0.01
1972	AUG	8	0.53	1972	AUG	8	0.42	-0.11	1972	AUG	8	0.52	-0.01
1973	SEP	11	0.28	1973	SEP	11	0.20	-0.08	1973	SEP	11	0.30	0.02
1974	OCT	13	0.32	1974	OCT	13	0.22	-0.10	1974	OCT	13	0.32	0.00
1975	AUG	11	0.34	1975	AUG	11	0.24	-0.10	1975	JUL	17	0.34	0.00
1976	OCT	17	0.34	1976	OCT	17	0.27	-0.08	1976	DEC	10	0.33	-0.01
1977	AUG	16	0.15	1977	AUG	16	0.12	-0.03	1977	AUG	16	0.22	0.07
1978	OCT	16	0.42	1978	JUL	9	0.33	-0.09	1978	JUL	9	0.33	-0.09
1979	AUG	7	0.23	1979	AUG	7	0.17	-0.07	1979	JUN	12	0.23	0.00
1980	AUG	23	0.35	1980	AUG	23	0.25	-0.09	1980	AUG	23	0.35	0.01
1981	SEP	11	0.30	1981	SEP	12	0.21	-0.08	1981	SEP	12	0.31	0.02
1982	AUG	6	0.42	1982	AUG	6	0.32	-0.10	1982	JUN	19	0.36	-0.06
1983	OCT	10	0.48	1983	OCT	10	0.40	-0.07	1983	OCT	10	0.50	0.03
1984	AUG	29	0.37	1984	AUG	29	0.27	-0.11	1984	AUG	29	0.37	-0.01
1985	AUG	29	0.27	1985	AUG	29	0.19	-0.07	1985	JUL	17	0.24	-0.03
1986	SEP	5	0.27	1986	SEP	5	0.19	-0.08	1986	SEP	5	0.29	0.02
1987	SEP	7	0.30	1987	SEP	6	0.22	-0.08	1987	OCT	24	0.26	-0.04
1988	SEP	11	0.26	1988	SEP	11	0.18	-0.07	1988	SEP	11	0.28	0.03
1989	OCT	3	0.37	1989	AUG	7	0.30	-0.07	1989	AUG	7	0.40	0.03
1990	SEP	25	0.31	1990	SEP	25	0.23	-0.08	1990	SEP	25	0.33	0.02
1991	OCT	9	0.34	1991	OCT	9	0.25	-0.09	1991	OCT	9	0.35	0.01
1992	SEP	16	0.31	1992	SEP	16	0.24	-0.06	1992	JUN	22	0.34	0.03
1993	SEP	29	0.28	1993	SEP	29	0.19	-0.08	1993	SEP	29	0.29	0.02
1994	AUG	26	0.23	1994	AUG	26	0.16	-0.07	1994	JUL	17	0.23	0.00
1995	SEP	20	0.35	1995	SEP	20	0.29	-0.06	1995	SEP	20	0.39	0.04
			16.32				12.29					16.45	

DES MOINES CREEK

COMPARISON OF 7-DAY LOW FLOW BY RANK

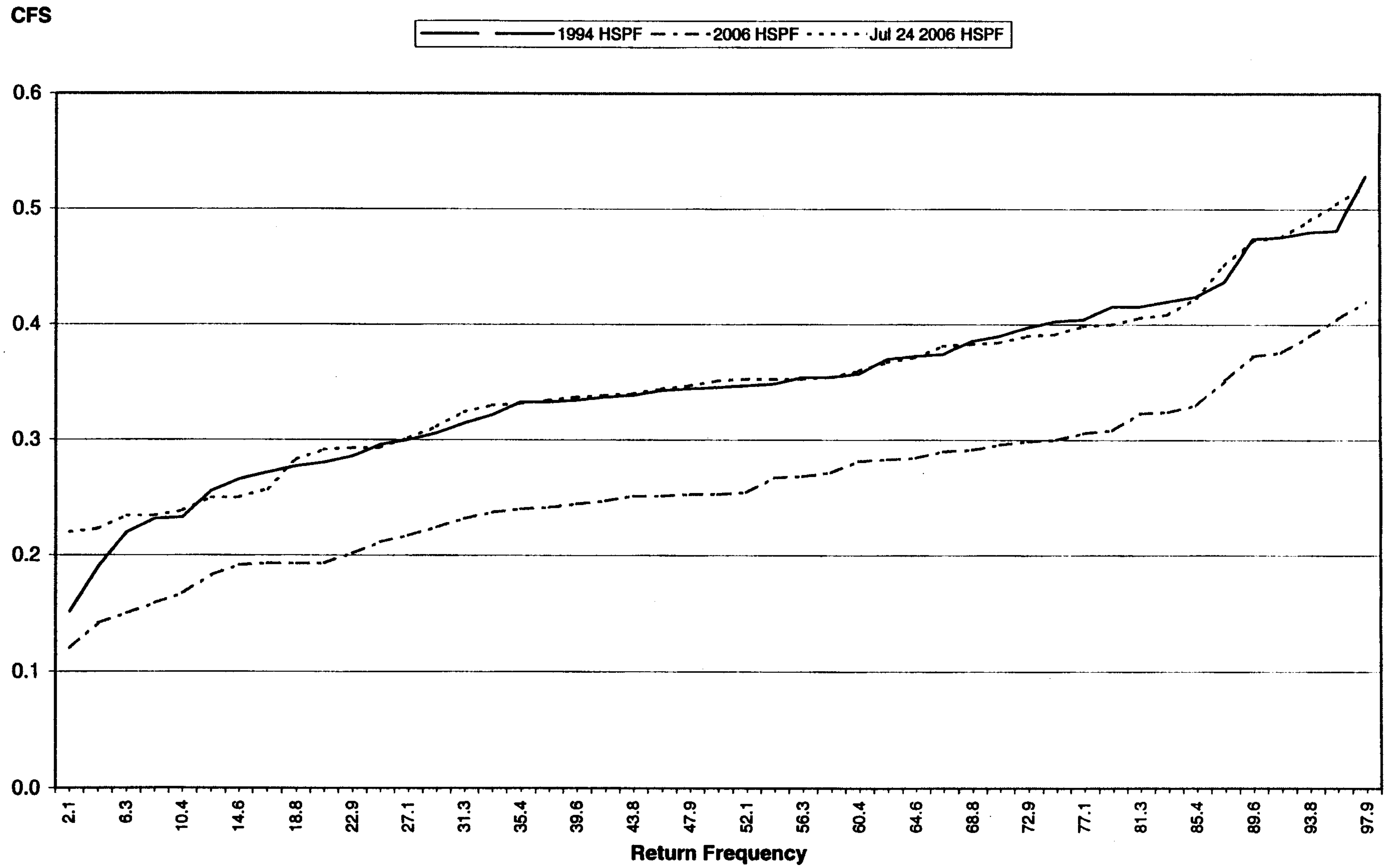
Comparison of 7-Day Low Flow by Rank
for Des Moines Creek

Rank	1994	2006	2006 -1994	2006 Release Jul 24	2006 Release Jul 24 -1994
1	0.15	0.12	-0.03	0.22	0.07
2	0.19	0.14	-0.05	0.22	0.03
3	0.22	0.15	-0.07	0.23	0.01
4	0.23	0.16	-0.07	0.23	0.00
5	0.23	0.17	-0.07	0.24	0.01
6	0.26	0.18	-0.07	0.25	-0.01
7	0.27	0.19	-0.07	0.25	-0.02
8	0.27	0.19	-0.08	0.26	-0.01
9	0.28	0.19	-0.08	0.28	0.01
10	0.28	0.19	-0.09	0.29	0.01
11	0.29	0.20	-0.08	0.29	0.01
12	0.30	0.21	-0.08	0.29	0.00
13	0.30	0.22	-0.08	0.30	0.00
14	0.31	0.22	-0.08	0.31	0.01
15	0.31	0.23	-0.08	0.32	0.01
16	0.32	0.24	-0.08	0.33	0.01
17	0.33	0.24	-0.09	0.33	0.00
18	0.33	0.24	-0.09	0.33	0.00
19	0.33	0.24	-0.09	0.34	0.00
20	0.34	0.25	-0.09	0.34	0.00
21	0.34	0.25	-0.09	0.34	0.00
22	0.34	0.25	-0.09	0.34	0.00
23	0.34	0.25	-0.09	0.35	0.00
24	0.35	0.25	-0.09	0.35	0.01
25	0.35	0.25	-0.09	0.35	0.01
26	0.35	0.27	-0.08	0.35	0.00
27	0.35	0.27	-0.09	0.35	0.00
28	0.35	0.27	-0.08	0.35	0.00
29	0.36	0.28	-0.08	0.36	0.00
30	0.37	0.28	-0.09	0.37	0.00
31	0.37	0.28	-0.09	0.37	0.00
32	0.37	0.29	-0.08	0.38	0.01
33	0.39	0.29	-0.09	0.38	0.00
34	0.39	0.30	-0.09	0.38	-0.01
35	0.40	0.30	-0.10	0.39	-0.01
36	0.40	0.30	-0.10	0.39	-0.01
37	0.40	0.31	-0.10	0.40	-0.01
38	0.42	0.31	-0.11	0.40	-0.02
39	0.42	0.32	-0.09	0.41	-0.01
40	0.42	0.32	-0.10	0.41	-0.01
41	0.42	0.33	-0.09	0.42	0.00
42	0.44	0.35	-0.09	0.45	0.01
43	0.47	0.37	-0.10	0.47	0.00
44	0.48	0.38	-0.10	0.48	0.00
45	0.48	0.39	-0.09	0.49	0.01
46	0.48	0.40	-0.08	0.50	0.02
47	0.53	0.42	-0.11	0.52	-0.01

DES MOINES CREEK

PLOTTED 7-DAY LOW FLOWS BY PERCENT RETURN FREQUENCY

Des Moines Creek 7-Day Low Flow Values



DES MOINES CREEK

SUMMARY OF LOW STREAM FLOW MITIGATION VAULT STORAGE AND FILLING

Reserve Storage Vaults for Des Moines Creek.

Vault sizes (dead storage in acre ft) required for 92-day release of 0.13 cfs (1949 – 1995).

	SDS3	SDS4
Mean	4.31	0.75
Median	3.9	0.67
Max	10.4	1.8
Min	1.87	0.32

Contributing Drainage Areas

Subbasin	Vault	Area	% Contribution
SDS3	SDS3	199.22	85.25
SDS4	SDS4	34.47	14.75
Total		**233.69**	

Fill time for 12.2 acre foot volume / Days to fill after closing vault on January 1.

Mean	8.0
Media	6.0
Max	32.0
Min	2.0

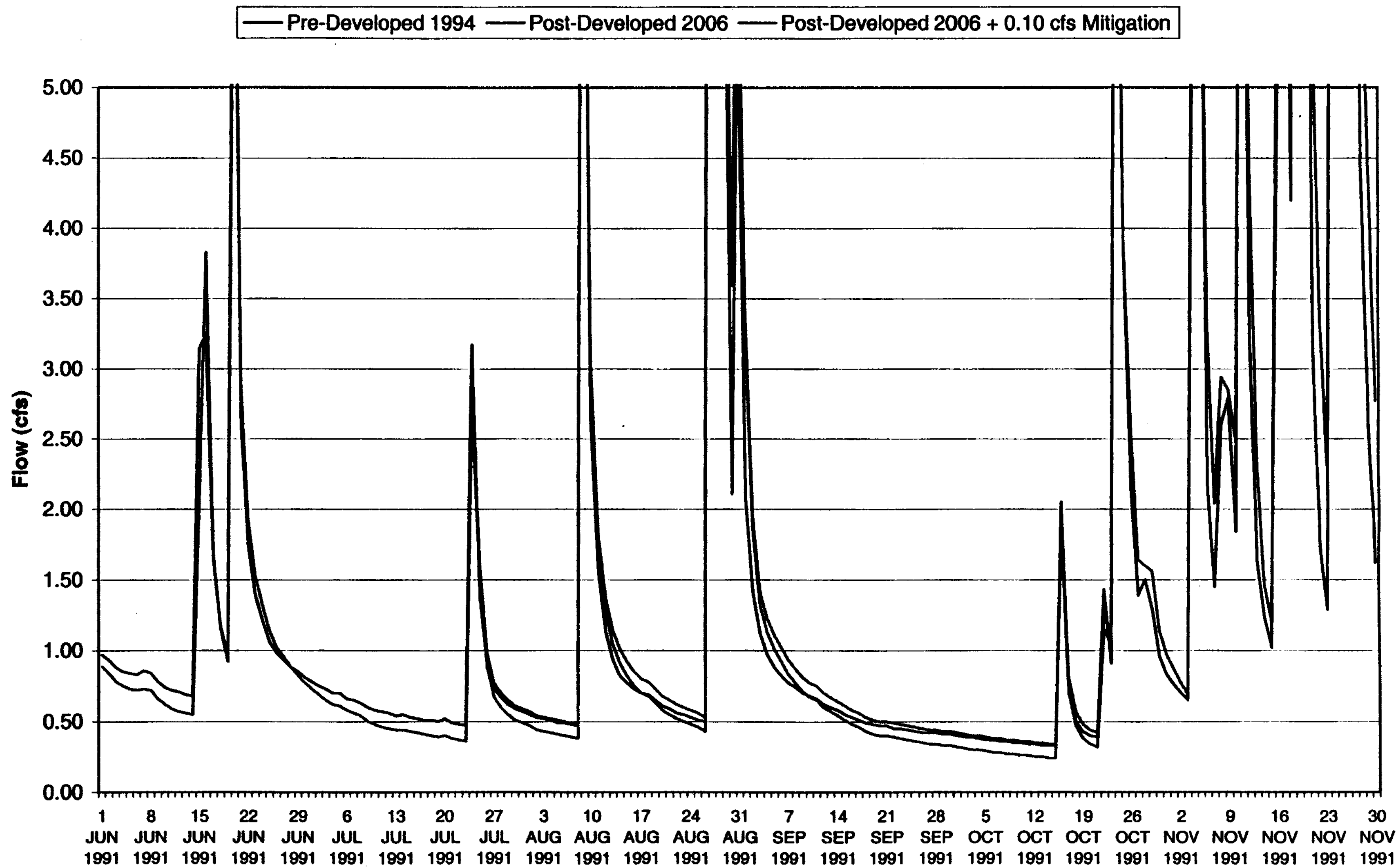
Remaining volume in vaults on October 23

	Volume ac ft	**Remaining Days**
Mean	11.40	57
Median	12.00	60
Max	12.20	61
Min	7.23	36

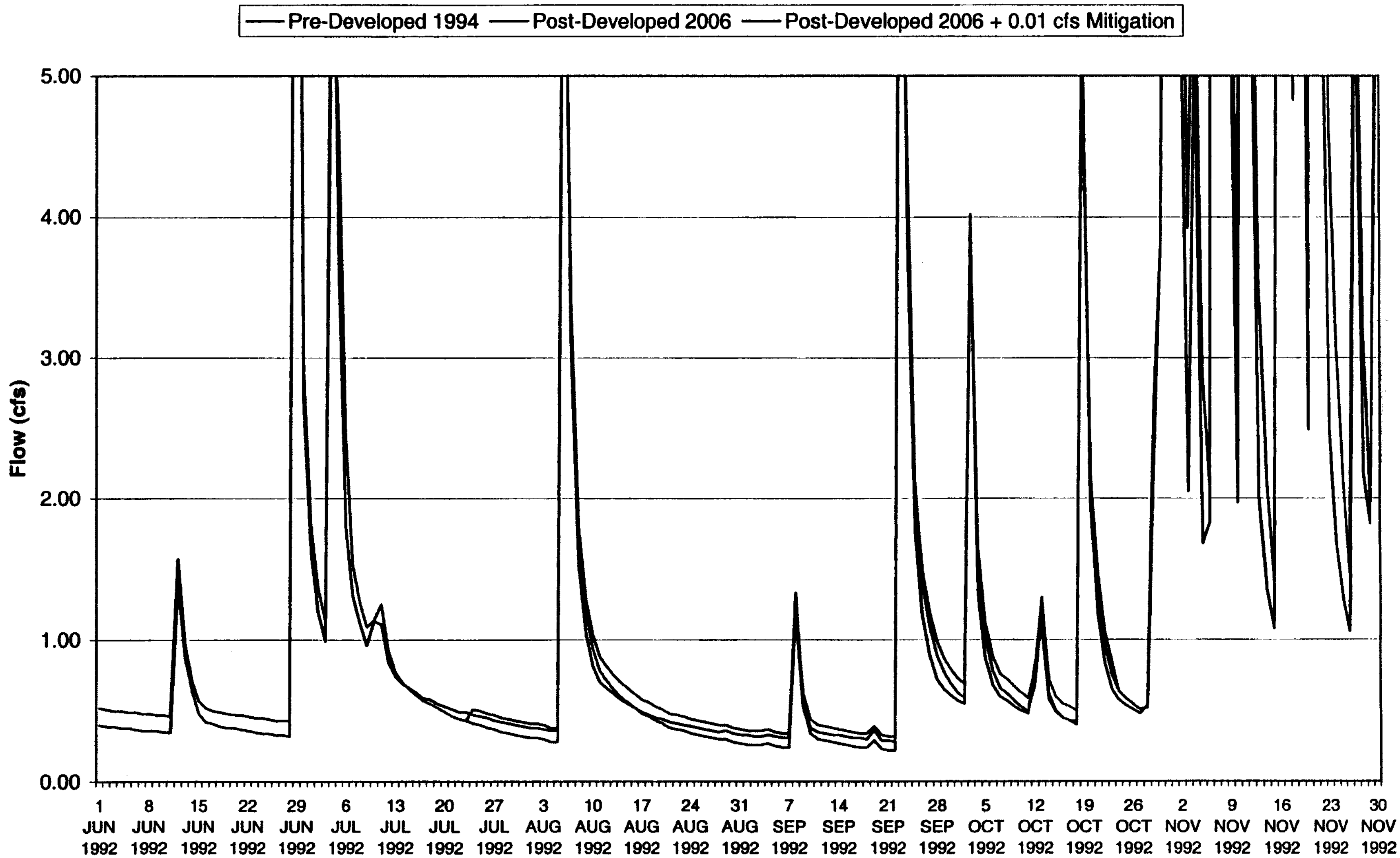
DES MOINES CREEK

LOW FLOW HYDROGRAPHS WITH MITIGATION (1991-1994)

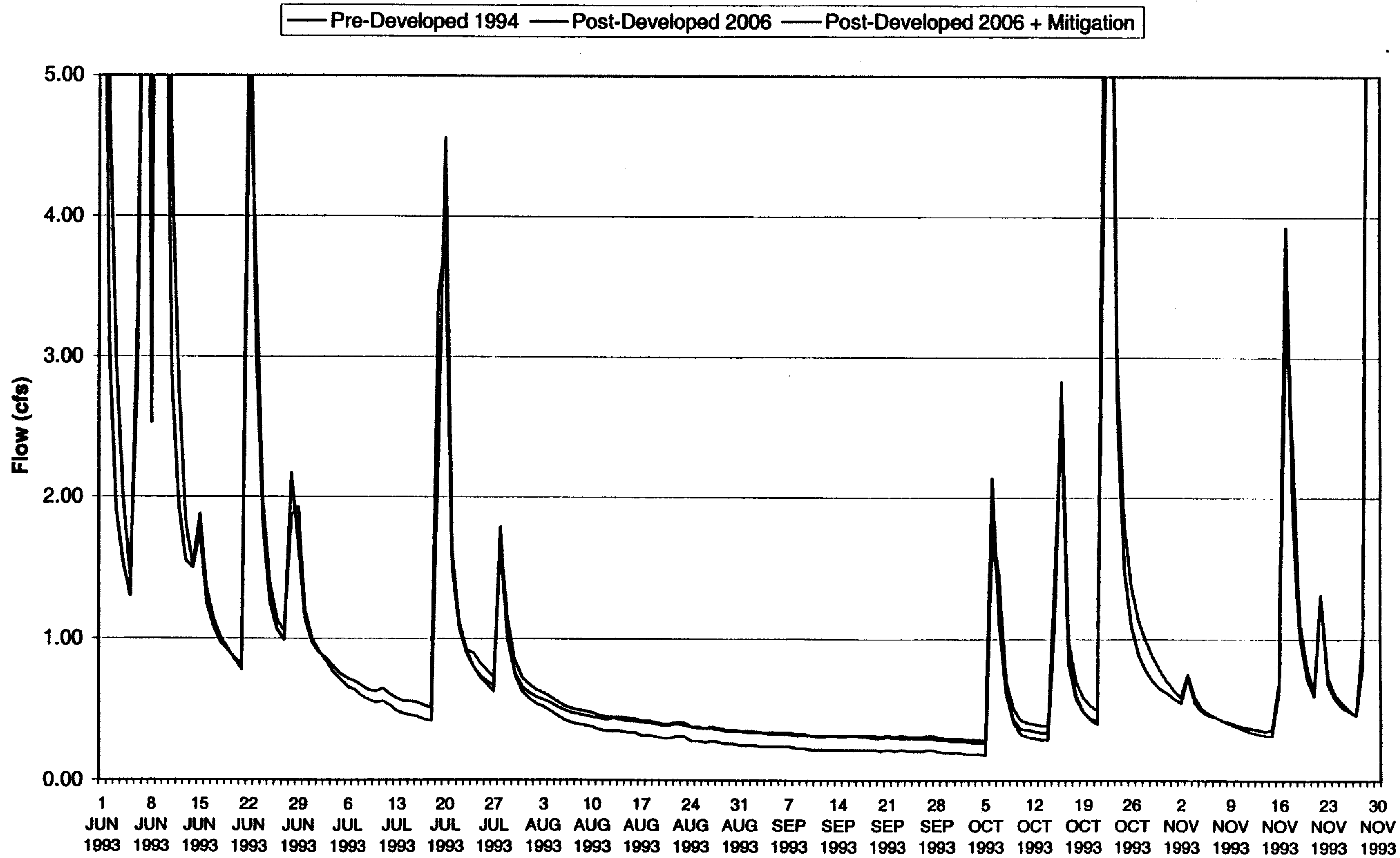
Des Moines Creek Low Flow 1991 + Mitigation



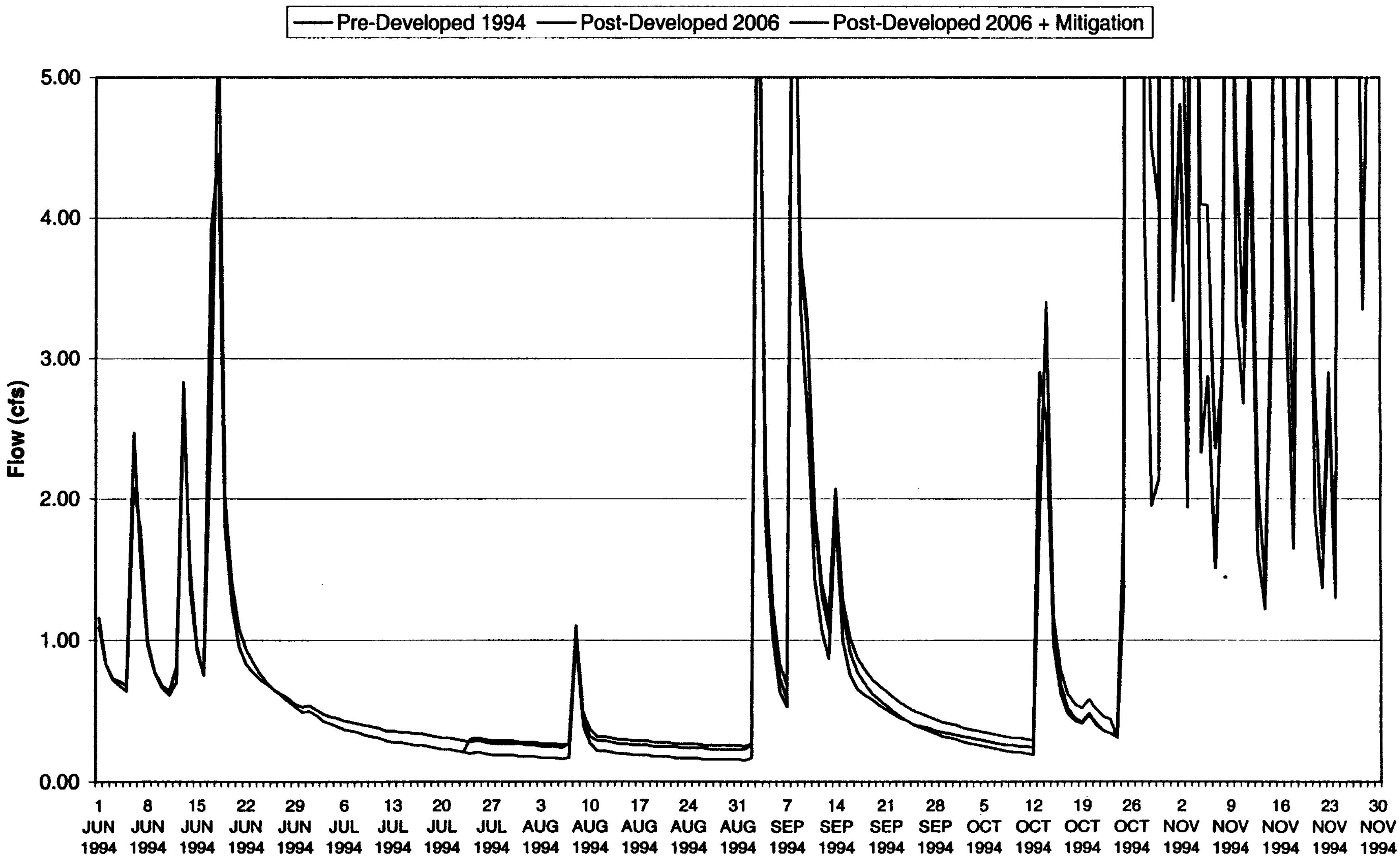
Des Moines Creek Low Flow 1992 + Mitigation



Des Moines Creek Low Flow 1993 + Mitigation



Des Moines Creek Low Flow 1994 + Mitigation



MILLER CREEK

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK (1994 HSPF)

HISTOGRAM LOW FLOW OCCURRENCES IN MILLER CREEK (1994)

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK 1991 – 1994, POST-PROJECT CONDITIONS (2006)

HISTOGRAM LOW FLOW OCCURRENCES IN MILLER CREEK 1991 – 1994, POST-PROJECT CONDITIONS (2006)

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK, 1991 – 1994, POST-PROJECT CONDITIONS (2006+ MITIGATION)

HISTOGRAM LOW FLOW OCCURRENCES IN MILLER CREEK 1991 – 1994, POST-PROJECT CONDITIONS (2006+ MITIGATION)

COMPARISON OF 7-DAY LOW FLOW BY YEAR, 1991-1994

COMPARISON OF 7-DAY LOW FLOW BY RANK, 1991-1994

PLOTTED 7-DAY LOW FLOWS BY PERCENT RETURN FREQUENCY, 1991-1994

SUMMARY OF LOW STREAM FLOW MITIGATION VAULT STORAGE AND FILLING

LOW FLOW HYDROGRAPHS WITH MITIGATION (1991-1994)

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK (1991-1994)

MILLER CREEK

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK (1994 HSPF)

Start of 7-Day Low Flows with Average Flow Rates

Statistical Ranking of Average 7-Day Low Flows
Period of Record: 1949-1995

	Date		1994 Miller Creek at Hwy 509 Flow / cfs	Date	Average 7-Day Lows Ordered	Rank	Rank/N+1	Return Frequency
1949	SEP	7	0.42	1949	0.42	1	0.02	2.1
1950	SEP	17	0.85	1994	0.49	2	0.04	4.2
1951	SEP	17	0.78	1952	0.52	3	0.06	6.3
1952	NOV	23	0.52	1977	0.52	4	0.08	8.3
1953	SEP	15	0.74	1979	0.54	5	0.10	10.4
1954	OCT	3	0.86	1987	0.57	6	0.13	12.5
1955	SEP	6	0.82	1993	0.57	7	0.15	14.6
1956	SEP	3	0.86	1986	0.58	8	0.17	16.7
1957	SEP	20	0.77	1988	0.59	9	0.19	18.8
1958	SEP	30	0.62	1985	0.61	10	0.21	20.8
1959	AUG	24	0.87	1958	0.62	11	0.23	22.9
1960	SEP	29	0.83	1973	0.64	12	0.25	25.0
1961	SEP	21	0.82	1992	0.64	13	0.27	27.1
1962	SEP	3	0.72	1980	0.66	14	0.29	29.2
1963	SEP	27	0.70	1989	0.66	15	0.31	31.3
1964	OCT	25	0.87	1981	0.68	16	0.33	33.3
1965	SEP	27	0.77	1976	0.68	17	0.35	35.4
1966	SEP	4	0.77	1963	0.70	18	0.38	37.5
1967	SEP	22	0.73	1990	0.70	19	0.40	39.6
1968	AUG	7	0.96	1974	0.71	20	0.42	41.7
1969	SEP	6	0.81	1970	0.71	21	0.44	43.8
1970	AUG	27	0.71	1962	0.72	22	0.46	45.8
1971	AUG	14	0.91	1967	0.73	23	0.48	47.9
1972	SEP	11	1.00	1953	0.74	24	0.50	50.0
1973	SEP	12	0.64	1995	0.75	25	0.52	52.1
1974	OCT	13	0.71	1957	0.77	26	0.54	54.2
1975	AUG	11	0.77	1966	0.77	27	0.56	56.3
1976	DEC	10	0.68	1975	0.77	28	0.58	58.3
1977	AUG	16	0.52	1965	0.77	29	0.60	60.4
1978	AUG	17	0.79	1984	0.77	30	0.63	62.5
1979	OCT	7	0.54	1951	0.78	31	0.65	64.6
1980	OCT	17	0.66	1991	0.79	32	0.67	66.7
1981	SEP	12	0.68	1978	0.79	33	0.69	68.8
1982	SEP	17	0.80	1982	0.80	34	0.71	70.8
1983	OCT	10	0.89	1969	0.81	35	0.73	72.9
1984	OCT	1	0.77	1961	0.82	36	0.75	75.0
1985	SEP	29	0.61	1955	0.82	37	0.77	77.1
1986	OCT	18	0.58	1960	0.83	38	0.79	79.2
1987	OCT	24	0.57	1950	0.85	39	0.81	81.3
1988	SEP	11	0.59	1956	0.86	40	0.83	83.3
1989	OCT	3	0.66	1954	0.86	41	0.85	85.4
1990	SEP	26	0.70	1964	0.87	42	0.88	87.5
1991	OCT	9	0.79	1959	0.87	43	0.90	89.6
1992	SEP	16	0.64	1983	0.89	44	0.92	91.7
1993	NOV	9	0.57	1971	0.91	45	0.94	93.8
1994	OCT	6	0.49	1968	0.96	46	0.96	95.8
1995	SEP	20	0.75	1972	1.00	47	0.98	97.9

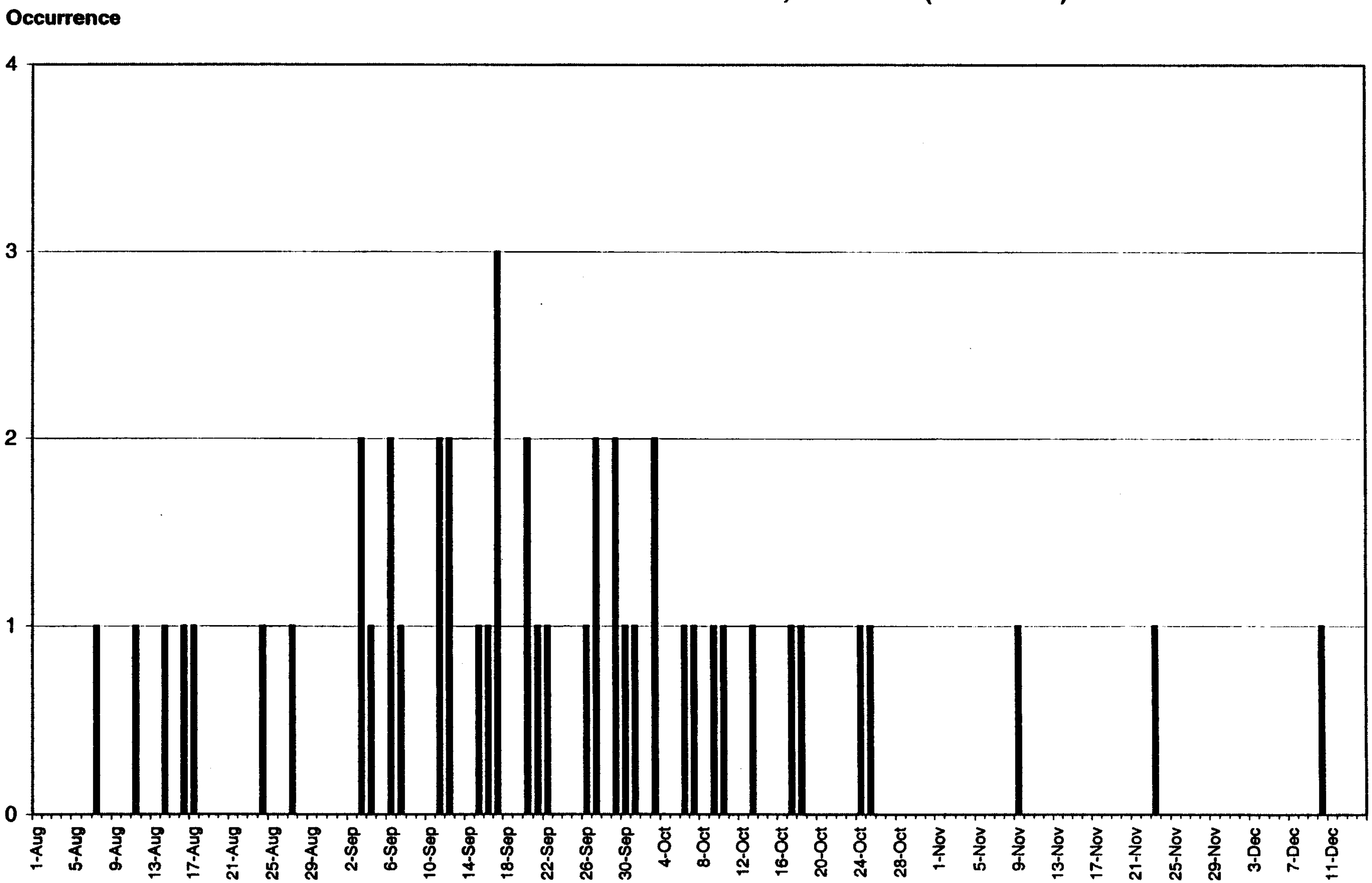
Rank = Numerical position or ordered low flow data with driest year equal to one.
N = 47

AR 011320

MILLER CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN MILLER CREEK (1994)

Low Flow Occurrences in Miller Creek, 1949-1995 (1994 HSPF)



MILLER CREEK

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK (1991-1994)

Start of 7-Day Low Flows with
Average Flow Rates

	Date		1994 Miller Creek at Hwy 509 Flow / cfs
1991	OCT	9	0.79
1992	SEP	16	0.64
1993	NOV	9	0.57
1994	OCT	6	0.49

Statistical Ranking of Average 7-Day Low Flows
Period of Record: 1949-1995

Date	Average 7-Day Lows Ordered	Rank	Rank/N+1	Return Frequency
1994	0.49	1	0.20	20.0
1993	0.57	2	0.40	40.0
1992	0.64	3	0.60	60.0
1991	0.79	4	0.80	80.0

Rank = Numerical position or ordered low flow data
with driest year equal to one.
N = 4

AR 011324

MILLER CREEK

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK 1991 – 1994, POST-PROJECT CONDITIONS (2006)

Start of 7-Day Low Flows with
Average Flow Rates

	Date		2006 Miller Creek at Hwy 509 Flow / cfs
1991	OCT	9	0.67
1992	SEP	16	0.54
1993	NOV	9	0.49
1994	SEP	24	0.46

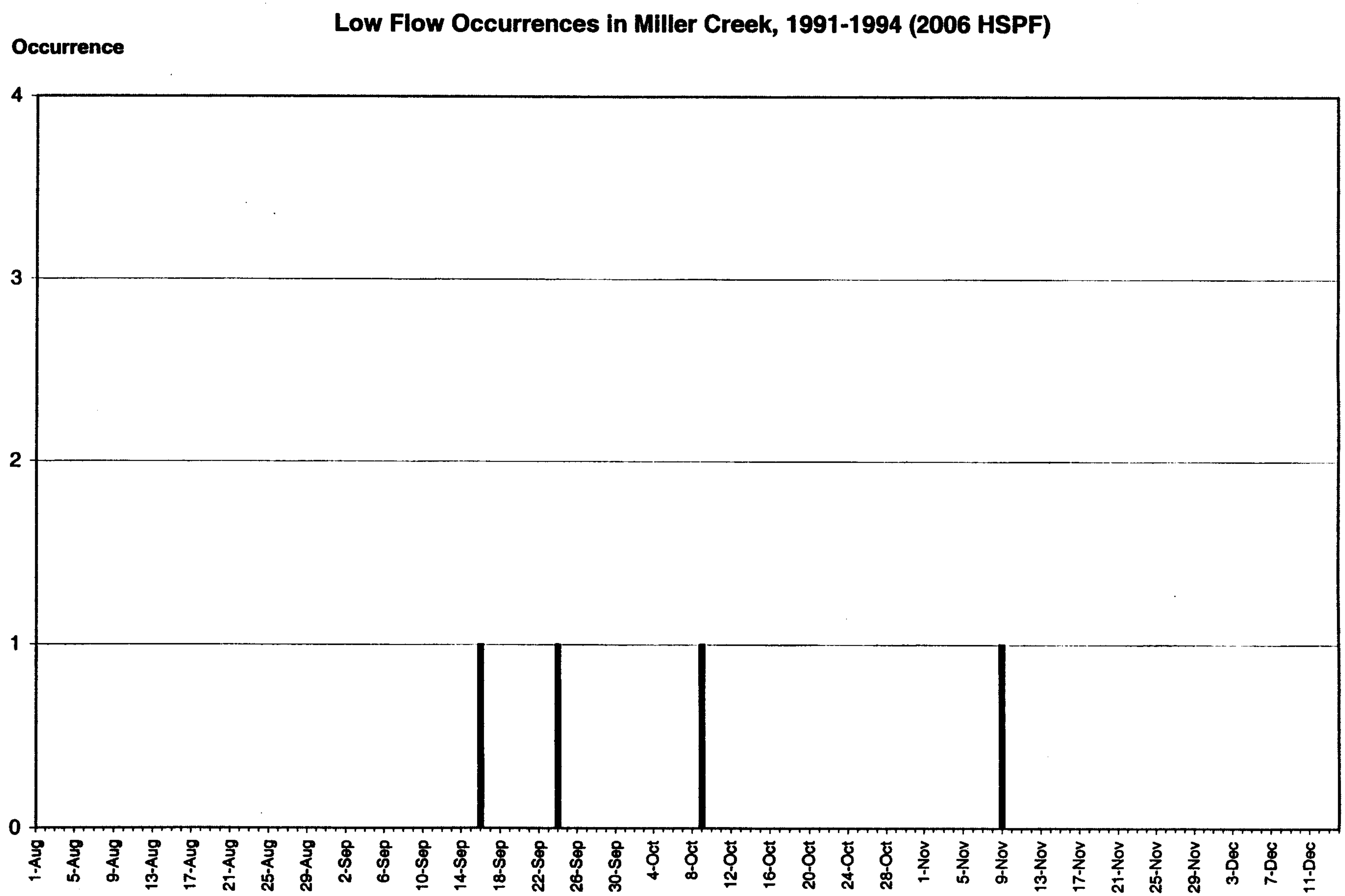
Statistical Ranking of Average 7-Day Low Flows
Period of Record: 1941-1994

Date	Average 7-Day Lows Ordered	Rank	Rank/N+1	Return Frequency
1994	0.46	1	0.20	20.0
1993	0.49	2	0.40	40.0
1992	0.54	3	0.60	60.0
1991	0.67	4	0.80	80.0

Rank = Numerical position or ordered low flow data
with driest year equal to one.
N = 4

MILLER CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN MILLER CREEK 1991 – 1994, POST-PROJECT CONDITIONS (2006)


Low Flow Occurrences in Miller Creek, 1991-1994 (2006 HSPF)
Occurrence
4
3
2
1
0
1-Aug
5-Aug
9-Aug
13-Aug
17-Aug
21-Aug
25-Aug
29-Aug
2-Sep
6-Sep
10-Sep
14-Sep
18-Sep
22-Sep
26-Sep
30-Sep
4-Oct
8-Oct
12-Oct
16-Oct
20-Oct
24-Oct
28-Oct
1-Nov
5-Nov
9-Nov
13-Nov
17-Nov
21-Nov
25-Nov
29-Nov
3-Dec
7-Dec
11-Dec

MILLER CREEK

7-DAY LOW FLOW OCCURRENCES IN MILLER CREEK, 1991 – 1994, POST-PROJECT CONDITIONS (2006+ MITIGATION)

Start of 7-Day Low Flows with Average Flow Rates

Statistical Ranking of Average 7-Day Low Flows
Period of Record: 1941-1994

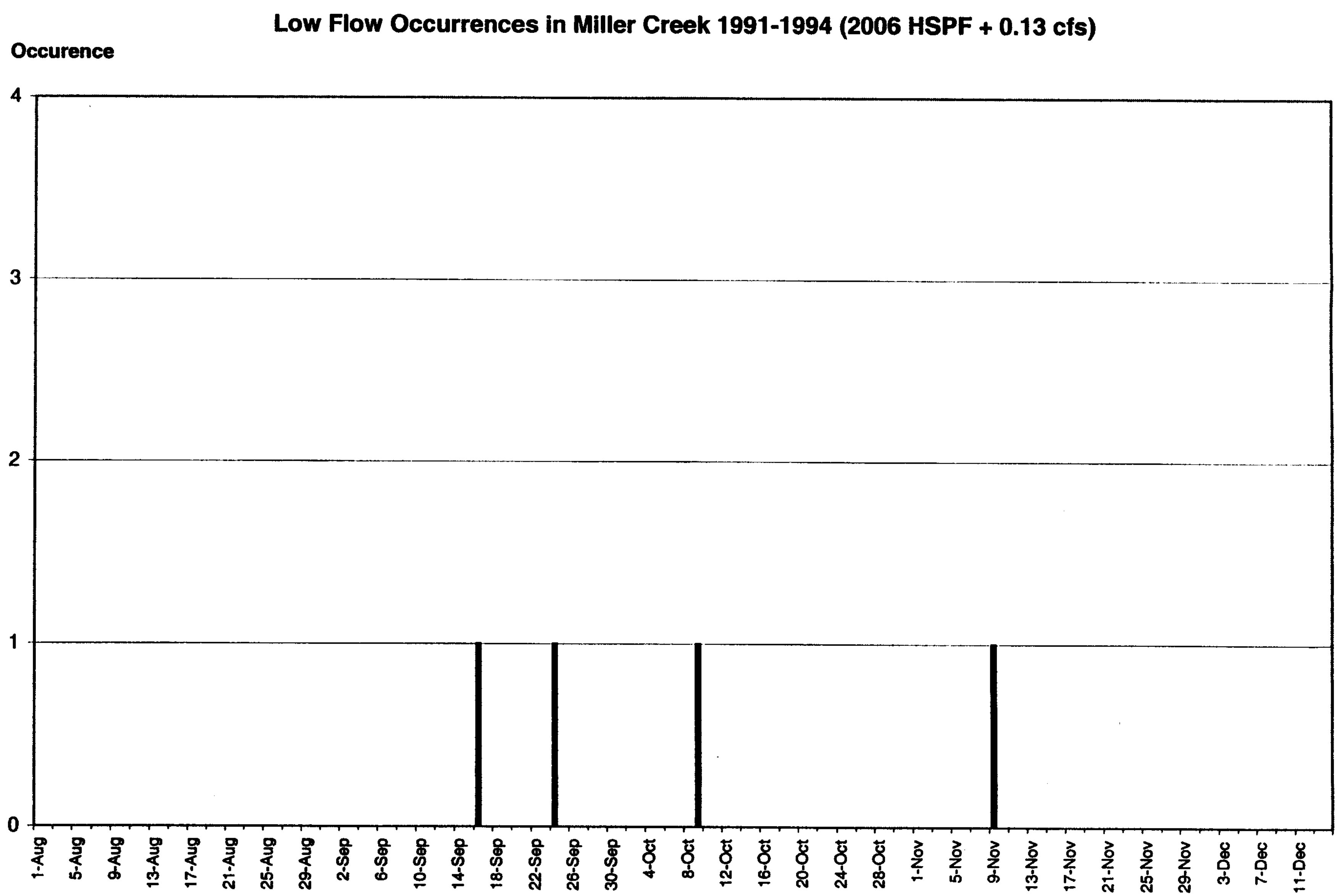
	Date		2006 + Mitigation Miller Creek at Hwy 509 Flow / cfs		Date	Average 7-Day Lows Ordered	Rank	Rank/N+1	Return Frequency
1991	OCT	9	0.80		1994	0.59	1	0.20	20.0
1992	SEP	16	0.67		1993	0.62	2	0.40	40.0
1993	NOV	9	0.62		1992	0.67	3	0.60	60.0
1994	SEP	24	0.59		1991	0.80	4	0.80	80.0

Rank = Numerical position or ordered low flow data with driest year equal to one.

N = 4

MILLER CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN MILLER CREEK
1991 – 1994, POST-PROJECT CONDITIONS
(2006+ MITIGATION)



Low Flow Occurrences in Miller Creek 1991-1994 (2006 HSPF + 0.13 cfs)
Occurence
4
3
2
1
0
1-Aug
5-Aug
9-Aug
13-Aug
17-Aug
21-Aug
25-Aug
29-Aug
2-Sep
6-Sep
10-Sep
14-Sep
18-Sep
22-Sep
26-Sep
30-Sep
4-Oct
8-Oct
12-Oct
16-Oct
20-Oct
24-Oct
28-Oct
1-Nov
5-Nov
9-Nov
13-Nov
17-Nov
21-Nov
25-Nov
29-Nov
3-Dec
7-Dec
11-Dec

MILLER CREEK

COMPARISON OF 7-DAY LOW FLOW BY YEAR, 1991-1994

Comparison of 7-Day Low Flows by Year
for Miller Creek

			1994 Miller Creek at				2006 Miller Creek at					2006 + Mitigation Miller Creek at	
	Date		Hwy 509 Flow / cfs		Date		Hwy 509 Flow / cfs	-1994		Date		Hwy 509 Flow / cfs	-1994
1991	OCT	9	0.79	1991	OCT	9	0.67	-0.12	1991	OCT	9	0.80	0.01
1992	SEP	16	0.64	1992	SEP	16	0.54	-0.10	1992	SEP	16	0.67	0.03
1993	NOV	9	0.57	1993	NOV	9	0.49	-0.08	1993	NOV	9	0.62	0.05
1994	SEP	24	0.49	1994	SEP	24	0.46	-0.03	1994	SEP	24	0.59	0.10

MILLER CREEK

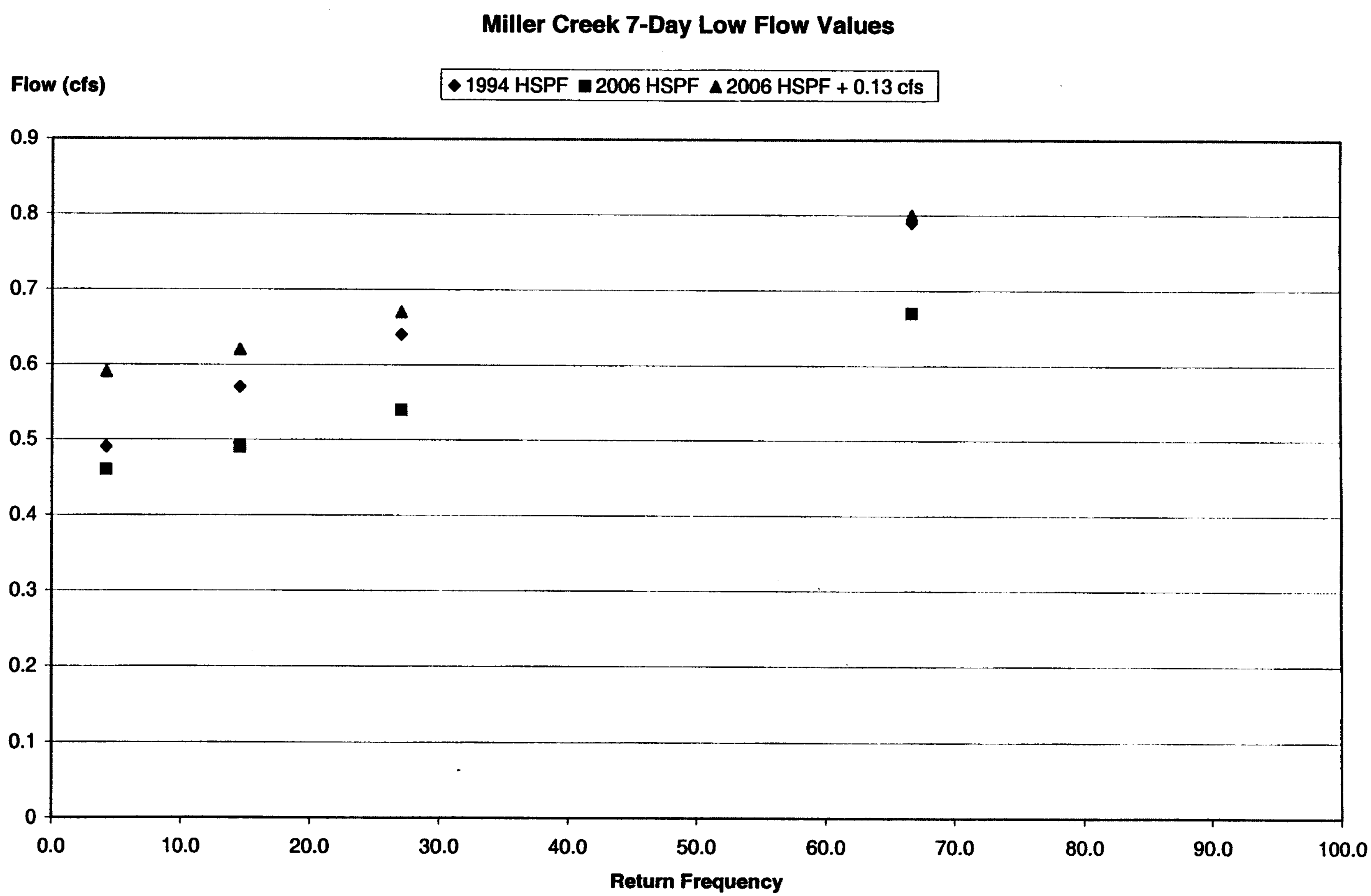
COMPARISON OF 7-DAY LOW FLOW BY RANK, 1991-1994

Comparison of 7-Day Low Flow by Rank
for Miller Creek

Rank	1994 HSPF	2006 HSPF	-1994	2006 + Mitigation Miller Creek at Hwy 509 Flow / cfs	-1994
1	0.49	0.46	-0.03	0.59	0.10
2	0.57	0.49	-0.08	0.62	0.05
3	0.64	0.54	-0.10	0.67	0.03
4	0.79	0.67	-0.12	0.80	0.01

MILLER CREEK

PLOTTED 7-DAY LOW FLOWS BY PERCENT RETURN FREQUENCY, 1991-1994



Miller Creek 7-Day Low Flow Values
Flow (cfs)
◆ 1994 HSPF ■ 2006 HSPF ▲ 2006 HSPF + 0.13 cfs
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
Return Frequency

MILLER CREEK

SUMMARY OF LOW STREAM FLOW MITIGATION VAULT STORAGE AND FILLING

Reserve Storage Vaults for Miller Creek.

Vault sizes (dead storage in acre ft) required for 92-day release of 0.13 cfs (1949 – 1995).

Mean	8.25
Median	7.71
Max	18.79
Min	3.47

Contributing Drainage Areas

Subbasin	Vault	Area	% Contribution
NEPL	NEPL	32.31	39.62
Cargo	Cargo	8.12	9.95
SDN2X	SDN2X/4X	0.36	20.64
SDN4		12.26	
SDN4X		4.21	
SDN3	SDN3X	24.30	29.79
SDN3X		0.00	
	Total	**81.56**	

Fill time for 18.8 acre foot volume / Days to fill after closing vault on January 1.

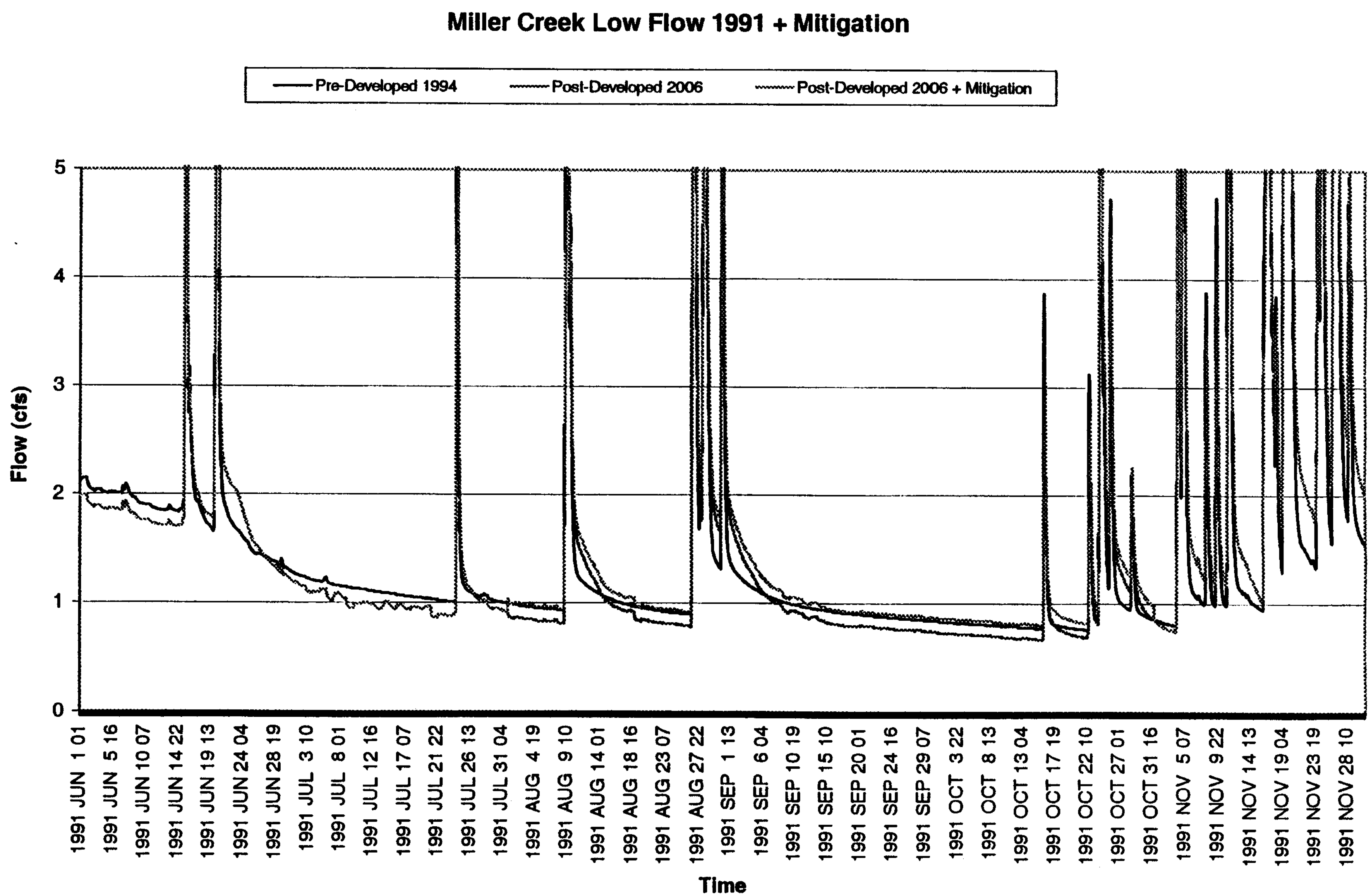
Mean	20.56
Media	16.00
Max	58.00
Min	4.0

Remaining volume in vaults on Oct 31

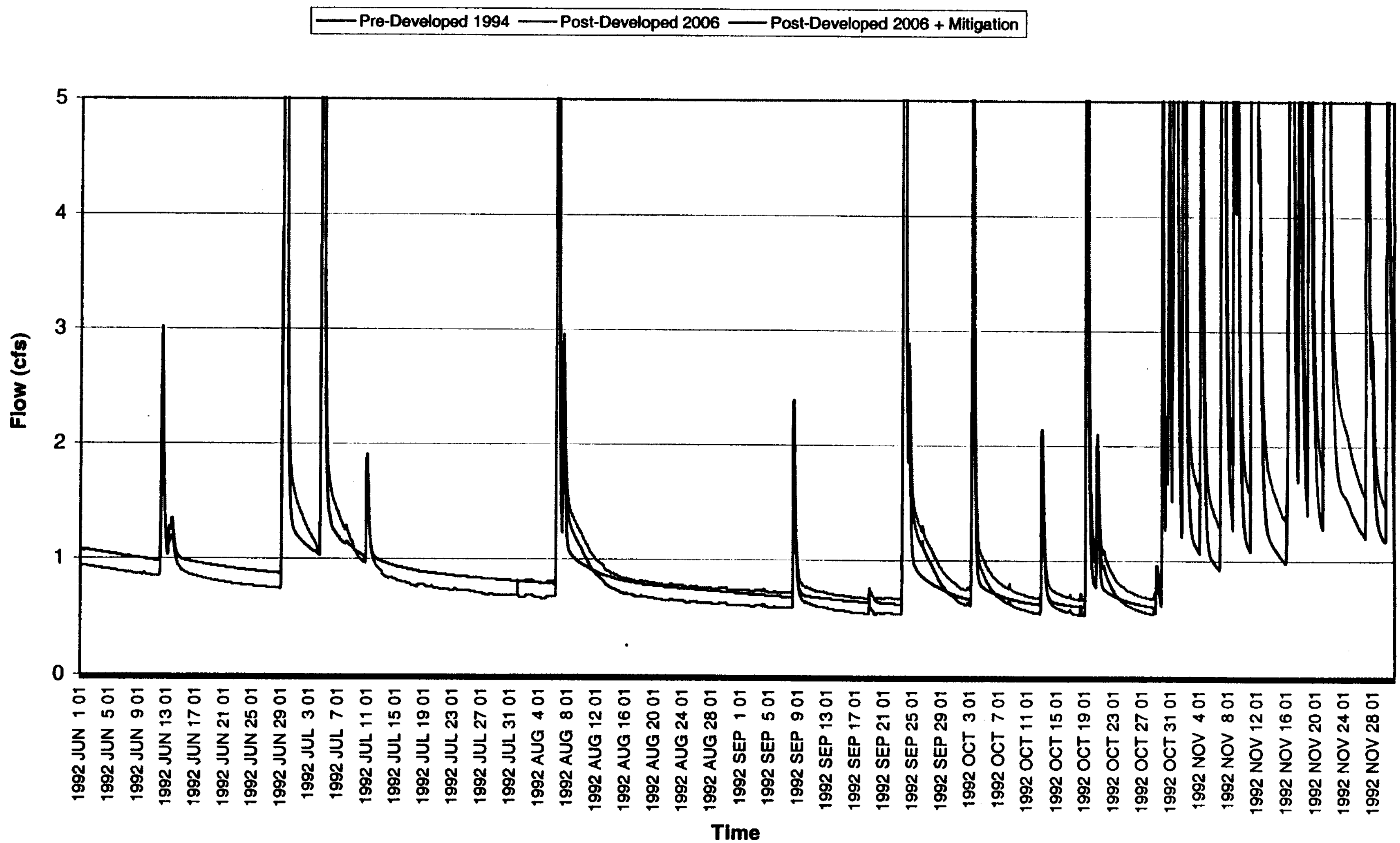
	Volume ac ft	Remaining Days
Mean	16.99	65
Median	18.24	70
Max	18.80	72
Min	5.34	20

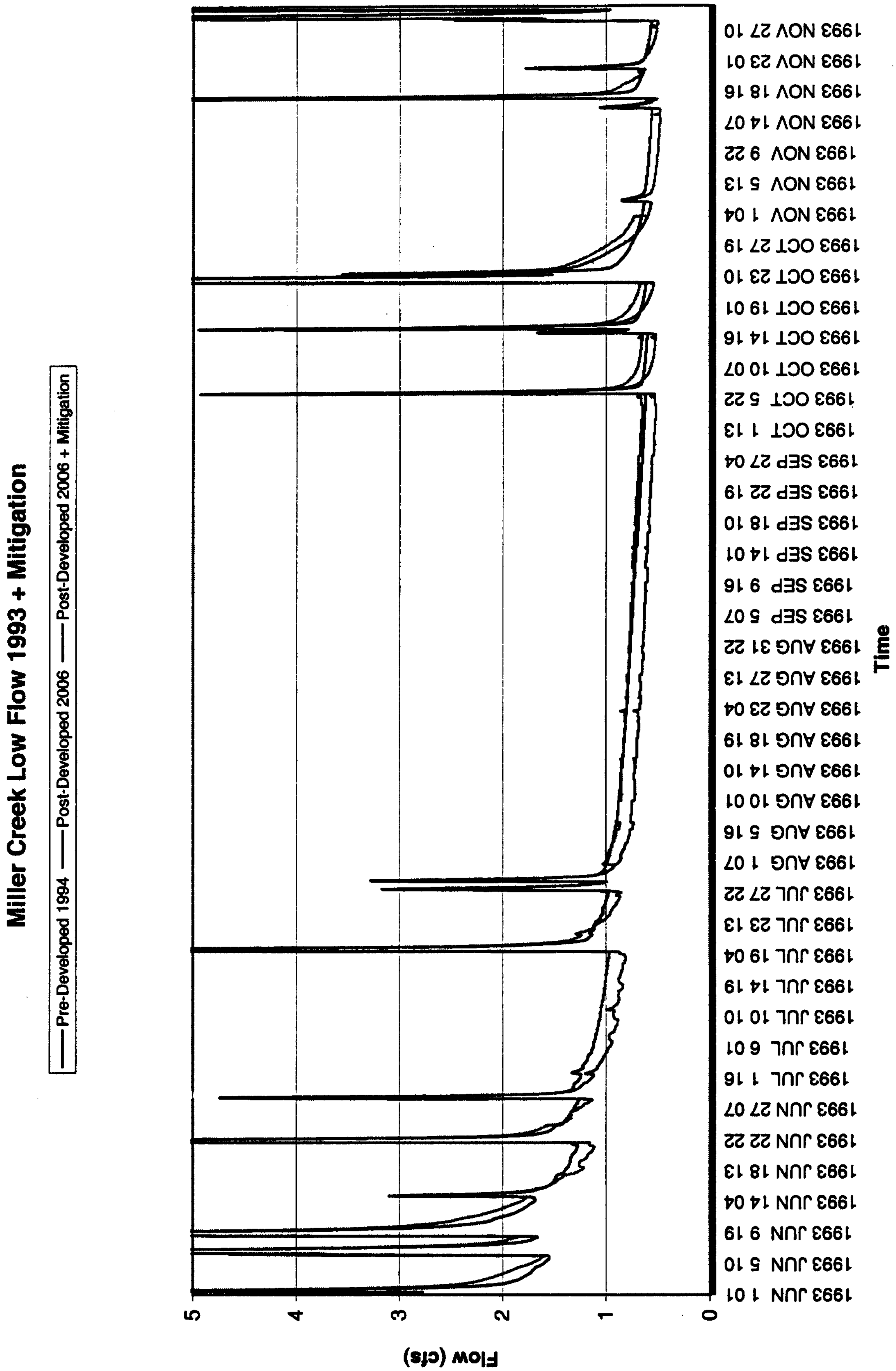
MILLER CREEK

LOW FLOW HYDROGRAPHS WITH MITIGATION (1991-1994)


Miller Creek Low Flow 1991 + Mitigation
Pre-Developed 1994
Post-Developed 2006
Post-Developed 2006 + Mitigation
Flow (cfs)
5
4
3
2
1
0
1991 JUN 1 01
1991 JUN 5 16
1991 JUN 10 07
1991 JUN 14 22
1991 JUN 19 13
1991 JUN 24 04
1991 JUN 28 19
1991 JUL 3 10
1991 JUL 8 01
1991 JUL 12 16
1991 JUL 17 07
1991 JUL 21 22
1991 JUL 26 13
1991 JUL 31 04
1991 AUG 4 19
1991 AUG 9 10
1991 AUG 14 01
1991 AUG 18 16
1991 AUG 23 07
1991 AUG 27 22
1991 SEP 1 13
1991 SEP 6 04
1991 SEP 10 19
1991 SEP 15 10
1991 SEP 20 01
1991 SEP 24 16
1991 SEP 29 07
1991 OCT 3 22
1991 OCT 8 13
1991 OCT 13 04
1991 OCT 17 19
1991 OCT 22 10
1991 OCT 27 01
1991 OCT 31 16
1991 NOV 5 07
1991 NOV 9 22
1991 NOV 14 13
1991 NOV 19 04
1991 NOV 23 19
1991 NOV 28 10
Time

Miller Creek Low Flow 1992 + Mitigation

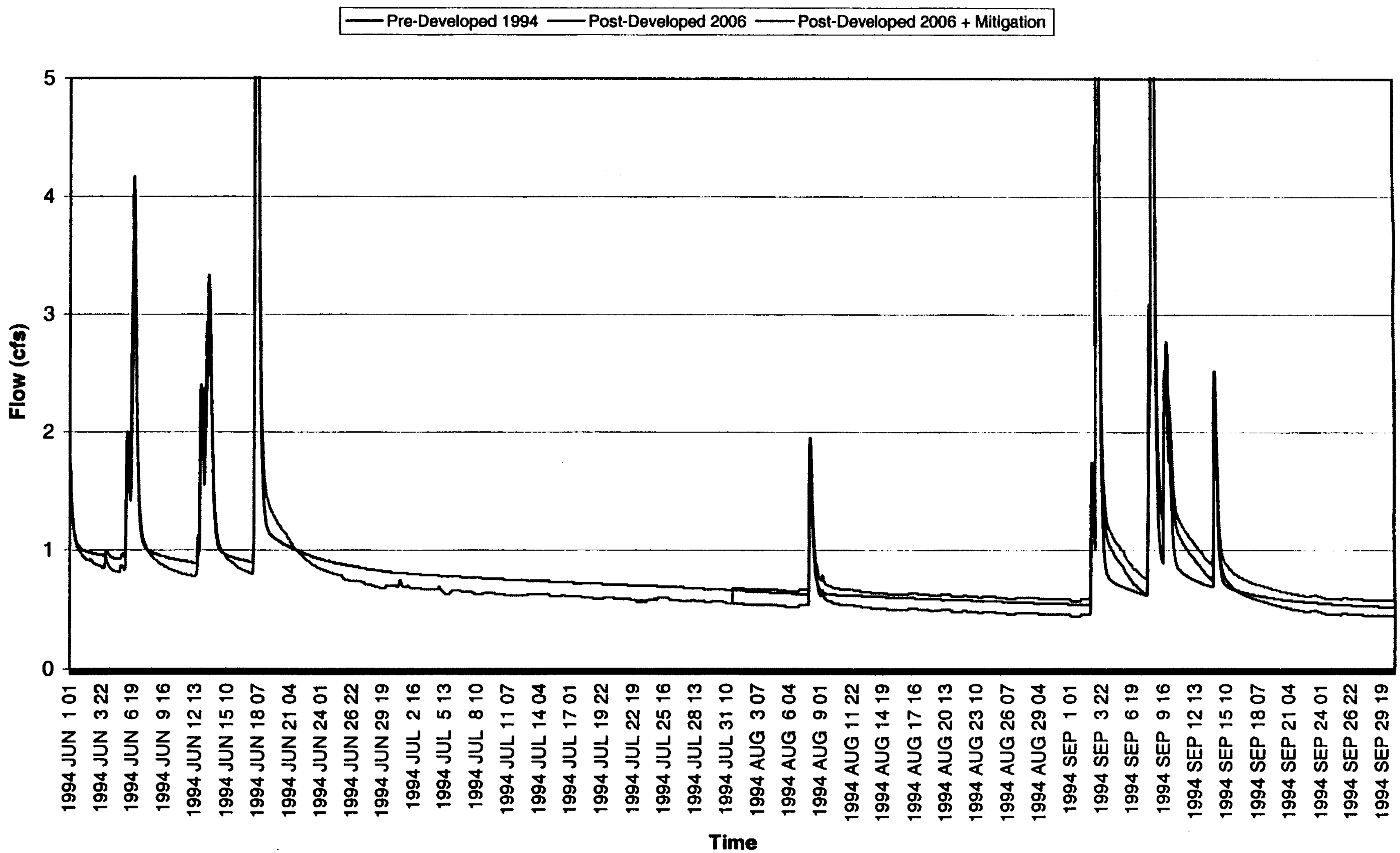




Miller Creek Low Flow 1993 + Mitigation
Pre-Developed 1994
Post-Developed 2006
Post-Developed 2006 + Mitigation
Flow (cfs)
0
1
2
3
4
5
Time
1993 JUN 1 01
1993 JUN 5 10
1993 JUN 9 19
1993 JUN 14 04
1993 JUN 18 13
1993 JUN 22 22
1993 JUN 27 07
1993 JUL 1 16
1993 JUL 6 01
1993 JUL 10 10
1993 JUL 14 19
1993 JUL 19 04
1993 JUL 23 13
1993 JUL 27 22
1993 AUG 1 07
1993 AUG 5 16
1993 AUG 10 01
1993 AUG 14 10
1993 AUG 18 19
1993 AUG 23 04
1993 AUG 27 13
1993 AUG 31 22
1993 SEP 5 07
1993 SEP 9 16
1993 SEP 14 01
1993 SEP 18 10
1993 SEP 22 19
1993 SEP 27 04
1993 OCT 1 13
1993 OCT 5 22
1993 OCT 10 07
1993 OCT 14 16
1993 OCT 19 01
1993 OCT 23 10
1993 OCT 27 19
1993 NOV 1 04
1993 NOV 5 13
1993 NOV 9 22
1993 NOV 14 07
1993 NOV 18 16
1993 NOV 23 01
1993 NOV 27 10

AR 011344

Miller Creek Low Flow 1994 + Mitigation



WALKER CREEK

WALKER CREEK

7-DAY LOW FLOW OCCURRENCES IN WALKER CREEK (1994)

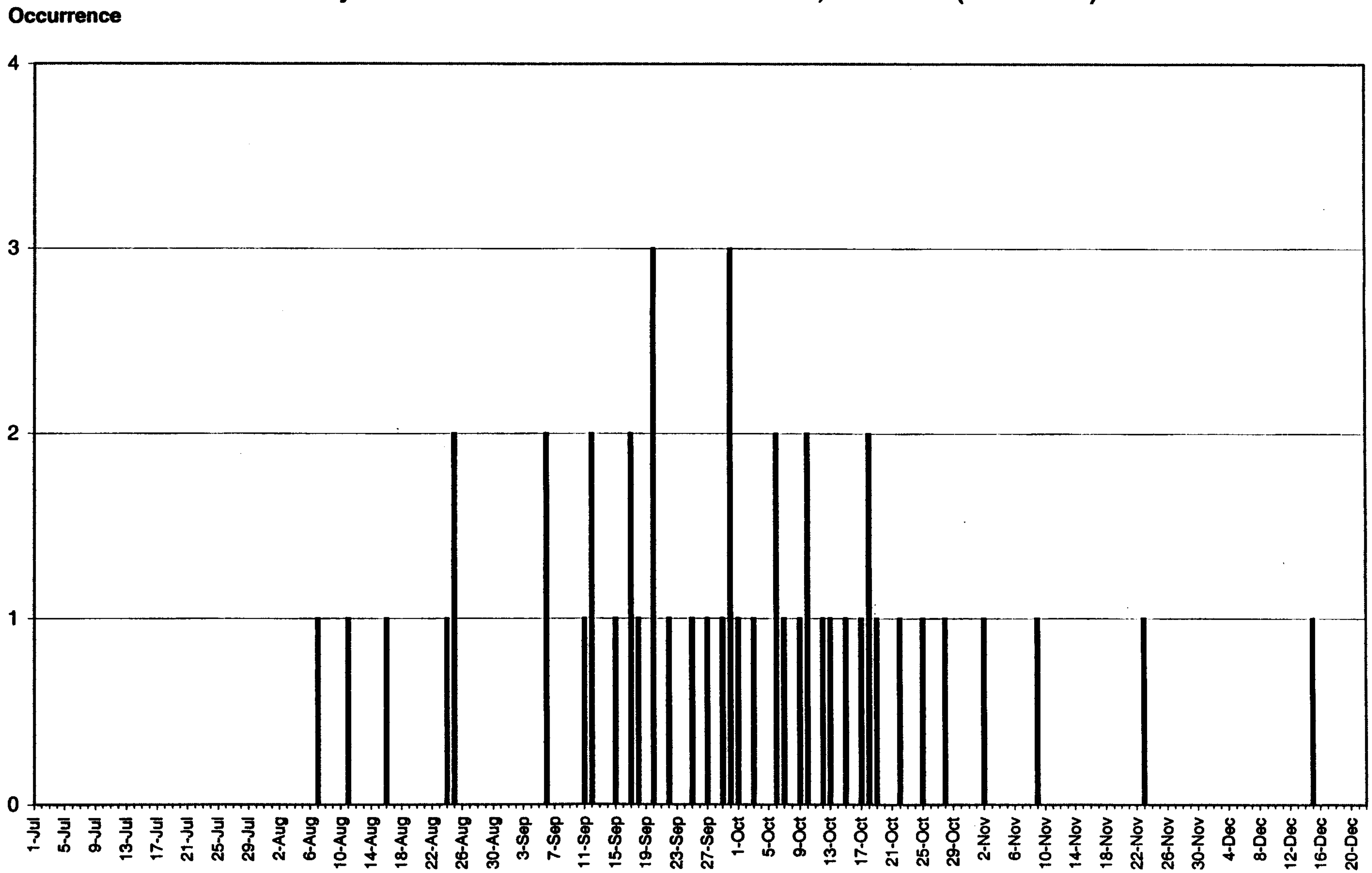
Start of 7-Day Low Flows with Average Flow Rates		Statistical Ranking of Average 7-Day Low Flows Period of Record: 1949-1995				
Date	1994 HSPF Walker Creek at POC	Date	Average 7-Day Lows Ordered	Rank	Rank/N+1	Return Frequency
19-Oct-49	0.63	1994	0.61	1	0.02	2.1
17-Sep-50	0.83	1949	0.63	2	0.04	4.2
17-Sep-51	0.79	1979	0.64	3	0.06	6.3
23-Nov-52	0.66	1987	0.66	4	0.08	8.3
15-Sep-53	0.79	1952	0.66	5	0.10	10.4
12-Oct-54	0.89	1993	0.67	6	0.13	12.5
6-Sep-55	0.86	1988	0.67	7	0.15	14.6
18-Sep-56	0.88	1986	0.68	8	0.17	16.7
20-Sep-57	0.83	1977	0.68	9	0.19	18.8
30-Sep-58	0.72	1992	0.68	10	0.21	20.8
24-Aug-59	0.88	1985	0.70	11	0.23	22.9
15-Oct-60	0.86	1980	0.70	12	0.25	25.0
30-Sep-61	0.82	1989	0.71	13	0.27	27.1
20-Sep-62	0.81	1958	0.72	14	0.29	29.2
6-Oct-63	0.76	1981	0.73	15	0.31	31.3
25-Oct-64	0.93	1990	0.74	16	0.33	33.3
27-Sep-65	0.80	1976	0.75	17	0.35	35.4
30-Sep-66	0.79	1995	0.75	18	0.38	37.5
22-Sep-67	0.78	1963	0.76	19	0.40	39.6
7-Aug-68	0.97	1973	0.76	20	0.42	41.7
6-Sep-69	0.84	1982	0.77	21	0.44	43.8
10-Oct-70	0.78	1967	0.78	22	0.46	45.8
25-Aug-71	0.91	1970	0.78	23	0.48	47.9
11-Sep-72	0.96	1953	0.79	24	0.50	50.0
12-Sep-73	0.76	1966	0.79	25	0.52	52.1
13-Oct-74	0.79	1991	0.79	26	0.54	54.2
11-Aug-75	0.82	1974	0.79	27	0.56	56.3
15-Dec-76	0.75	1951	0.79	28	0.58	58.3
16-Aug-77	0.68	1984	0.80	29	0.60	60.4
25-Aug-78	0.81	1965	0.80	30	0.63	62.5
7-Oct-79	0.64	1978	0.81	31	0.65	64.6
17-Oct-80	0.70	1962	0.81	32	0.67	66.7
12-Sep-81	0.73	1975	0.82	33	0.69	68.8
29-Sep-82	0.77	1961	0.82	34	0.71	70.8
10-Oct-83	0.93	1957	0.83	35	0.73	72.9
1-Oct-84	0.80	1950	0.83	36	0.75	75.0
9-Oct-85	0.70	1969	0.84	37	0.77	77.1
18-Oct-86	0.68	1960	0.86	38	0.79	79.2
2-Nov-87	0.66	1955	0.86	39	0.81	81.3
6-Oct-88	0.67	1956	0.88	40	0.83	83.3
3-Oct-89	0.71	1959	0.88	41	0.85	85.4
25-Sep-90	0.74	1954	0.89	42	0.88	87.5
28-Oct-91	0.79	1971	0.91	43	0.90	89.6
22-Oct-92	0.68	1964	0.93	44	0.92	91.7
9-Nov-93	0.67	1983	0.93	45	0.94	93.8
18-Oct-94	0.61	1972	0.96	46	0.96	95.8
20-Sep-95	0.75	1968	0.97	47	0.98	97.9

Rank = Numerical position of ordered low flow data with the driest year equal to one.
N = 47

WALKER CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN WALKER CREEK (1994)

7-Day Low Flow Occurrences in Walker Creek, 1949-1995 (1994 HSPF)



WALKER CREEK

7-DAY LOW FLOW OCCURRENCES IN WALKER CREEK (2006)

Start of 7-Day Low Flows with Average Flow Rates		Statistical Ranking of Average 7-Day Low Flows Period of Record: 1949-1995				
Date	2006 HSPF Walker Creek at POC	Date	Average 7-Day Lows Ordered	Rank	Rank/N+1	Return Frequency
19-Oct-49	0.57	1994	0.55	1	0.02	2.1
17-Sep-50	0.75	1949	0.57	2	0.04	4.2
17-Sep-51	0.71	1979	0.58	3	0.06	6.3
23-Nov-52	0.59	1952	0.59	4	0.08	8.3
15-Sep-53	0.71	1987	0.60	5	0.10	10.4
12-Oct-54	0.81	1993	0.60	6	0.13	12.5
6-Sep-55	0.77	1988	0.60	7	0.15	14.6
18-Sep-56	0.79	1986	0.61	8	0.17	16.7
20-Sep-57	0.75	1977	0.62	9	0.19	18.8
30-Sep-58	0.65	1992	0.62	10	0.21	20.8
24-Aug-59	0.79	1980	0.63	11	0.23	22.9
15-Oct-60	0.77	1985	0.63	12	0.25	25.0
30-Sep-61	0.74	1989	0.64	13	0.27	27.1
20-Sep-62	0.73	1958	0.65	14	0.29	29.2
6-Oct-63	0.69	1981	0.65	15	0.31	31.3
25-Oct-64	0.84	1990	0.66	16	0.33	33.3
27-Sep-65	0.72	1995	0.67	17	0.35	35.4
30-Sep-66	0.71	1976	0.68	18	0.38	37.5
22-Sep-67	0.70	1973	0.69	19	0.40	39.6
7-Aug-68	0.87	1963	0.69	20	0.42	41.7
6-Sep-69	0.76	1967	0.70	21	0.44	43.8
27-Aug-70	0.71	1982	0.70	22	0.46	45.8
25-Aug-71	0.82	1970	0.71	23	0.48	47.9
11-Sep-72	0.87	1953	0.71	24	0.50	50.0
12-Sep-73	0.69	1974	0.71	25	0.52	52.1
13-Oct-74	0.71	1991	0.71	26	0.54	54.2
11-Aug-75	0.74	1966	0.71	27	0.56	56.3
15-Dec-76	0.68	1951	0.71	28	0.58	58.3
16-Aug-77	0.62	1984	0.72	29	0.60	60.4
25-Aug-78	0.73	1965	0.72	30	0.63	62.5
7-Oct-79	0.58	1978	0.73	31	0.65	64.6
17-Oct-80	0.63	1962	0.73	32	0.67	66.7
12-Sep-81	0.65	1975	0.74	33	0.69	68.8
17-Sep-82	0.70	1961	0.74	34	0.71	70.8
10-Oct-83	0.84	1957	0.75	35	0.73	72.9
1-Oct-84	0.72	1950	0.75	36	0.75	75.0
9-Oct-85	0.63	1969	0.76	37	0.77	77.1
18-Oct-86	0.61	1955	0.77	38	0.79	79.2
2-Nov-87	0.60	1960	0.77	39	0.81	81.3
6-Oct-88	0.60	1956	0.79	40	0.83	83.3
3-Oct-89	0.64	1959	0.79	41	0.85	85.4
25-Sep-90	0.66	1954	0.81	42	0.88	87.5
9-Oct-91	0.71	1971	0.82	43	0.90	89.6
22-Oct-92	0.62	1964	0.84	44	0.92	91.7
9-Nov-93	0.60	1983	0.84	45	0.94	93.8
18-Oct-94	0.55	1972	0.87	46	0.96	95.8
20-Sep-95	0.67	1968	0.87	47	0.98	97.9

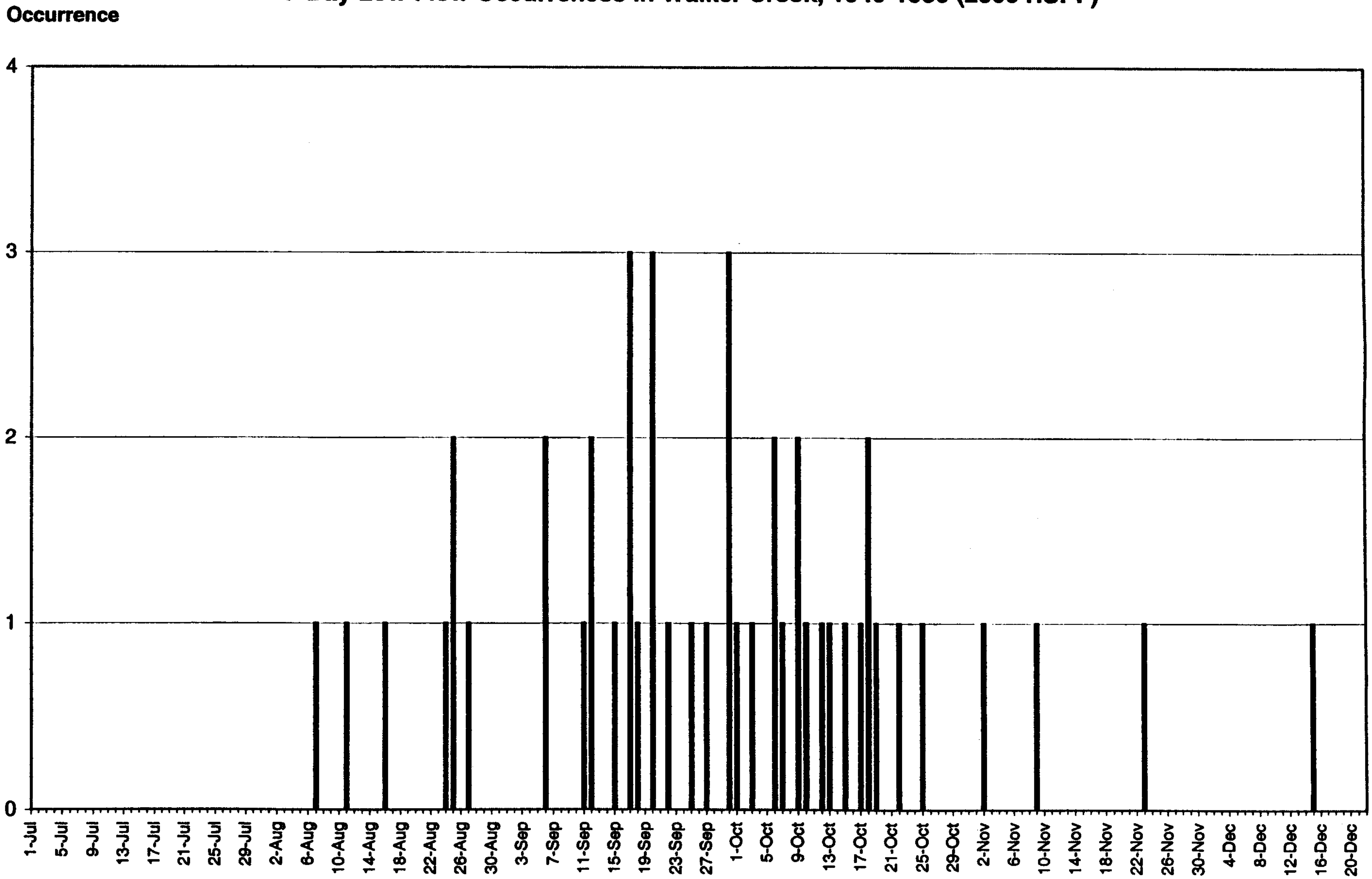
Rank = Numerical position of ordered low flow data with the driest year equal to one.

N = 47

WALKER CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN WALKER CREEK (2006)

7-Day Low Flow Occurrences in Walker Creek, 1949-1995 (2006 HSPF)



WALKER CREEK

7-DAY LOW FLOW OCCURRENCES IN WALKER CREEK (WITH MITIGATION)

Start of 7-Day Low Flows with Average Flow Rates		Statistical Ranking of Average 7-Day Low Flows Period of Record: 1949-1995				
Date	Walker Creek at POC 2006 + AUGMENT Aug 1 - Oct 31 0.09 cfs	Date	Average 7-Day Lows Ordered	Rank	Rank/N+1	Return Frequency
2-Nov-49	0.64	1952	0.59	1	0.02	2.1
17-Sep-50	0.84	1987	0.60	2	0.04	4.2
17-Sep-51	0.80	1993	0.60	3	0.06	6.3
23-Nov-52	0.59	1949	0.64	4	0.08	8.3
15-Sep-53	0.80	1994	0.64	5	0.10	10.4
28-Oct-54	0.87	1979	0.65	6	0.13	12.5
6-Sep-55	0.86	1976	0.68	7	0.15	14.6
18-Sep-56	0.88	1977	0.68	8	0.17	16.7
5-Nov-57	0.83	1988	0.69	9	0.19	18.8
30-Sep-58	0.74	1986	0.70	10	0.21	20.8
24-Aug-59	0.88	1992	0.71	11	0.23	22.9
15-Oct-60	0.86	1991	0.72	12	0.25	25.0
30-Sep-61	0.83	1980	0.72	13	0.27	27.1
20-Sep-62	0.82	1985	0.72	14	0.29	29.2
6-Oct-63	0.78	1989	0.73	15	0.31	31.3
25-Oct-64	0.93	1958	0.74	16	0.33	33.3
27-Sep-65	0.81	1981	0.74	17	0.35	35.4
4-Nov-66	0.79	1990	0.75	18	0.38	37.5
22-Sep-67	0.79	1995	0.76	19	0.40	39.6
7-Aug-68	0.96	1973	0.78	20	0.42	41.7
6-Sep-69	0.85	1963	0.78	21	0.44	43.8
10-Oct-70	0.80	1967	0.79	22	0.46	45.8
25-Aug-71	0.91	1982	0.79	23	0.48	47.9
11-Sep-72	0.96	1966	0.79	24	0.50	50.0
12-Sep-73	0.78	1970	0.80	25	0.52	52.1
13-Oct-74	0.80	1975	0.80	26	0.54	54.2
25-Jul-75	0.80	1953	0.80	27	0.56	56.3
15-Dec-76	0.68	1974	0.80	28	0.58	58.3
25-Jul-77	0.68	1951	0.80	29	0.60	60.4
9-Jul-78	0.80	1978	0.80	30	0.63	62.5
25-Jul-79	0.65	1984	0.81	31	0.65	64.6
17-Oct-80	0.72	1965	0.81	32	0.67	66.7
12-Sep-81	0.74	1962	0.82	33	0.69	68.8
17-Sep-82	0.79	1957	0.83	34	0.71	70.8
10-Oct-83	0.93	1961	0.83	35	0.73	72.9
1-Oct-84	0.81	1950	0.84	36	0.75	75.0
9-Oct-85	0.72	1969	0.85	37	0.77	77.1
18-Oct-86	0.70	1955	0.86	38	0.79	79.2
2-Nov-87	0.60	1960	0.86	39	0.81	81.3
6-Oct-88	0.69	1954	0.87	40	0.83	83.3
3-Oct-89	0.73	1956	0.88	41	0.85	85.4
25-Sep-90	0.75	1959	0.88	42	0.88	87.5
28-Oct-91	0.72	1971	0.91	43	0.90	89.6
22-Oct-92	0.71	1964	0.93	44	0.92	91.7
9-Nov-93	0.60	1983	0.93	45	0.94	93.8
18-Oct-94	0.64	1972	0.96	46	0.96	95.8
20-Sep-95	0.76	1968	0.96	47	0.98	97.9

Rank = Numerical position of ordered low flow data with the driest year equal to one.

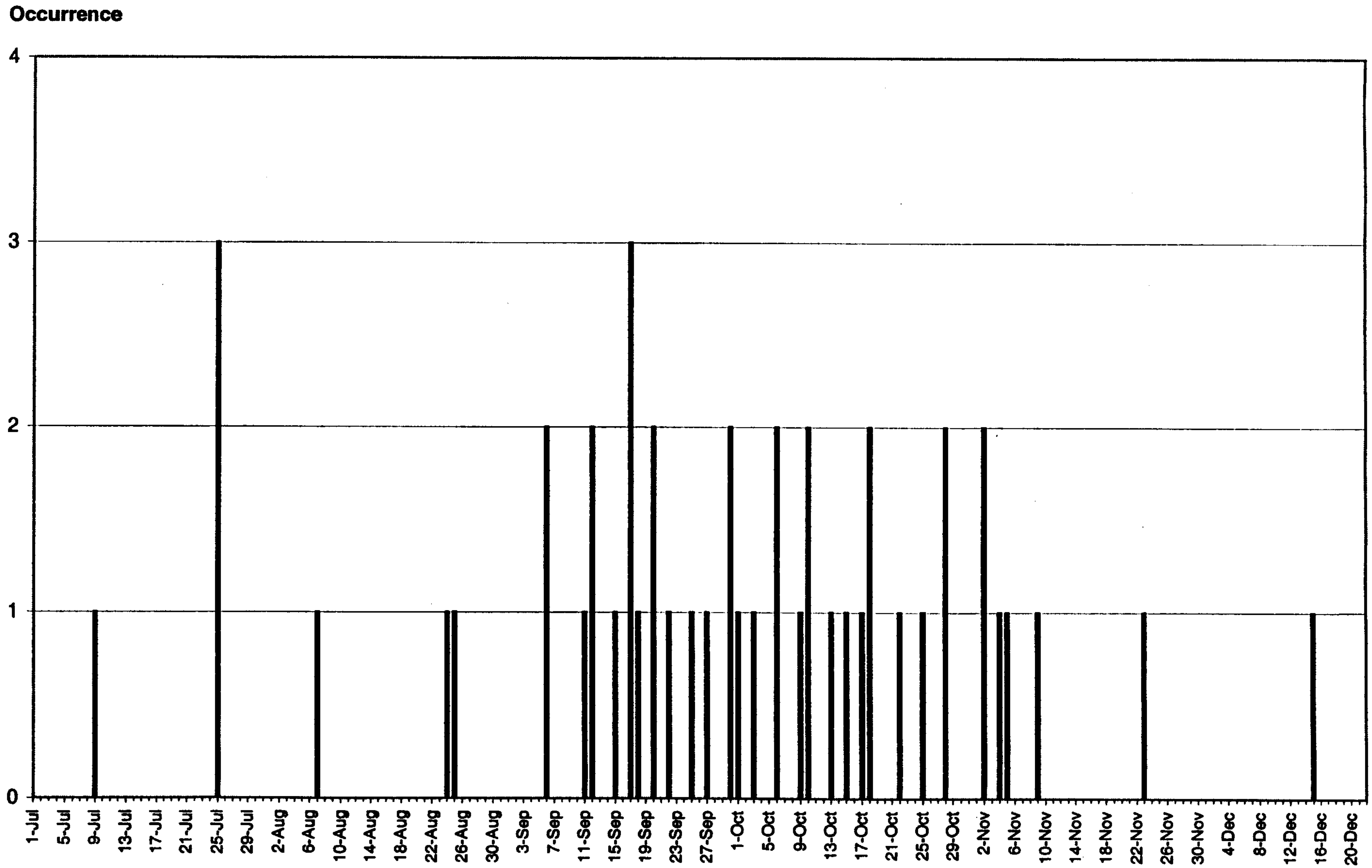
N = 47

AR 011356

WALKER CREEK

HISTOGRAM LOW FLOW OCCURRENCES IN WALKER CREEK (WITH MITIGATION)

7-Day Low Flow Occurrences in Walker Creek, 1949-1995 (2006 HSPF + 0.09 cfs)



AR 011358

WALKER CREEK

COMPARISON OF 7-DAY LOW FLOW BY YEAR

Comparison of [illegible] Low Flow by Year
for Walker Creek

Date	1994 HSPF Walker Creek at POC	Date	2006 HSPF Walker Creek at POC	-1994	Date	Walker Creek at POC 2006 + Mitigation Aug 1 - Oct 31 0.09 cfs	-1994
19-Oct-49	0.63	19-Oct-49	0.57	-0.06	2-Nov-49	0.64	0.01
17-Sep-50	0.83	17-Sep-50	0.75	-0.08	17-Sep-50	0.84	0.01
17-Sep-51	0.79	17-Sep-51	0.71	-0.08	17-Sep-51	0.80	0.01
23-Nov-52	0.66	23-Nov-52	0.59	-0.07	23-Nov-52	0.59	-0.07
15-Sep-53	0.79	15-Sep-53	0.71	-0.08	15-Sep-53	0.80	0.01
12-Oct-54	0.89	12-Oct-54	0.81	-0.08	28-Oct-54	0.87	-0.02
6-Sep-55	0.86	6-Sep-55	0.77	-0.09	6-Sep-55	0.86	0.00
18-Sep-56	0.88	18-Sep-56	0.79	-0.09	18-Sep-56	0.88	0.00
20-Sep-57	0.83	20-Sep-57	0.75	-0.08	5-Nov-57	0.83	0.00
30-Sep-58	0.72	30-Sep-58	0.65	-0.07	30-Sep-58	0.74	0.02
24-Aug-59	0.88	24-Aug-59	0.79	-0.09	24-Aug-59	0.88	0.00
15-Oct-60	0.86	15-Oct-60	0.77	-0.08	15-Oct-60	0.86	0.01
30-Sep-61	0.82	30-Sep-61	0.74	-0.08	30-Sep-61	0.83	0.01
20-Sep-62	0.81	20-Sep-62	0.73	-0.08	20-Sep-62	0.82	0.01
6-Oct-63	0.76	6-Oct-63	0.69	-0.07	6-Oct-63	0.78	0.02
25-Oct-64	0.93	25-Oct-64	0.84	-0.09	25-Oct-64	0.93	0.00
27-Sep-65	0.80	27-Sep-65	0.72	-0.08	27-Sep-65	0.81	0.01
30-Sep-66	0.79	30-Sep-66	0.71	-0.07	4-Nov-66	0.79	0.01
22-Sep-67	0.78	22-Sep-67	0.70	-0.08	22-Sep-67	0.79	0.01
7-Aug-68	0.97	7-Aug-68	0.87	-0.10	7-Aug-68	0.96	-0.01
6-Sep-69	0.84	6-Sep-69	0.76	-0.09	6-Sep-69	0.85	0.00
10-Oct-70	0.78	27-Aug-70	0.71	-0.07	10-Oct-70	0.80	0.02
25-Aug-71	0.91	25-Aug-71	0.82	-0.09	25-Aug-71	0.91	0.00
11-Sep-72	0.96	11-Sep-72	0.87	-0.09	11-Sep-72	0.96	0.00
12-Sep-73	0.76	12-Sep-73	0.69	-0.07	12-Sep-73	0.78	0.02
13-Oct-74	0.79	13-Oct-74	0.71	-0.08	13-Oct-74	0.80	0.01
11-Aug-75	0.82	11-Aug-75	0.74	-0.08	25-Jul-75	0.80	-0.02
15-Dec-76	0.75	15-Dec-76	0.68	-0.07	15-Dec-76	0.68	-0.07
16-Aug-77	0.68	16-Aug-77	0.62	-0.06	25-Jul-77	0.68	0.00
25-Aug-78	0.81	25-Aug-78	0.73	-0.08	9-Jul-78	0.80	0.00
7-Oct-79	0.64	7-Oct-79	0.58	-0.06	25-Jul-79	0.65	0.01
17-Oct-80	0.70	17-Oct-80	0.63	-0.07	17-Oct-80	0.72	0.02
12-Sep-81	0.73	12-Sep-81	0.65	-0.07	12-Sep-81	0.74	0.02
29-Sep-82	0.77	17-Sep-82	0.70	-0.07	17-Sep-82	0.79	0.02
10-Oct-83	0.93	10-Oct-83	0.84	-0.09	10-Oct-83	0.93	0.00
1-Oct-84	0.80	1-Oct-84	0.72	-0.08	1-Oct-84	0.81	0.01
9-Oct-85	0.70	9-Oct-85	0.63	-0.07	9-Oct-85	0.72	0.02
18-Oct-86	0.68	18-Oct-86	0.61	-0.06	18-Oct-86	0.70	0.03
2-Nov-87	0.66	2-Nov-87	0.60	-0.06	2-Nov-87	0.60	-0.06
6-Oct-88	0.67	6-Oct-88	0.60	-0.07	6-Oct-88	0.69	0.02
3-Oct-89	0.71	3-Oct-89	0.64	-0.07	3-Oct-89	0.73	0.02
25-Sep-90	0.74	25-Sep-90	0.66	-0.07	25-Sep-90	0.75	0.02
28-Oct-91	0.79	9-Oct-91	0.71	-0.08	28-Oct-91	0.72	-0.07
22-Oct-92	0.68	22-Oct-92	0.62	-0.06	22-Oct-92	0.71	0.03
9-Nov-93	0.67	9-Nov-93	0.60	-0.06	9-Nov-93	0.60	-0.06
18-Oct-94	0.61	18-Oct-94	0.55	-0.06	18-Oct-94	0.64	0.03
20-Sep-95	0.75	20-Sep-95	0.67	-0.08	20-Sep-95	0.76	0.01
	36.59		33.02			36.65	

WALKER CREEK

COMPARISON OF 7-DAY LOW FLOW BY RANK

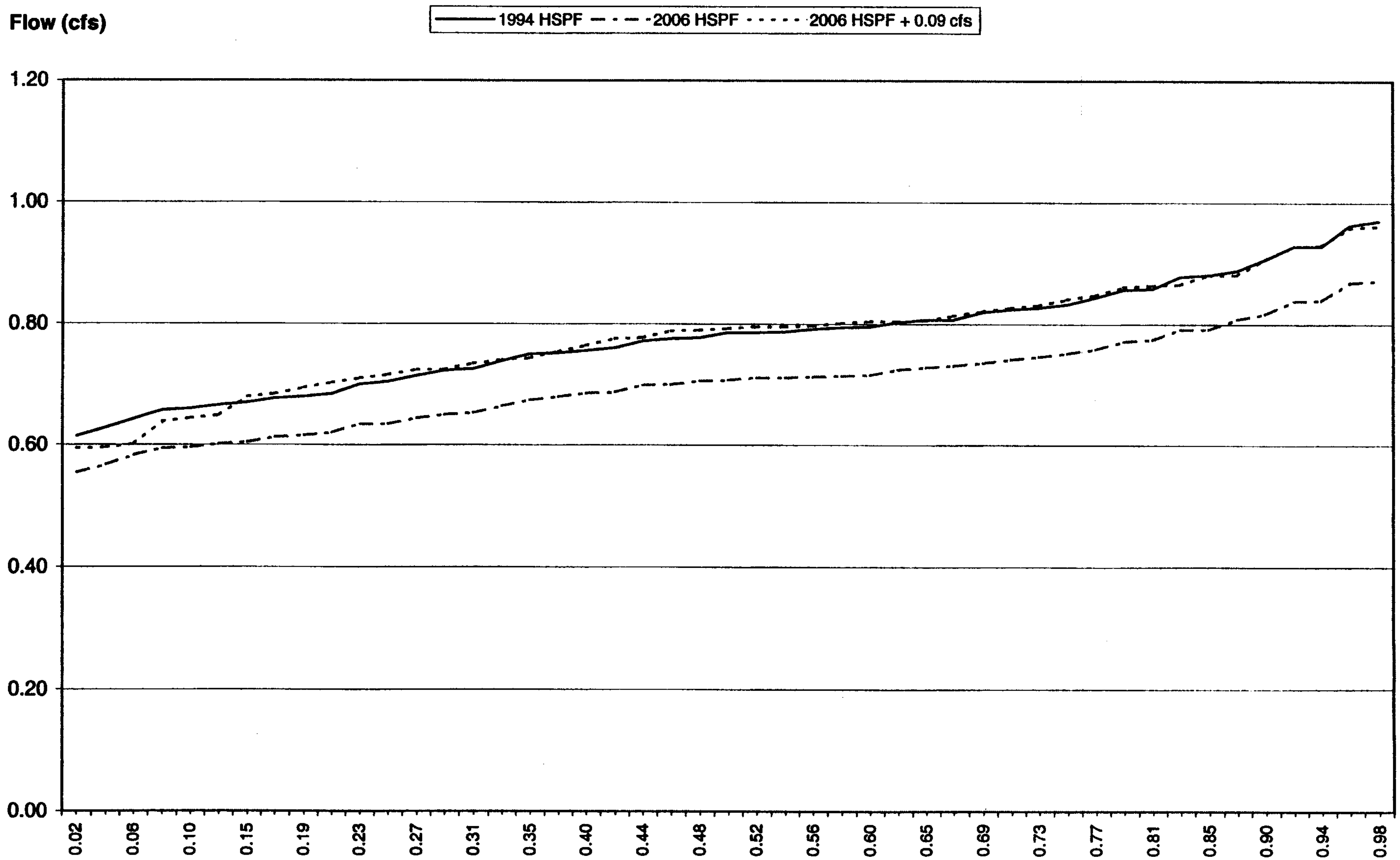
Comparison of 7-Day Low Flows by Rank
for Walker Creek

Date	Rank	1994 HSPF Walker Creek at POC	2006 HSPF Walker Creek at POC	-1994	Walker Creek at POC 2006 + Mitigation Aug 1 - Oct 31 0.09 cfs	-1994
19-Oct-49	1	0.63	0.57	-0.06	0.59	-0.03
17-Sep-50	2	0.83	0.75	-0.08	0.60	-0.24
17-Sep-51	3	0.79	0.71	-0.08	0.60	-0.19
23-Nov-52	4	0.66	0.59	-0.07	0.64	-0.02
15-Sep-53	5	0.79	0.71	-0.08	0.64	-0.14
12-Oct-54	6	0.89	0.81	-0.08	0.65	-0.24
6-Sep-55	7	0.86	0.77	-0.09	0.68	-0.18
18-Sep-56	8	0.88	0.79	-0.09	0.68	-0.19
20-Sep-57	9	0.83	0.75	-0.08	0.69	-0.13
30-Sep-58	10	0.72	0.65	-0.07	0.70	-0.02
24-Aug-59	11	0.88	0.79	-0.09	0.71	-0.17
15-Oct-60	12	0.86	0.77	-0.08	0.72	-0.14
30-Sep-61	13	0.82	0.74	-0.08	0.72	-0.10
20-Sep-62	14	0.81	0.73	-0.08	0.72	-0.08
6-Oct-63	15	0.76	0.69	-0.07	0.73	-0.02
25-Oct-64	16	0.93	0.84	-0.09	0.74	-0.19
27-Sep-65	17	0.80	0.72	-0.08	0.74	-0.06
30-Sep-66	18	0.79	0.71	-0.07	0.75	-0.03
22-Sep-67	19	0.78	0.70	-0.08	0.76	-0.01
7-Aug-68	20	0.97	0.87	-0.10	0.78	-0.19
6-Sep-69	21	0.84	0.76	-0.09	0.78	-0.07
10-Oct-70	22	0.78	0.71	-0.07	0.79	0.01
25-Aug-71	23	0.91	0.82	-0.09	0.79	-0.12
11-Sep-72	24	0.96	0.87	-0.09	0.79	-0.17
12-Sep-73	25	0.76	0.69	-0.07	0.80	0.04
13-Oct-74	26	0.79	0.71	-0.08	0.80	0.00
11-Aug-75	27	0.82	0.74	-0.08	0.80	-0.02
15-Dec-76	28	0.75	0.68	-0.07	0.80	0.05
16-Aug-77	29	0.68	0.62	-0.06	0.80	0.12
25-Aug-78	30	0.81	0.73	-0.08	0.80	0.00
7-Oct-79	31	0.64	0.58	-0.06	0.81	0.16
17-Oct-80	32	0.70	0.63	-0.07	0.81	0.11
12-Sep-81	33	0.73	0.65	-0.07	0.82	0.10
29-Sep-82	34	0.77	0.70	-0.07	0.83	0.06
10-Oct-83	35	0.93	0.84	-0.09	0.83	-0.10
1-Oct-84	36	0.80	0.72	-0.08	0.84	0.05
9-Oct-85	37	0.70	0.63	-0.07	0.85	0.15
18-Oct-86	38	0.68	0.61	-0.06	0.86	0.18
2-Nov-87	39	0.66	0.60	-0.06	0.86	0.21
6-Oct-88	40	0.67	0.60	-0.07	0.87	0.20
3-Oct-89	41	0.71	0.64	-0.07	0.88	0.17
25-Sep-90	42	0.74	0.66	-0.07	0.88	0.14
28-Oct-91	43	0.79	0.71	-0.08	0.91	0.12
22-Oct-92	44	0.68	0.62	-0.06	0.93	0.24
9-Nov-93	45	0.67	0.60	-0.06	0.93	0.26
18-Oct-94	46	0.61	0.55	-0.06	0.96	0.34
20-Sep-95	47	0.75	0.67	-0.08	0.96	0.21
		36.59	33.02		36.65	

WALKER CREEK

PLOTTED 7-DAY LOW FLOWS BY PERCENT RETURN FREQUENCY

Walker Creek 7-Day Low Flow Values



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WALKER CREEK

SUMMARY OF LOW STREAM FLOW MITIGATION
VAULT STORAGE AND FILLING

Reserve Storage Vaults for Walker Creek.

Vault sizes (dead storage in acre ft) required for 92-day release of 0.09 cfs (1949 – 1995).

	Vault F
Mean	11.02
Median	11.22
Max	15.02
Min	6.04

Contributing Drainage Areas

Subbasin	Vault	Area	% Contribution
SDW2	F	3.5	30
SDW2 Lined Area	F	6.0	52
SDW2 Pond Cover	F	2.0	18
	Total	**11.5**	

Fill time for 15.0 acre foot volume / Days to fill after closing vault on November 30

	Vault F
Mean	102.33
Media	81.50
Max *	282.00
Min	47.00

Remaining volume in vaults on October 31

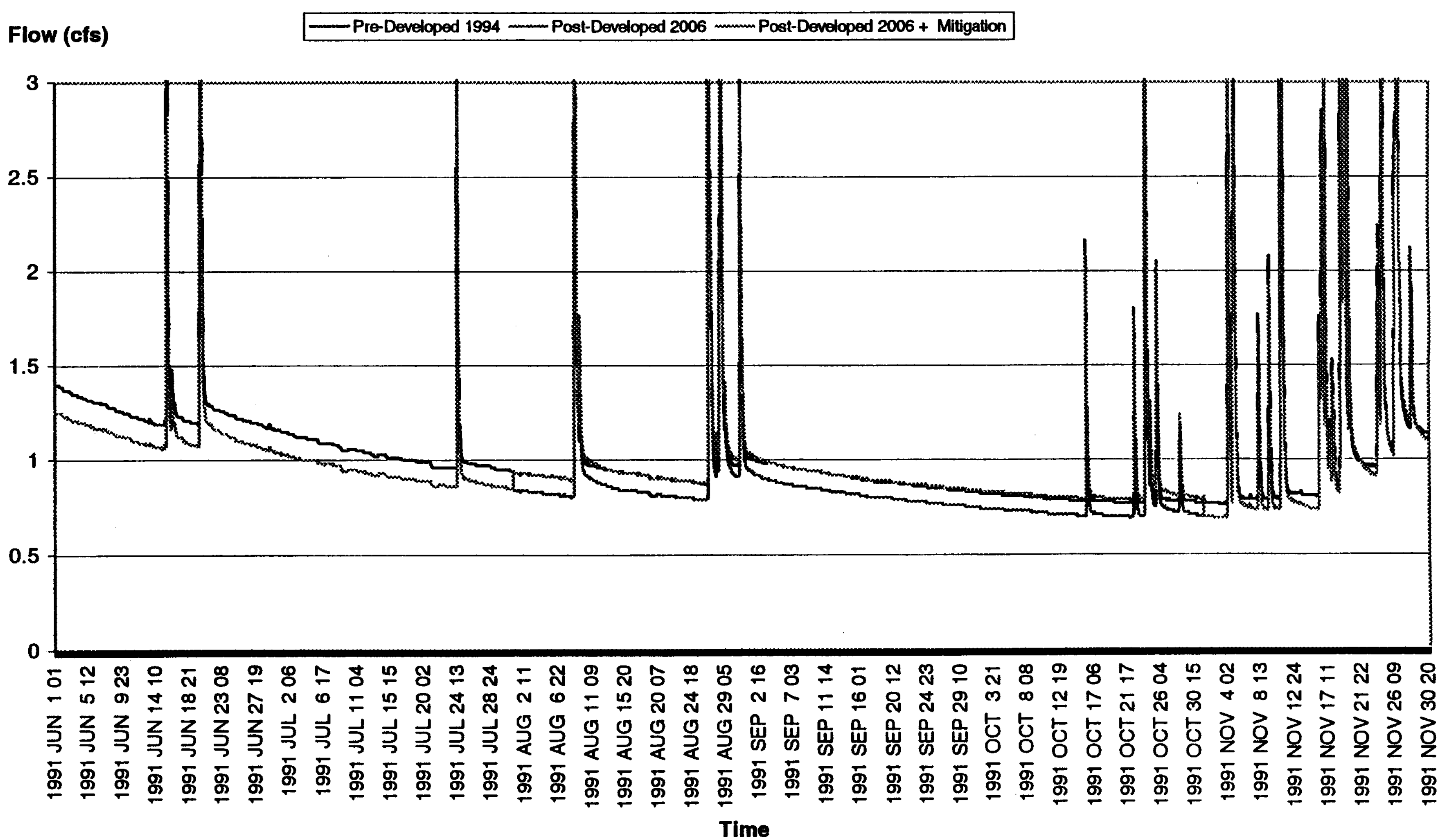
	Volume ac ft	Remaining Days
Mean	4.62	25.8
Median	4.52	25.3
Max	10.42	58.4
Min	0.04	0.2

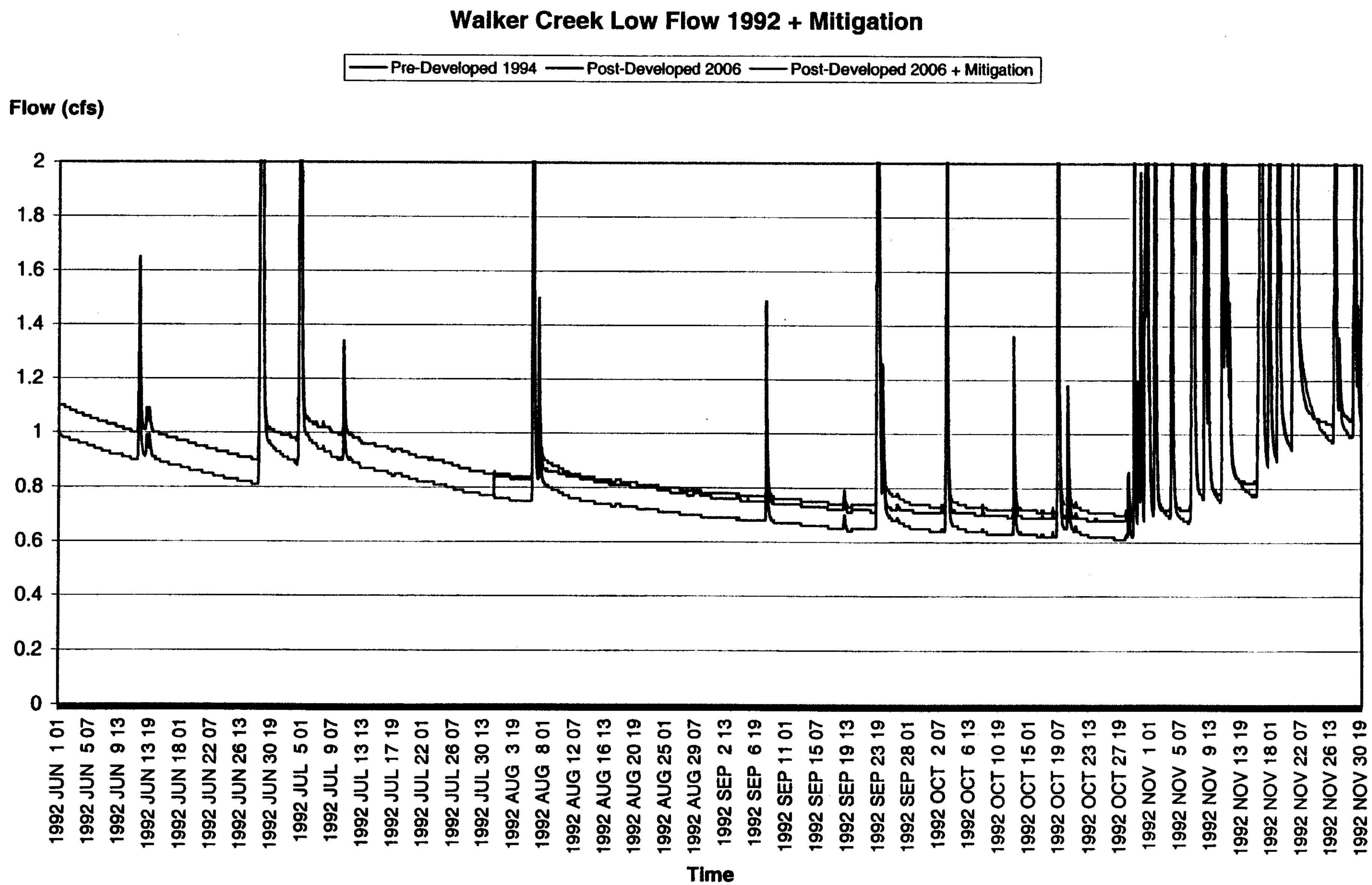
* Vault fills all years except 1977 and 1979

WALKER CREEK

LOW FLOW HYDROGRAPHS WITH MITIGATION (1991-1994)

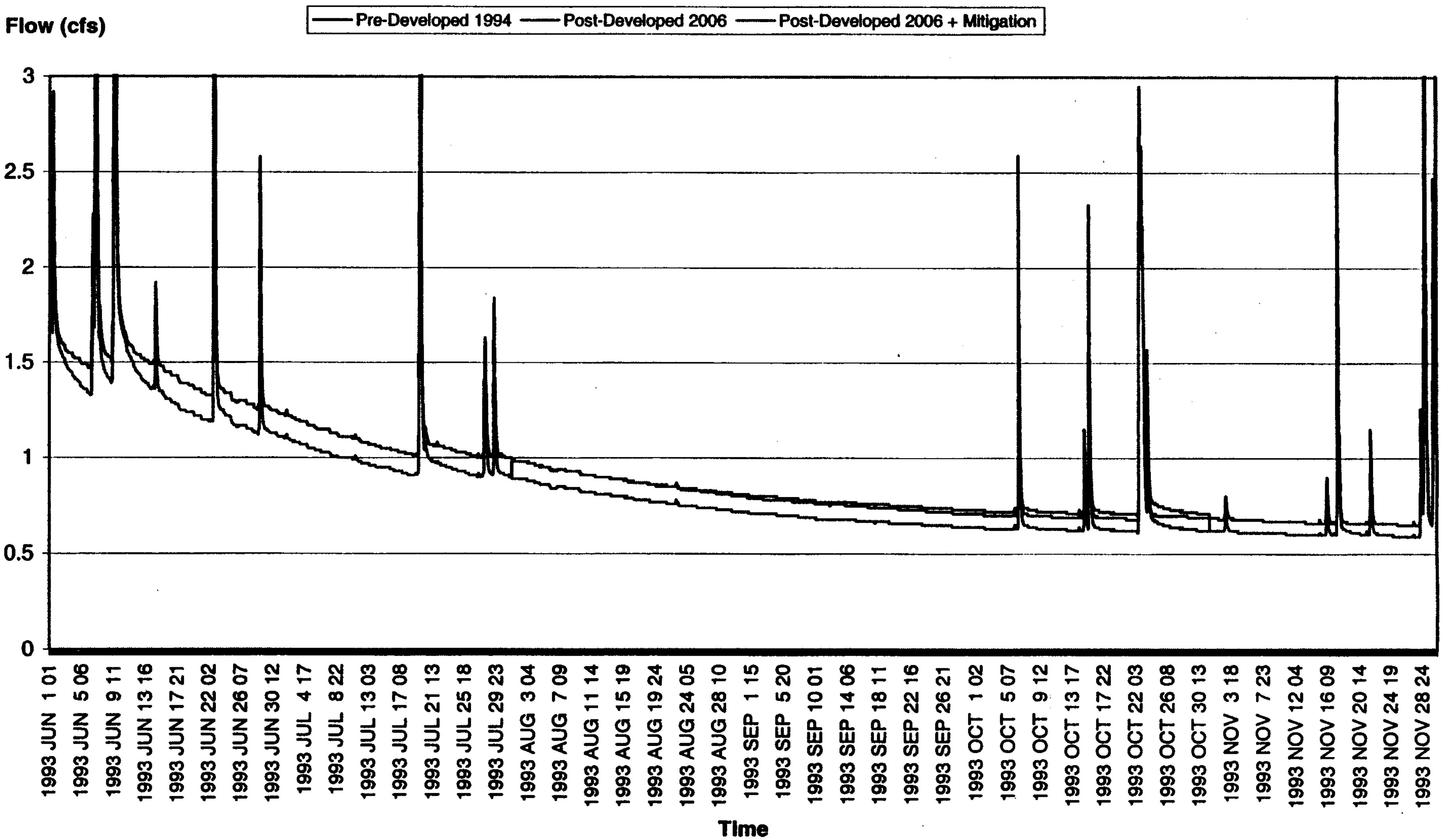
Walker Creek Low Flow 1991 + Mitigation

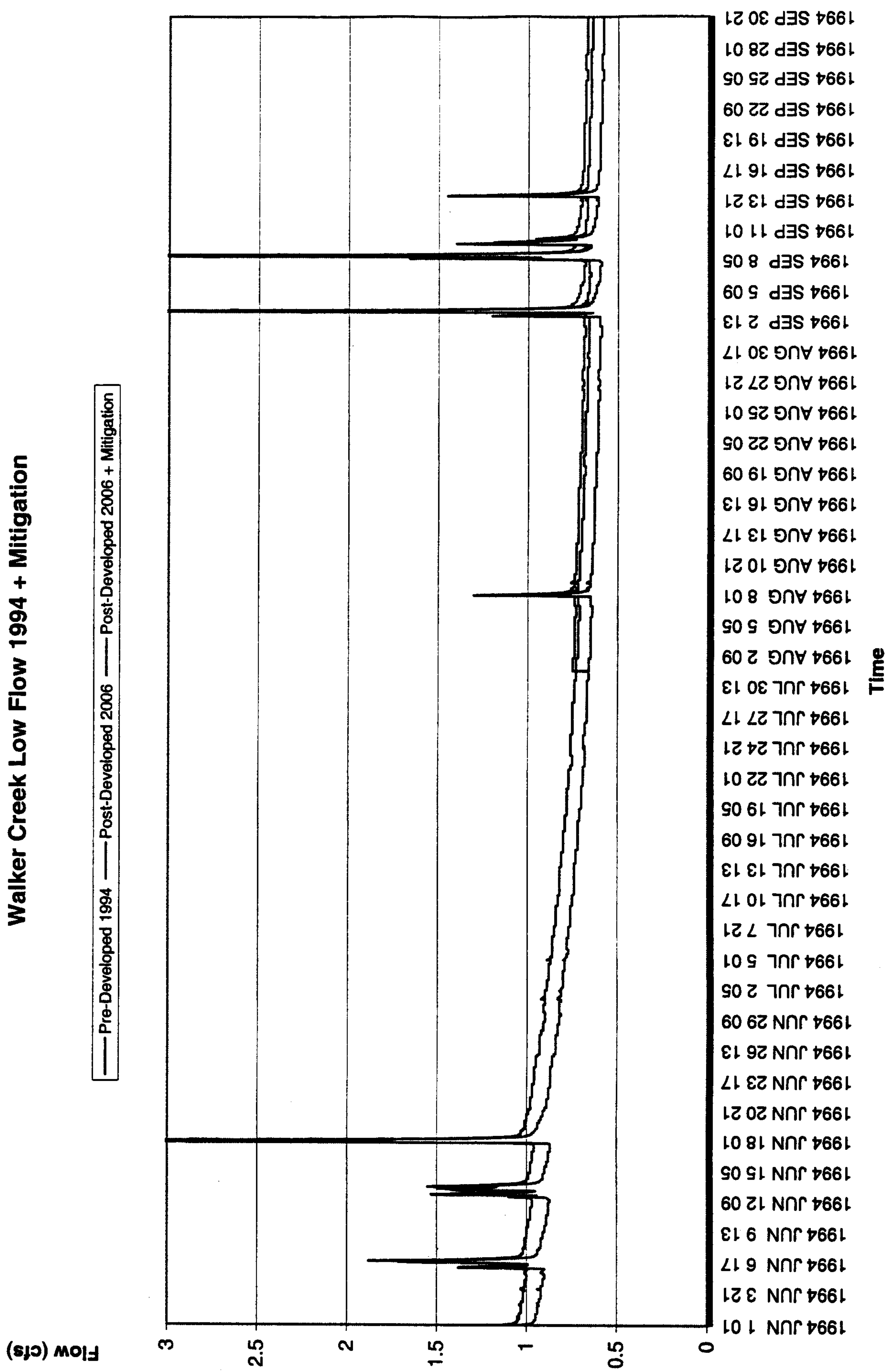



Walker Creek Low Flow 1992 + Mitigation
Pre-Developed 1994
Post-Developed 2006
Post-Developed 2006 + Mitigation
Flow (cfs)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1992 JUN 1 01
1992 JUN 5 07
1992 JUN 9 13
1992 JUN 13 19
1992 JUN 18 01
1992 JUN 22 07
1992 JUN 26 13
1992 JUN 30 19
1992 JUL 5 01
1992 JUL 9 07
1992 JUL 13 13
1992 JUL 17 19
1992 JUL 22 01
1992 JUL 26 07
1992 JUL 30 13
1992 AUG 3 19
1992 AUG 8 01
1992 AUG 12 07
1992 AUG 16 13
1992 AUG 20 19
1992 AUG 25 01
1992 AUG 29 07
1992 SEP 2 13
1992 SEP 6 19
1992 SEP 11 01
1992 SEP 15 07
1992 SEP 19 13
1992 SEP 23 19
1992 SEP 28 01
1992 OCT 2 07
1992 OCT 6 13
1992 OCT 10 19
1992 OCT 15 01
1992 OCT 19 07
1992 OCT 23 13
1992 OCT 27 19
1992 NOV 1 01
1992 NOV 5 07
1992 NOV 9 13
1992 NOV 13 19
1992 NOV 18 01
1992 NOV 22 07
1992 NOV 26 13
1992 NOV 30 19
Time

AR 011369

Walker Creek Low Flow 1993 + Mitigation





Walker Creek Low Flow 1994 + Mitigation
Pre-Developed 1994
Post-Developed 2006
Post-Developed 2006 + Mitigation
Flow (cfs)
3
2.5
2
1.5
1
0.5
0
Time
1994 JUN 1 01
1994 JUN 3 21
1994 JUN 6 17
1994 JUN 9 13
1994 JUN 12 09
1994 JUN 15 05
1994 JUN 18 01
1994 JUN 20 21
1994 JUN 23 17
1994 JUN 26 13
1994 JUN 29 09
1994 JUL 2 05
1994 JUL 5 01
1994 JUL 7 21
1994 JUL 10 17
1994 JUL 13 13
1994 JUL 16 09
1994 JUL 19 05
1994 JUL 22 01
1994 JUL 24 21
1994 JUL 27 17
1994 JUL 30 13
1994 AUG 2 09
1994 AUG 5 05
1994 AUG 8 01
1994 AUG 10 21
1994 AUG 13 17
1994 AUG 16 13
1994 AUG 19 09
1994 AUG 22 05
1994 AUG 25 01
1994 AUG 27 21
1994 AUG 30 17
1994 SEP 2 13
1994 SEP 5 09
1994 SEP 8 05
1994 SEP 11 01
1994 SEP 13 21
1994 SEP 16 17
1994 SEP 19 13
1994 SEP 22 09
1994 SEP 25 05
1994 SEP 28 01
1994 SEP 30 21

MEMORANDUM

to: Paul Fendt — July 20, 2001

from: Don Weitkamp — 556 2912 001 1 28

re: Low Stream Flow Fish Behavior and Stream Characteristics

The following are some thoughts on the issues raised in the e-mail message from Kelly Whiting to Ann Kenny of July 2, 2001 which we discussed at our meeting with the agencies.

1. Migrations of juvenile and adult salmonids appear to be stimulated/regulated by a variety of biological and physical factors of which flow is one. Young fish generally require growth to a certain size range before migration will occur. The physiological processes (smoltification) that ready them for migration also depend of a sequence of events that appears to be triggered by a combination of temperature, photoperiod, and phase of the moon that stimulate hormonal mediated physiological changes. Once these fish are prepared to migrate a substantial change in flow will often trigger the initiation of migration. However, flow increases alone are not likely to initiate a process that depends on many factors.

   Likewise the migrations of adult salmonids are commonly the result of a variety of factors. Adults commonly do not approach streams or prepare to move into headwaters until specific times apparently regulated by photoperiod, temperature, potentially food supply, etc. When ready to migrate the adults are commonly stimulated by freshet conditions that involve both a flow increase and runoff from riparian areas. The chemical cues in the runoff appear to play some role in triggering the migrations. The relationship to flow is far from certain. Sometimes minor increases in flow will stimulate migrations, sometimes minor increases are ignored, and sometimes migrations occur in the absence of flow increases. A minor flow supplementation during normal low flow periods is not likely to provide a trigger for biological processes that would not normally occur during that time period.

2. Severe drought conditions are generally a habitat-limiting factor that can severely limit the carry capacity of a stream. In most Puget Sound lowland streams the low flow conditions of late July to mid-September determine the minimum habitat available to support the resident fish populations including juvenile salmon and trout. Prolonged low flows of several weeks to months during this period are commonly the factor that establishes the carrying capacity of a stream.

   Protection or restoration of stream flows during the late July through September period will maintain the habitat that sustains and controls fish populations remaining within the stream through out the year. Stream flow supplementation during this period can have a substantial influence on the abundance of resident and anadromous salmonids. Providing flow outside this late summer low flow period is unlikely to provide an increase in the fish population that can be sustained within the stream. Additional habitat provided by flow increases preceding the limiting low flow period is unlikely to provide an increase in the fish population following the low flow period. The potential effects of providing additional habitat outside the limiting flow period would likely be negated by the subsequent low flows. Maintaining existing flow conditions during the common low flow period will ensure that habitat does not become more of a limiting factor than it is under existing conditions.

3. Water quality can be a critical factor in determining salmonid habitat. However, sudden changes of a moderate degree are naturally common in small streams. Freshet conditions (storm events) can naturally change temperature and chemical parameters within hours, depending on the nature of the storm event, the drainage basin, stream characteristics and ambient conditions. Generally decreasing temperatures have little immediate effect on salmonids other than reduced activity for a brief period. Decreasing temperatures rapidly within the range of a few degrees can be a benefit if temperatures are near the upper end of the range of acceptable temperatures or greater. Decreases in DO appear to have little effect on behavior when they remain within a range acceptable for survival and growth. The relatively small amount of water provided during low flow mitigation together with the proposed oxygenation techniques is likely to maintain adequate DO conditions.

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Memorandum

To: Keith Smith – Port of Seattle

From: Crispin Prahl, Charles Ellingson – Pacific Groundwater Group

Date: 05/25/01

Re: Selection of Cross Sections for Third Runway Slice Modeling

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This memorandum documents basin fill geometries and the selection of hydrogeologic cross sections required as input to low flow analyses for the SeaTac third runway fill. This memorandum and the attached figures serve as the Task 1 deliverable of Pacific Groundwater Group's Hydrus+Slice (H-S) modeling scope dated May 22, 2001. We welcome your comments on the cross section locations presented herein.

PGG used existing GIS coverages of existing topography, "built" topography, and third runway pavement distribution to calculate areas for H-S modeling. The areas to be removed from HSPF and modeled by Hydrus and Slice are shown on Figure 1. The area includes all contiguous fill areas in Miller and Walker Creek basins planned for the third runway, minus the steep apron slopes at the perimeter of the fill. The areas are as follows:

	Miller Creek Basin	Walker Creek Basin
Pervious Fill Area	2,836,250 sq. ft. (65.2 ac)	645,000 sq. ft. (14.8 ac)
Runway and Taxiway Impervious Area	1,722,328 sq. ft. (39.6 ac)	372,343 sq. ft. (8.6 ac)
Total Area in Basin to be modeled by H-S	4,558,578 sq. ft. (104.8 ac)	1,017,343 sq. ft. (23.4 ac)

PGG reviewed hydrogeologic conditions and embankment geometries along the extent of the embankment fill. Three representative hydrogeologic cross sections were selected using available subsurface data and interpretations. Cross sections 1 and 2 are representative of conditions within the Miller Creek basin fill while cross section 3 is representative of conditions in the Walker Creek basin fill. Hydrogeologic cross sections will be used to create slice models under Task 4 of our work scope.

Cross sections are based on subsurface data described in available geotechnical and hydrogeologic reports and from the existing and "built" topography of the third runway area. PGG compiled and reviewed consulting reports completed since the Ecology Study in order to select cross section alignments. Structural surface maps (AESI, 1999) for glacial till will be used to refine hydrogeologic conditions in the final cross sections and related slice models.

The following is a brief summary of each cross section and the extent of embankment fill that each cross section represents.

MILLER CREEK SECTIONS

For purposes of developing the slice models and low flow estimates, two cross sections represent subsurface conditions within the Miller Creek basin fill. Both cross sections are oriented parallel to horizontal groundwater flow directions expected in the fill. **Figure 1** shows the approximate locations of cross sections proposed through the Miller Creek fill.

Cross Section 1 (Slice 1): This cross section is located through the thickest portion of the fill embankment with a fill thickness of up to 160 feet. Cross section 1 is located at the same location as the original slice model used by PGG in the Ecology study. **Figure 2** presents a working draft of the Slice 1 model, with implied hydrogeologic conditions. Fill located behind the West MSE wall will be modeled using Slice 1. This represents approximately 1,640 linear feet (30%) of the fill embankment within the Miller Creek basin area.

Cross Section 2 (Slice 2): This cross section is located through the northern portion of the fill embankment near the northern end of the third runway. Cross section 2 will be developed from a generalized hydrogeologic cross section originally created by Hart Crowser through the northern toe of the fill embankment (Hart Crowser, 1999). The slice location is based on availability of suitable subsurface data. **Figure 3** presents Hart Crowser's Section A-A' which will be used as the basis for the Slice 2 model. Working drafts of soilunit designations to be used in the slice are also shown. Modifications that will be made to the final cross section through this area include the use of existing topography (thereby more accurately defining the drain slope) and "built" fill topography (thereby defining fill thickness), with consideration of till surface configurations defined by AESI (1999). For purposes of the low flow analysis, cross section 2 represents subsurface conditions in the bulk of Miller Creek embankment fill. It will be used to model subsurface conditions for all fill in the Miller Creek basin not modeled using Slice 1 as described above. Approximately 3,760 linear feet (70%) of fill will be represented by fill geometry and hydrogeologic conditions described by cross section 2.

WALKER CREEK SECTION

For purposes of developing the slice models, one cross section will be used to represent subsurface conditions within the Walker Creek basin fill. The section was chosen through fill of intermediate thickness. (Although this single section will not accurately represent the variety of fill thicknesses in Walker Creek basin fill, the thick portion of the fill is of small areal extent.) **Figure 1** shows the approximate cross section location proposed through the Walker Creek fill.

Cross Section 3 (Slice 3): This cross section is located immediately north of the South MSE wall. A fill thickness of up to 40 feet occurs in this slice. Cross section 3 will be based on a generalized hydrogeologic cross section originally created by Hart Crowser through the northern end of the MSE wall study area (Hart Crowser, 2000b). It will be updated base on supplemental geotechnical data (Hart Crowser, 2000c), existing and "built" topography, and available till mapping data. **Figure 4** presents Hart Crowser's Section E-E' which will be used as the basis for cross section 3. Working drafts of soil-unit designations to be used in the slice are also shown.

REFERENCES CITED

Associated Earth Sciences, Inc. (AESI), 1999. *Seattle-Tacoma International Airport Ground Water Study – Model Boundary Presentation.* Unpublished figures and cross sections prepared for The Port of Seattle dated October 15, 1999.

Hart Crowser, Inc., 1999a. *Subsurface Conditions Data Report 404 Support Third Runway Embankment.* Unpublished consulting report prepared for HNTB and The Port of Seattle dated July 1999.

Hart Crowser, Inc., 2000a. *Draft Subsurface Conditions Data Report Additional Field Explorations and Advanced Testing, Third Runway Project Sea-Tac International Airport.* Unpublished consulting report prepared for HNTB dated September 5, 2000.

Hart Crowser, Inc., 2000b. *Draft Subsurface Conditions Data Report South MSE Wall and Adjacent Embankment Third Runway Project Sea-Tac International Airport.* Unpublished consulting report prepared for Port of Seattle and HNTB dated April 7, 2000.

Hart Crowser, Inc., 2000c. *Subsurface Conditions Data Report Phase 4 Fill, Third Runway Project Sea-Tac International Airport.* Unpublished consulting report prepared for Port of Seattle and HNTB dated November 29, 2000.

ATTACHMENTS

Figure 1 – Cross section locations, fill thickness intervals, and model area designation

Figure 2 – Draft cross section for Slice 1 (Figure 3-5 of Ecology Study)

Figure 3 - Draft cross section for Slice 2 (H-C generalized geologic cross section A-A' with markups)

Figure 4 - Draft cross section for Slice 3 (H-C generalized subsurface cross section E-E' with markups)

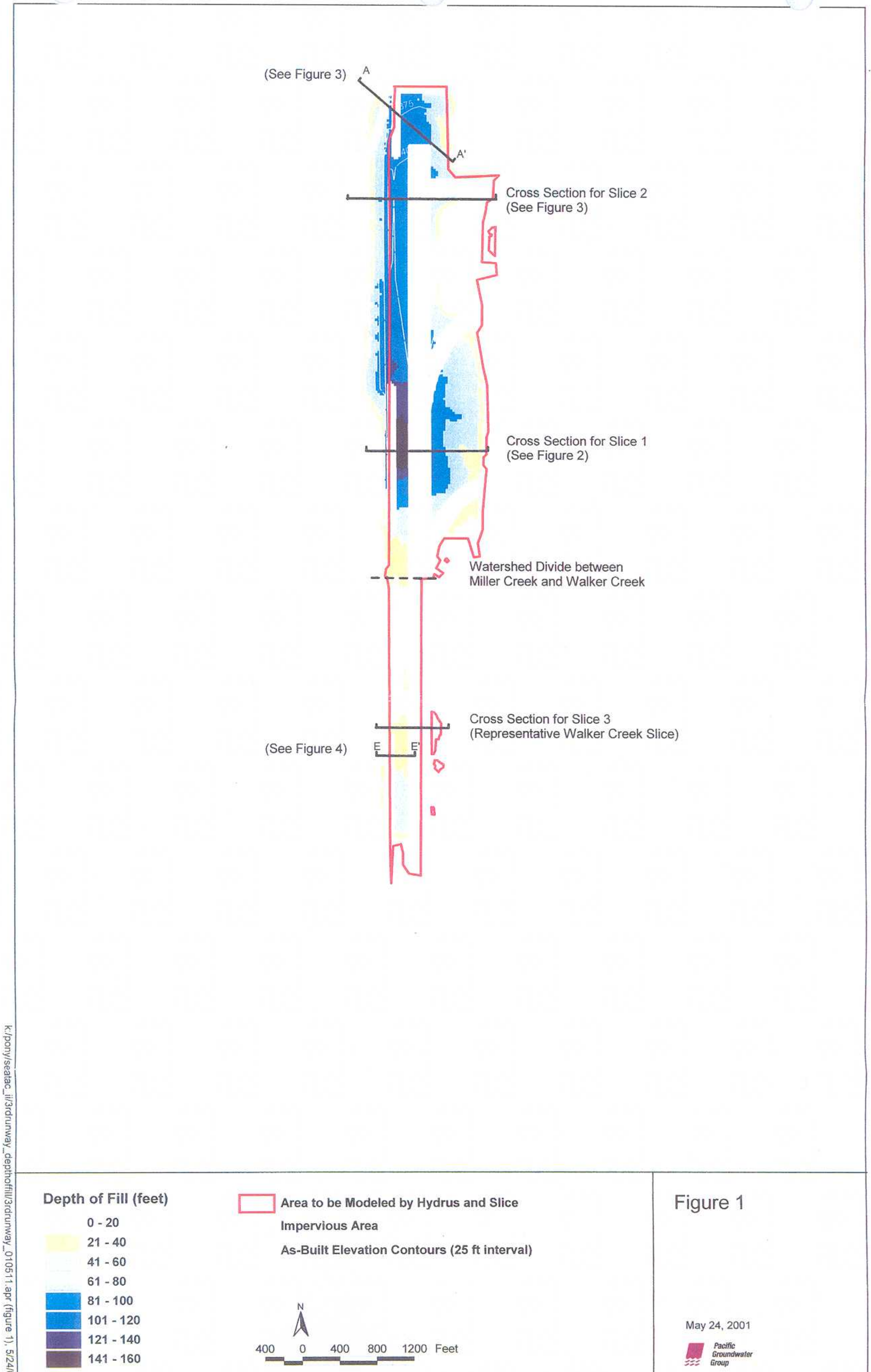


Figure 1

May 24, 2001

Pacific Groundwater Group

k:/pony/seatac_ii/3rdrunway_depthoffill/3rdrunway_010511.apr (figure 1), 5/24/01

AR 011377

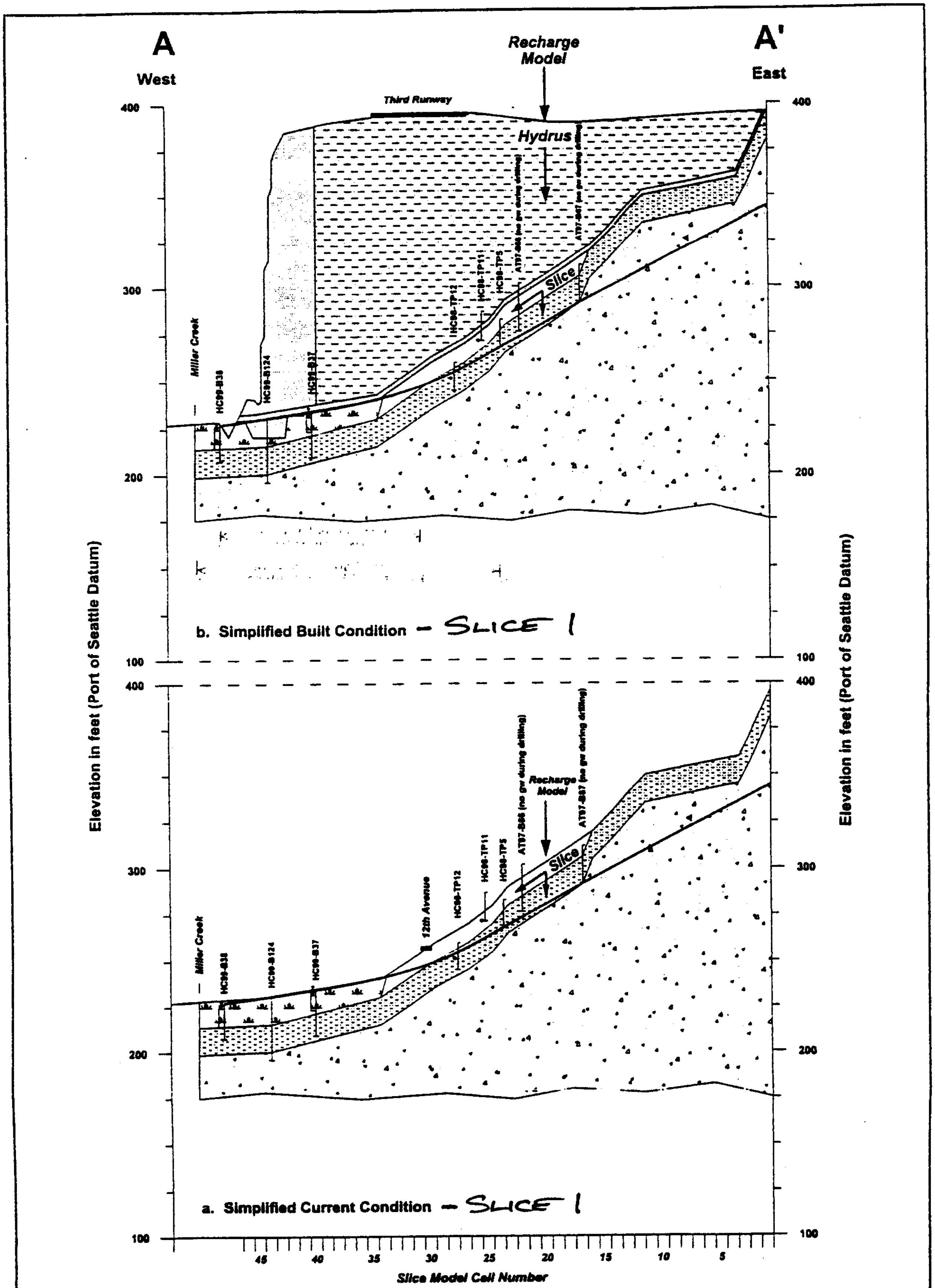


Figure ~~3.6~~ 2
Simplified West Wall Cross Section for Modeling
SLICE 1

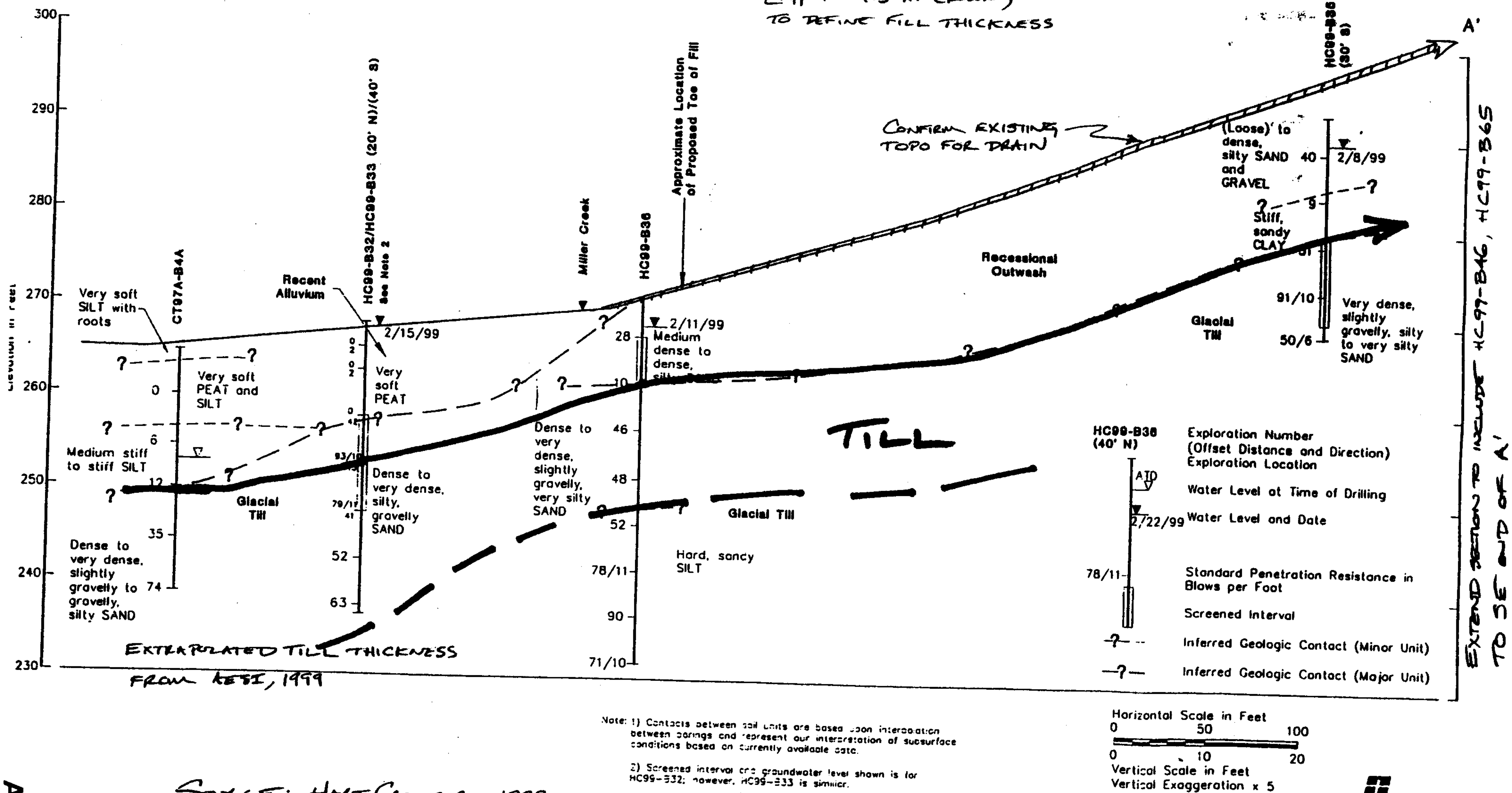
SeaTac Runway Fill Hydrologic Studies

Pacific Groundwater Group

AR 011378

Generalized Geologic Cross Section A-A' = SLICE 2

Looking Northeast



Note: 1) Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data.

2) Screened interval and groundwater level shown is for HC99-B32; however, HC99-B33 is similar.

SOURCE: HART CROWSER, 1999a

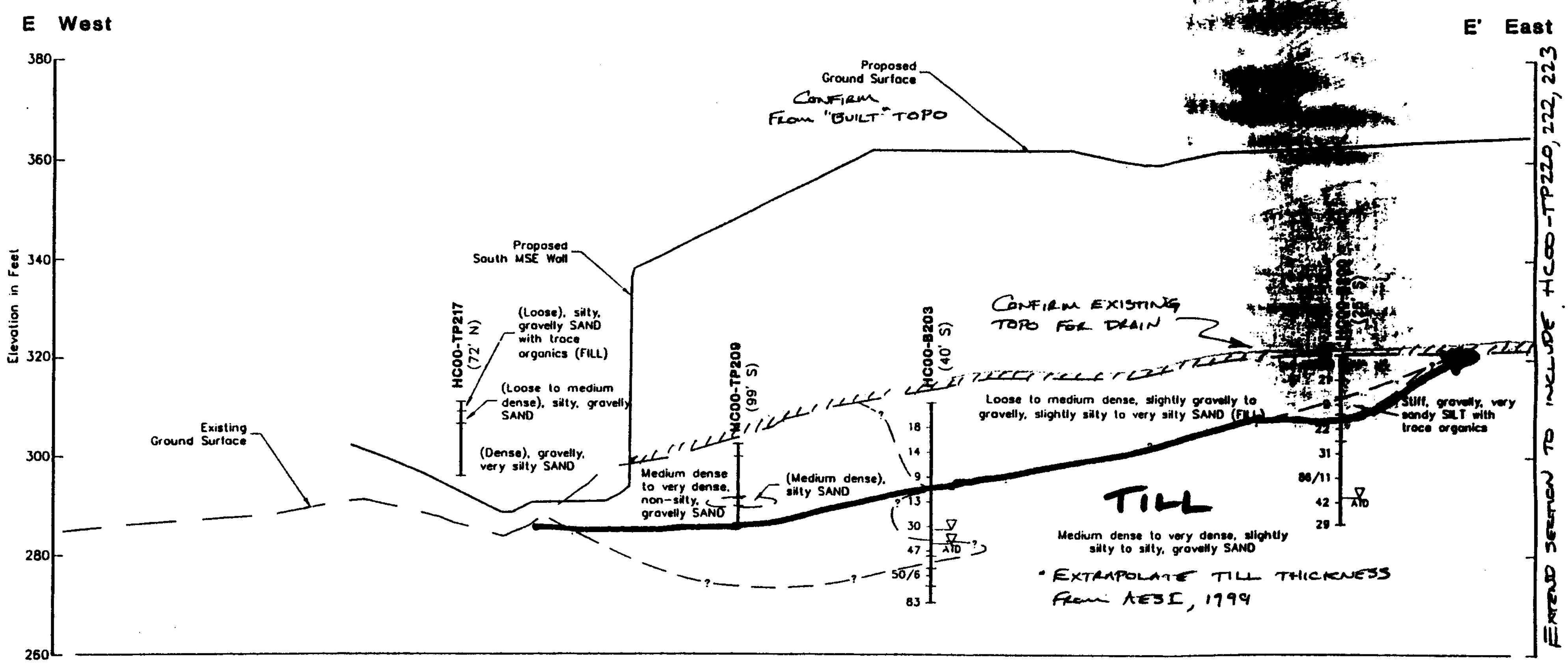
HARTCROWSER

J-4978-06 7/99

~~Figure 4~~

FIGURE 3 - DRAFT CROSS SECTION FOR SLICE 2

Generalized Subsurface Cross Section E-E' = SLICE 3
South MSE Wall (Station 145+44) (Looking North)



Note: Contacts between soil units are based upon interpolation between borings and represent our interpretation of subsurface conditions based on currently available data. See exploration logs for detailed information at specific locations.

HC00-TP217 (72' N) Exploration Number (Offset Distance and Direction)

Exploration Location

ATD Water Level

50/6 N Value

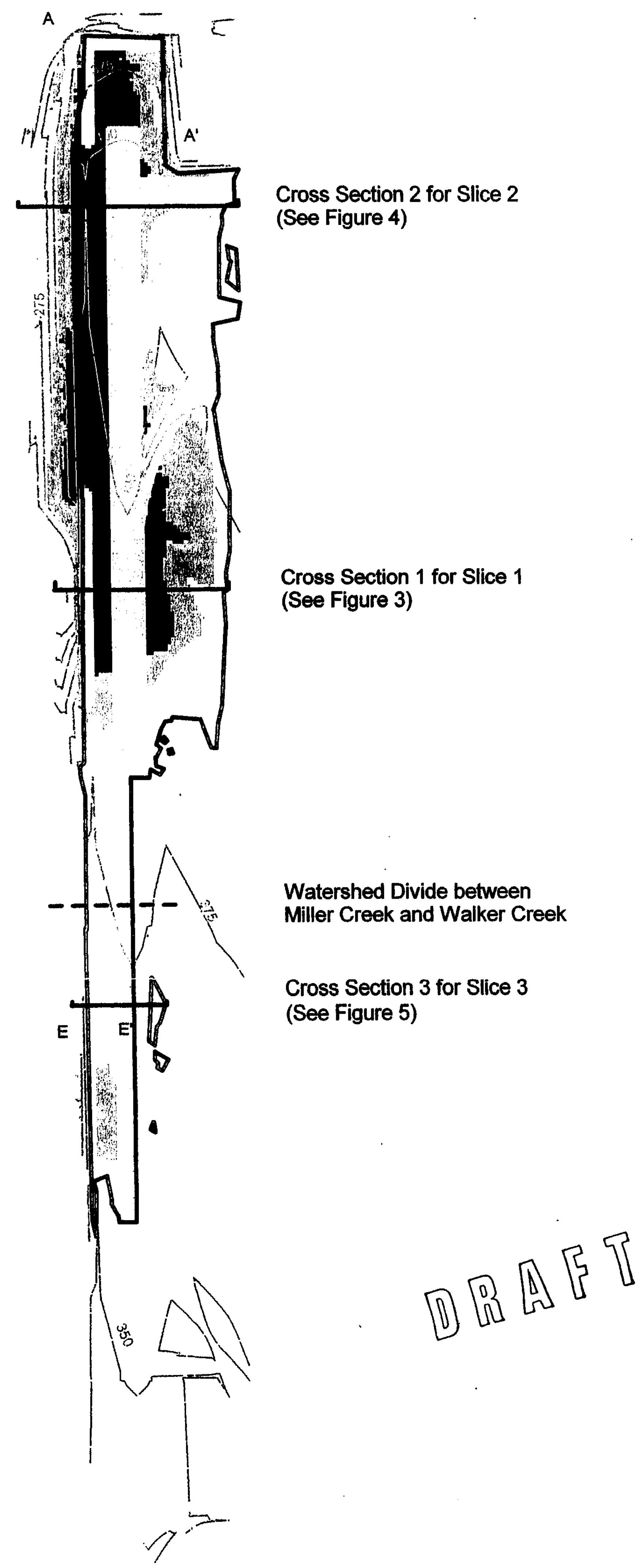
0 20 40
Scale in Feet

SOURCE: HART CROWSER, 2000b

HARTCROWSER
J-4978-23 4/00
~~Figure 5~~

FIGURE 4 - DRAFT CROSS SECTION FOR SLICE 3

AR 011380



Depth of Fill (feet)

- 0 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100
- 101 - 120
- 121 - 140
- 141 - 160

Area to be Modeled by Hydrus and Slice

Impervious Area

As-Built Elevation Contours (25 ft Interval)

N

0 1000 Feet

1:12000

Figure 1

SeaTac Third Runway

Site Features for
Hydrus-Slice Modeling

Pacific Groundwater Group

k:/pony/seatac_ii/3rdrunway_depthoffill/3rdrunway_010511.apr (figure 1), 6/22/01

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Memorandum

To:	Keith Smith, Port of Seattle
From:	Charles Ellingson, Pacific Groundwater Group
Re:	Modeled Area and Hydrus Model Results Draft Interim Deliverables
Date:	June 25, 2001

This memo presents the following interim draft deliverables related to Hydrus/Slice modeling of third runway fill:

- Definition of the area to be modeled by Hydrus/Slice instead of HSPF
- Effective Recharge
- Selection of Cross Sections (locations for Slice models)
- Fill thickness
- Definition of soil as modeled in Hydrus
- Draft Interim Hydrus Modeling Results

Definition of the Area to be Modeled by Hydrus/Slice Instead of HSPF

PGG used existing GIS coverages of existing topography, "built" topography, and third runway pavement distribution to calculate areas for Hydrus/Slice modeling. The areas to be modeled by Hydrus and Slice (and therefore removed from HSPF) are shown on **Figure 1** and **Table 1**. The areas include proposed additional runway fill in the Miller and Walker Creek basins minus the steep slopes along the western edge of the constructed fill.

The north-south extent of the fill within the Miller Creek and Walker Creek basins will be used along with other data to integrate Slice model results along the respective basin lengths. A dashed line is drawn on **Figure 1** between the Miller and Walker Creek Basins. The location of the line is approximately the same as the co-incident surface water and groundwater basin boundaries used within the HSPF models (Parametrix SMP Figure B2-2). The areas indicated in **Table 1** below are consistent with the line drawn on **Figure 1**. The basin areas to be modeled by Hydrus/Slice are as follows:

AR 011382

Table 1

Summary of Areas to be Modeled by Hydrus/Slice

	Miller Creek Basin	Walker Creek Basin
Pervious Fill Area	3,030,620 sq ft	450,630 sq ft
Runway and Taxiway Impervious Area	1,833,928 sq ft	260,743 sq ft
Total Area in Basin to be modeled by H-S	4,864,548 sq ft	711,373 sq ft

Runoff from impervious area (IA) is assumed to infiltrate in pervious areas (PA). Therefore the impervious and pervious areas in **Table 1** above are used to calculate effective recharge on pervious areas. IA in Walker creek consists of only the western half of the runway because runoff from the eastern half will not flow onto new third runway fill.

Effective Recharge

Effective recharge was calculated using the following algorithm which is called "recharge 1":

- *AquaTerra applied daily precipitation between 1984 and 1994 to grass on flat outwash in HSPF (regional parameters)*
- *the resulting daily recharge (R) was increased to account for secondary infiltration of runoff from impervious surfaces using the following formula for effective recharge (ER):*

$$ER=R+(R*(IA/PA))$$

While this method accounts for runoff from the impervious areas, we acknowledge that it employs a lower-end estimate of impervious runoff. Impervious runoff is underestimated because it is assumed equal to the recharge rate below grass on outwash soils. In actuality, the impervious areas will lose less water to evapotranspiration than grass would, and would therefore have more water available for runoff to the pervious area. The simplifying assumption that runoff rates equal calculated recharge rates was adopted to facilitate the timeline of the modeling exercise. However, we performed additional analysis on whether an upper-end estimation of runoff from impervious areas is not likely to cause significant overland flow in the pervious areas. Based on conversations with team members, the following algorithm (called "recharge 2") was used to assess the upper-end estimation of runoff:

AR 011383

- *AquaTerra increased precipitation (P) to account for runoff from impervious surfaces to pervious surfaces using the following formula for effective precipitation:*

$$EP=P+(P*IA/PA))$$

- *AquaTerra applied EP between water years 1984 to 1994 for grass on flat outwash in HSPF (regional parameters)*

The sum of daily "recharge 1" over the 11-year period was 18.7% less than the sum of daily "recharge 2" over the same period. This result suggests that the difference in runoff from the two methods is relatively small, and that recharge 1 may underestimate actual recharge. **Figure 2** is a plot of Miller Creek ER as calculated by "recharge 1" and "recharge 2". Walker Creek has a very similar IA/PA ratio and therefore similar ER.

Selection of Cross Sections (Locations for Slice Models)

PGG reviewed hydrogeologic conditions and embankment geometries along the extent of the embankment fill. Three representative hydrogeologic cross sections were selected using available subsurface data and interpretations. Cross sections 1 and 2 are representative of conditions within the thicker Miller Creek basin fill while cross section 3 is representative of conditions in the Walker Creek basin fill and the southern, thinner portion of the Miller Creek fill. Hydrogeologic cross sections will be used to create Slice models.

Cross sections are based on subsurface data described in available geotechnical and hydrogeologic reports and from the existing and proposed topography of the third runway area. PGG compiled and reviewed consulting reports completed since the Ecology Study in order to select cross section alignments. The following is a brief summary of each cross section. **Figure 1** shows the approximate locations of cross sections.

Cross Section 1 (Slice 1): This cross section is located through the thickest portion of the fill embankment with a fill thickness of up to 160 feet. Cross section 1 is located at the same location as the original slice model used by PGG in the Ecology study. **Figure 3** presents the schematic cross section upon which the Slice 1 model will be based.

Cross Section 2 (Slice 2): This cross section is located through the northern portion of the fill embankment near the northern end of the proposed third runway. Cross section 2 was developed from a generalized hydrogeologic cross section originally created by Hart Crowser through the northern toe of the fill embankment (Hart Crowser, 1999) and from supplemental test pit data in this area. **Figure 4** presents the schematic cross section which will be used as the basis for the Slice 2 model. The third runway fill in Cross Section 2 is thinner than Cross Section 1. Soil unit designations to be used in the slice model are also shown.

Cross Section 3 (Slice 3): This cross section is located immediately north of the South MSE wall. A fill thickness of up to 23 feet occurs in this slice. Cross section 3 was based on a generalized hydrogeologic cross section originally created by Hart Crowser through the northern end of the MSE wall study area (Hart Crowser, 2000b). It was updated based on supplemental geotechnical data (Hart Crowser, 2000c), existing and proposed topography, and available till mapping data. **Figure 5** presents the schematic cross section which will be used as the basis for the Slice 3 model. Soil-unit designations to be used in the slice model are also shown.

Only Cross Section 3 will be used to represent subsurface conditions within the Walker Creek basin fill. The section was chosen through fill of intermediate thickness. Although this single section will not accurately represent the variety of fill thicknesses in Walker Creek basin fill, the thick portion of the fill is of small areal extent.

Fill Thickness

The thickness of fill is mapped on **Figure 1** based on pre- and post- construction topography as provided in existing GIS coverages. A series of Hydrus models was used to represent discrete values of fill thickness over the observed range.

Definition of Soil as Modeled in Hydrus

Soils are defined in Hydrus using variables that relate hydraulic conductivity to moisture content and soil tension. For this modeling exercise, soils were defined the same way as they were for the modeling work done for the Ecology project (Sea-Tac Runway Fill Hydrologic Studies Report, PGG, 2000). Appendix C of PGG (2000) provides a detailed description of the fill soils and modeled soil parameters.

Draft Interim Hydrus Modeling Results

Separate one-dimensional Hydrus models were run for fill thicknesses of 10, 30, 50, 70, 90, 110, 130, and 150 feet in both the Miller and Walker Creek basins (as dictated by the thicknesses observed on the cross sections). In addition, a 20-foot model was developed for Walker Creek only. **Figure 6** shows daily effective recharge (input to the top boundary of all Hydrus models) and eight daily outflow graphs (flow out of the bottom boundary of the Hydrus model) for the Miller Creek basin over the "test period" of October 1, 1990 through September 30, 1994. Conservation of mass was confirmed for each model by comparing the total effective recharge and total outflow. Time series outflow from Hydrus runs of varying thicknesses will be used as input to the three Slice models.

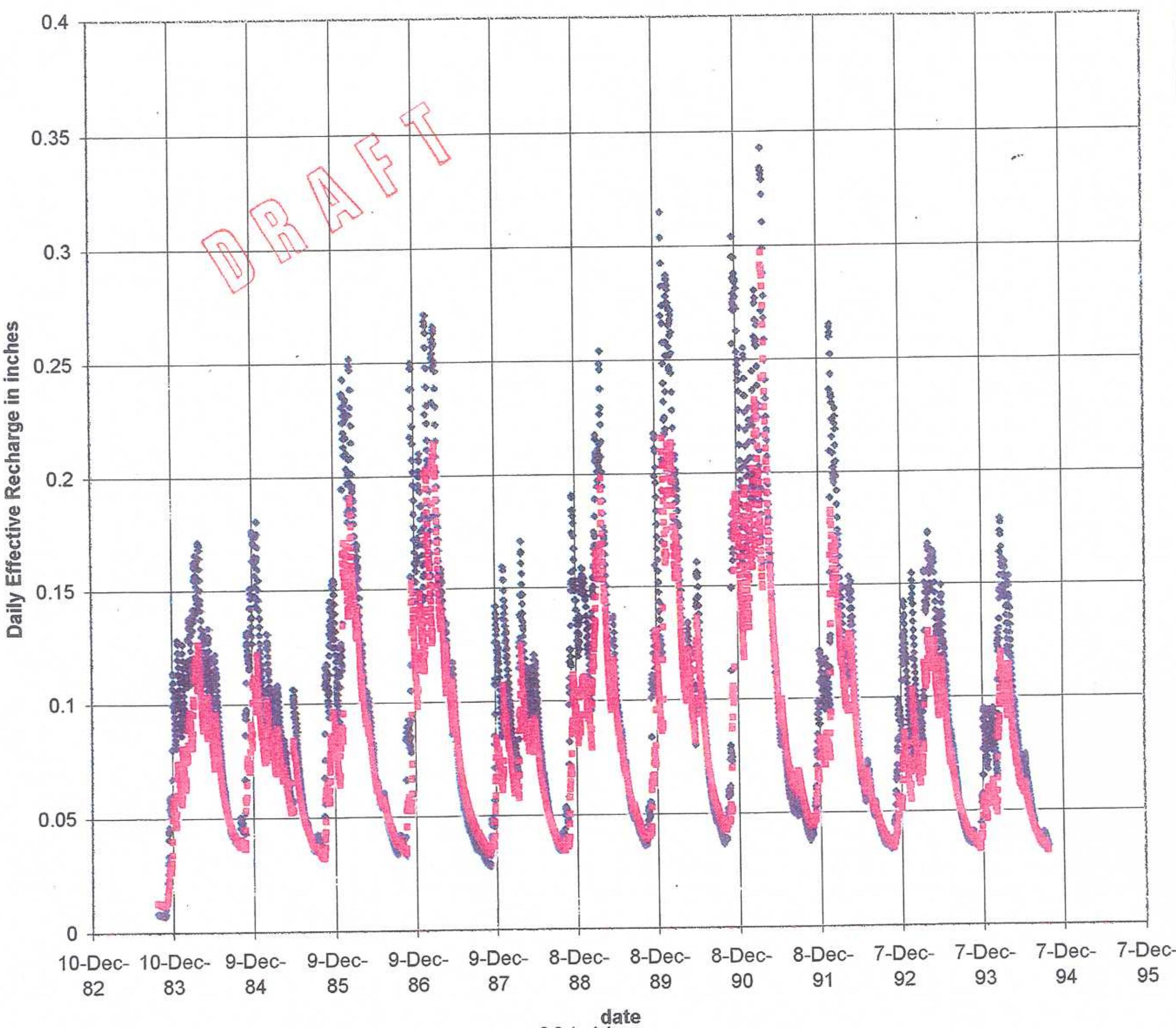
Figure 6 shows that the seasonal recharge pulse introduced at the land surface (ER) is predicted to be lagged and dampened as a function of the thickness of the fill. Lagging causes the arrival of the recharge pulse to be delayed from its introduction at the land surface to its arrival at the bottom of the fill. Dampening causes a reduction in the overall range of recharge values (high minus low) due to uptake and subsequent release of

AR 011385

recharge inflow into the soil's pore water. Lagging and dampening both increase with increasing thicknesses of fill. These effects on the timing of recharge will impact the arrival of flow to the top of the slice model, and ultimately the arrival of baseflow to the steams bordering the study area.

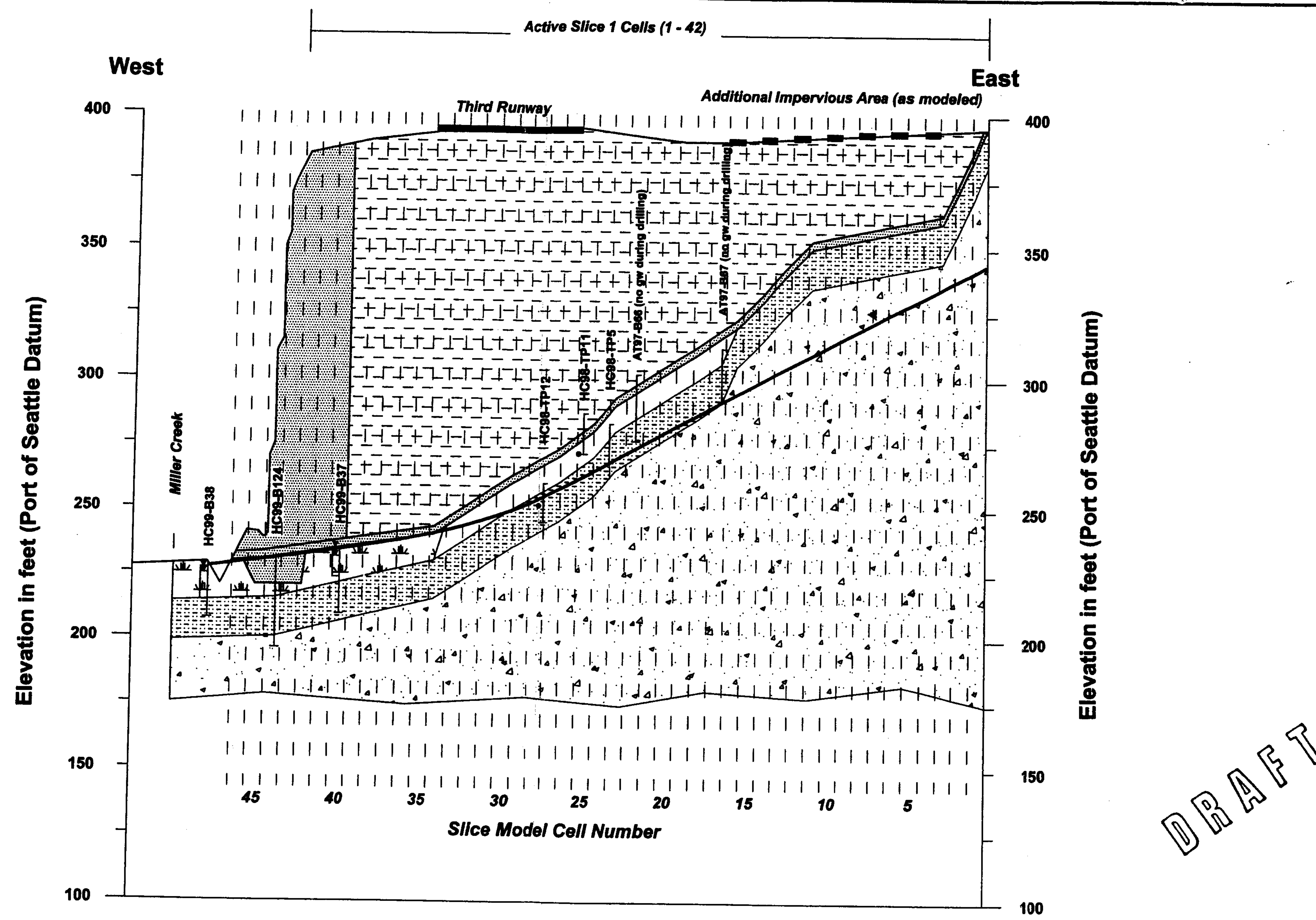
AR 011386

Figure 2
Comparison of Effective Recharge Estimates For Miller Creek



Recharge 1 total inches over 10 years = 331.44
Recharge 2 total inches over 10 years = 407.48
Difference = 18.7% ((R2-R1)/R2)

- Recharge 2 - ER from scaled EP->HSPF
- Recharge 1 - ER from P->HSPF then scaled



AR 011388

LEGEND

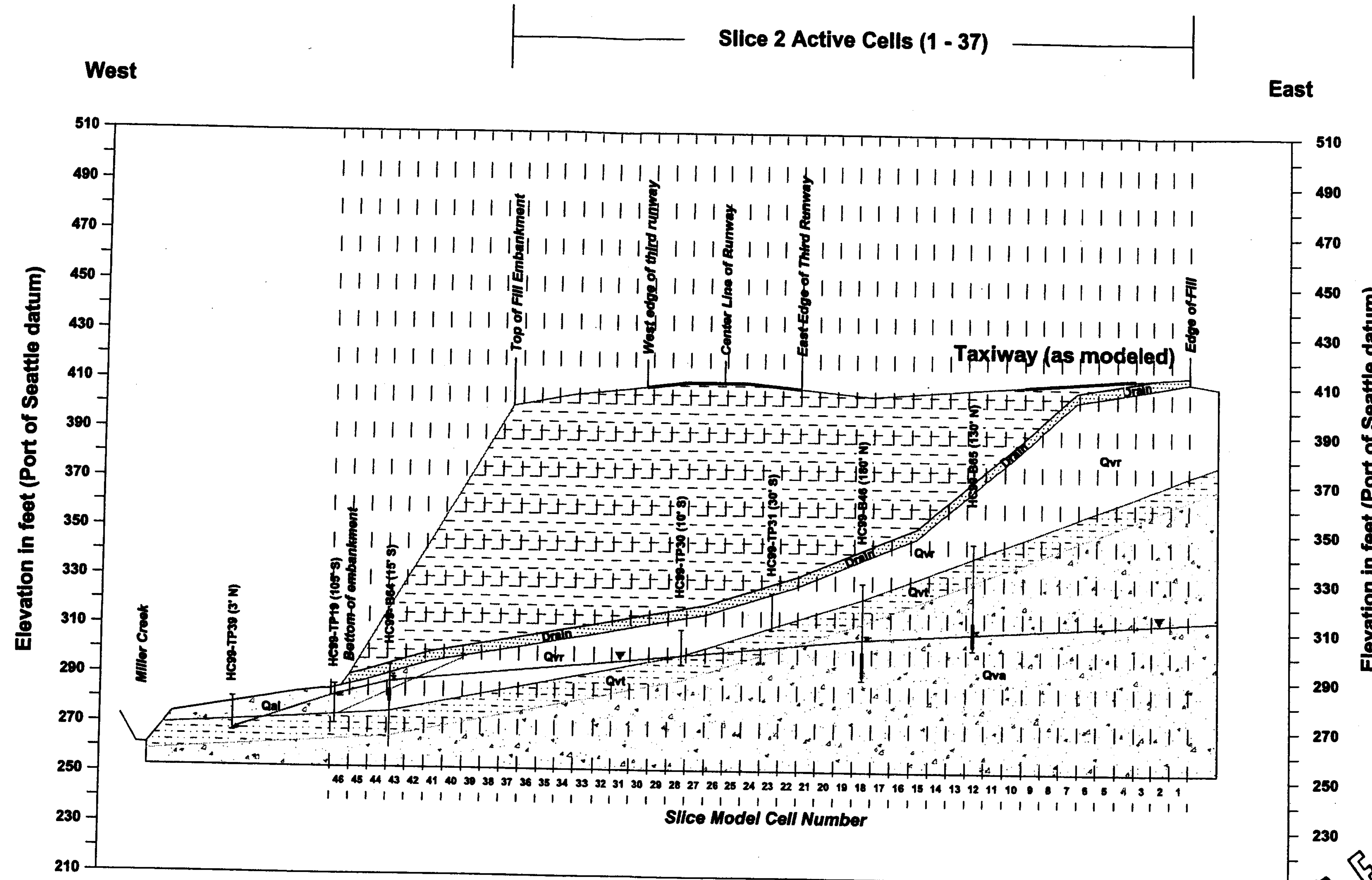
- Groundwater Elevation
- Groundwater Seepage Elevation
- Conceptual Water Table
- Fill
- Qvr - Vashon Recessional
- Qvt - Vashon Till
- Qva - Vashon Advance

Horizontal Scale in Feet: 0 100 200
Vertical Scale in Feet: 0 25 50

FIGURE 3
Simplified Cross Section for Slice 1

SeaTac Third Runway
Embankment Fill Modeling
JE0105, Runway-Section2.dwg, 06/01

Pacific Groundwater Group



DRAFT

AR 011389

LEGEND

- Groundwater Elevation
- Groundwater Seepage Elevation
- Conceptual Water Table

- Fill
- Qvr - Vashon Recessional
- Qvt - Vashon Till
- Qva - Vashon Advance

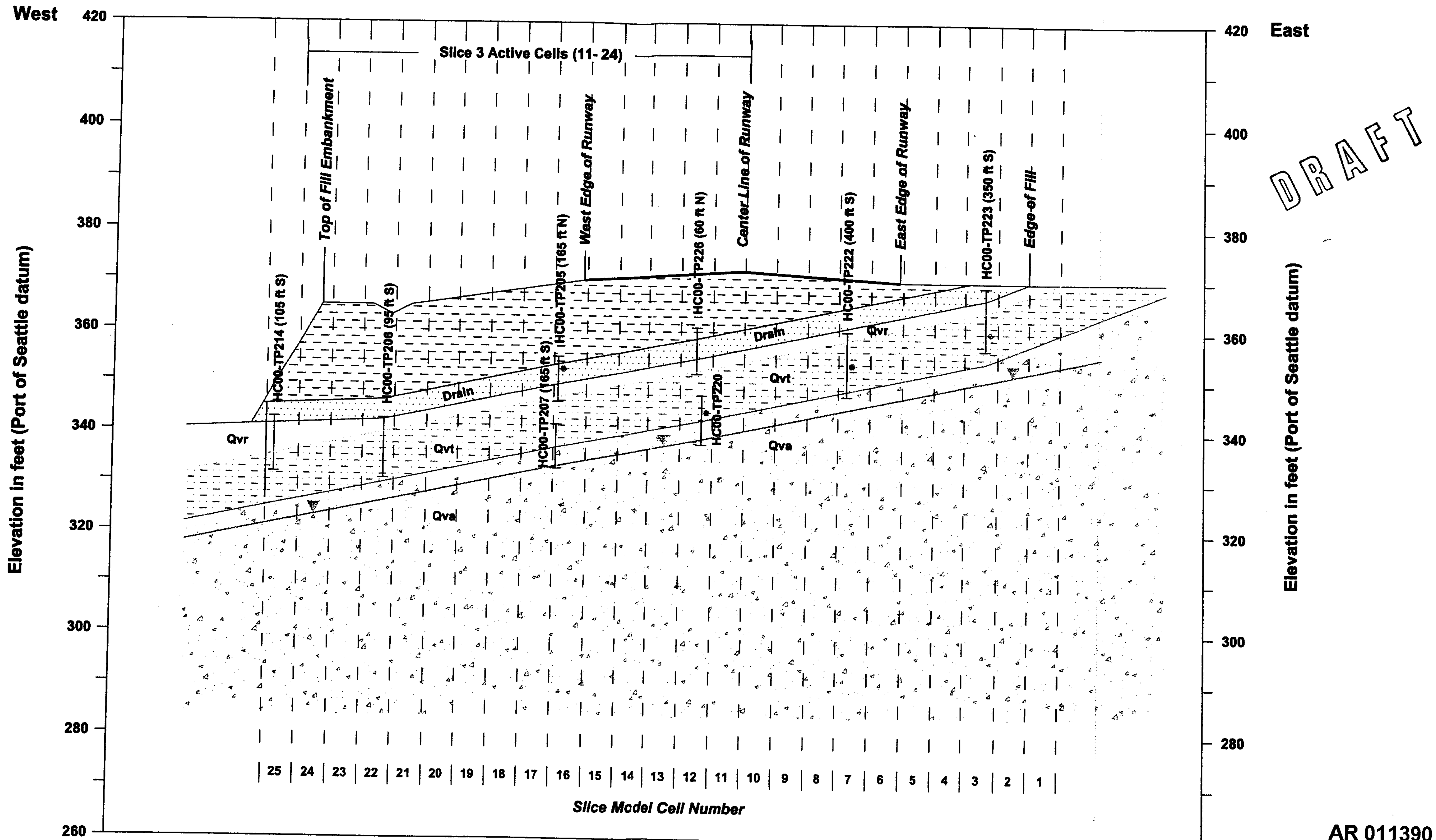
Horizontal Scale In Feet: 0, 100, 200

Vertical Scale In Feet: 0, 25, 50

FIGURE 4
Simplified Cross Section for Slice 2

SeaTac Third Runway
Embankment Fill Modeling
JE0105, Runway-Section2.dwg, 06/01

Pacific Groundwater Group



AR 011390

LEGEND

- Groundwater Elevation
- Groundwater Seepage Elevation
- Conceptual Water Table
- Fill
- Qvr - Vashon Recessional
- Qvt - Vashon Till
- Qva - Vashon Advance

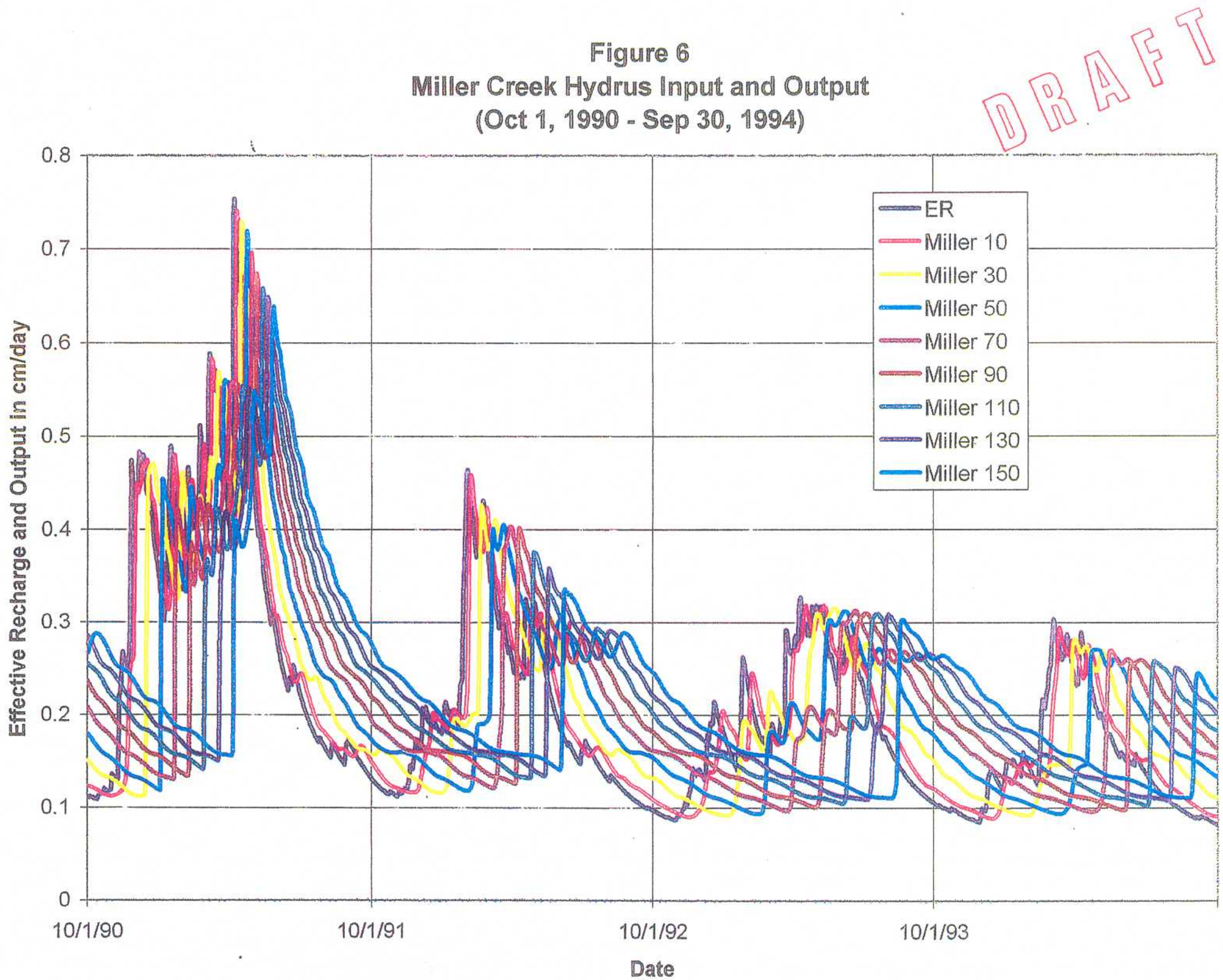
Horizontal Scale in Feet: 0 40 80
Vertical Scale in Feet: 0 10 20

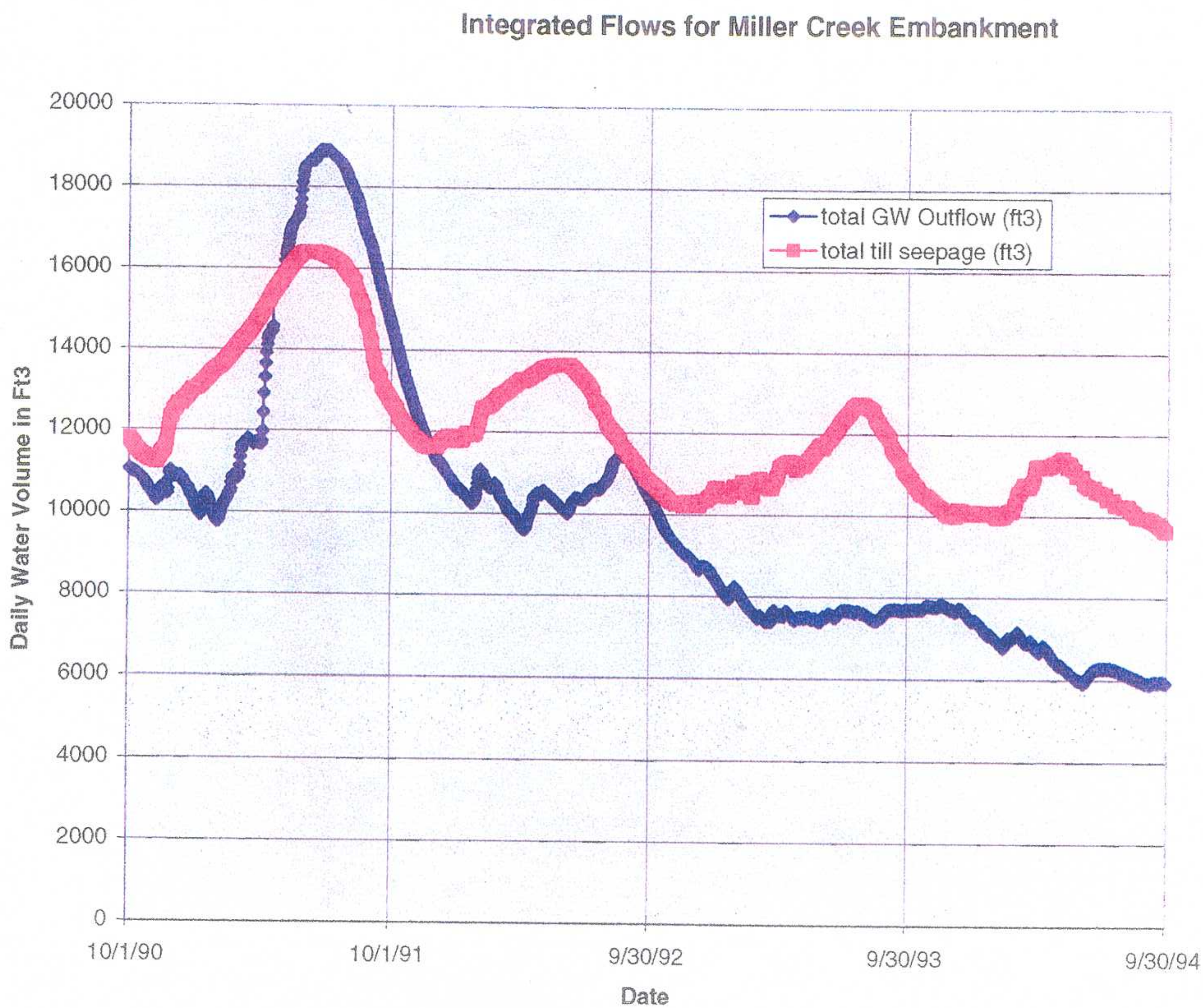
FIGURE 5
Simplified Cross Section for Slice 3

SeaTac Third Runway
Embankment Fill Modeling
JC0105, Runway-Section3.dwg, 06/01

Pacific Groundwater Group

Figure 6
Miller Creek Hydrus Input and Output
(Oct 1, 1990 - Sep 30, 1994)

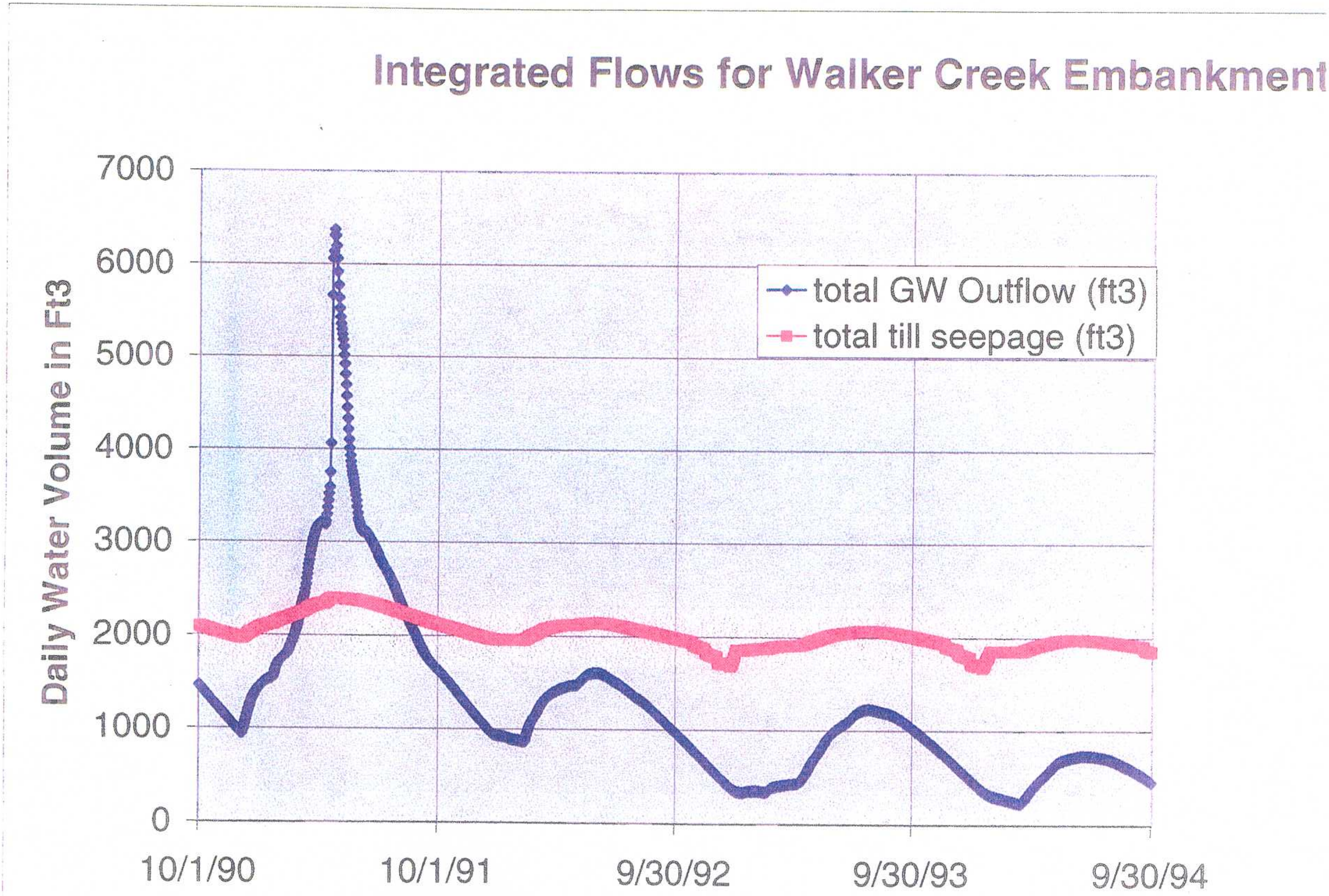




AR 011392

6/28/01

test period integrated results jun27.xlsMiller Creek chart


Integrated Flows for Walker Creek Embankment
Daily Water Volume in Ft3
7000
6000
5000
4000
3000
2000
1000
0
10/1/90
10/1/91
9/30/92
9/30/93
9/30/94
total GW Outflow (ft3)
total till seepage (ft3)

Summary of non-hydrologic impacts.

Creek	Number of Septic Tanks	Flows (cfs)			
		Septic Tank Estimated	Septic Tank Adjusted[a]	Withdrawals[b]	Total Impact
Miller	236	-0.082	-0.057	+0.042	-0.02
Walker	41	-0.014	-0.009	N/A	-0.01

[a] Septic tank flow adjusted by percentage of seepage to DEEPFR (flow x 0.7)

[b] Assumed average withdrawal rates form June 1 through September 30.

Water Recharge from Imported Water

Documentation

This spreadsheet was created for the purpose of developing time series representing water recharge from water imported into the buyout area via water distribution systems. Recharge takes two potential forms: 1. recharge from septic systems; 2. recharge from infiltration of irrigation water. These time series is intended to represent conditions prior to the acquisition and removal of homes in the buyout area.

The time series on this worksheet (Recharge from Septic) represents water recharge from septic systems in the buyout area. The recharge to each watershed from septic systems was based on estimated water consumption. Recharge from septic systems is based on winter water use. Additional water use during summer months (above and beyond winter water use) is provided in a separate time series.

The estimated annual water recharge from septic systems in the buyout area to each of the three watersheds is provided below in Columns A - D. The time series is constructed with an hourly time step. However, the recharge rates reflect estimated daily recharge.

The estimated annual water recharge from infiltration of imported irrigation water in the buyout area to each of the three watersheds is provided on the "Infiltration" worksheet in Columns A - D. The time series is constructed with an hourly time step. However, the recharge rates reflect estimated daily recharge. It should be noted that this time series contains the quantity of imported water available for infiltration. It is recommended that losses due to evaporation be applied to the time series before it is added as recharge flow.

Estimated Recharge Quantity

Number of Active Septic Tanks	236	41	0	A total of 291 homes were served by septic in Walker and Miller Creek Basins prior to the buy-out. Some of these homes (14) were also served by sewer, and the septic systems were inactive. Based on an inventory of septic tanks removed, there were 41 active tanks in the Walker Creek basin buy-out area and 236 in the Miller Creek basin buy-out area. (277 total active tanks, 14 inactive tanks)
Summer Water Use (gallons per home per day)	349	349	349	Summer water use was not used to estimate recharge from septic systems. It was used to estimate the quantity of imported water potentially available for infiltration, with the assumption that the additional water use is for irrigation. Typical values for summer water use were provided by Water District #20 and Water District #125.
Summer Recharge via Infiltration (gallons per day)	23,539	4,089	-	Summer water use exceeding winter water use may be available for infiltration. The time series constructed on the "Infiltration" worksheet is based on this daily flow.
Winter Water Use (gallons per home per day)	249	249	249	Winter water use was used to estimate recharge from septic systems. Typical values for winter water use were provided by Water District #20 and Water District #125.
Recharge from Septic Systems (gallons per day)	52,962	9,201	-	Estimated recharge to each watershed expressed in gallons per day.

Documentation

This spreadsheet was created for the purpose of developing a time series representing water withdrawl from Miller Creek due to pumping. This time series is intended to represent conditions prior to the acquisition and removal of homes in the buyout area.

The worksheet "Annual Time Series" contains the estimated annual water withdrawl from Miller Creek. The total water withdrawl is shaded in yellow in Column B. It is the sum at each hour of the estimated water withdrawl from each parcel contained in Columns C - Y

The time series was constructed using the values and notes presented in Table G-2 that was provided on 6/11/01. A reproduction of the values included in Table G-2 is provided below.

Key notes from Table G-2 used to construct the time series are listed below:

The quantity of water withdrawn was estimated as follows:

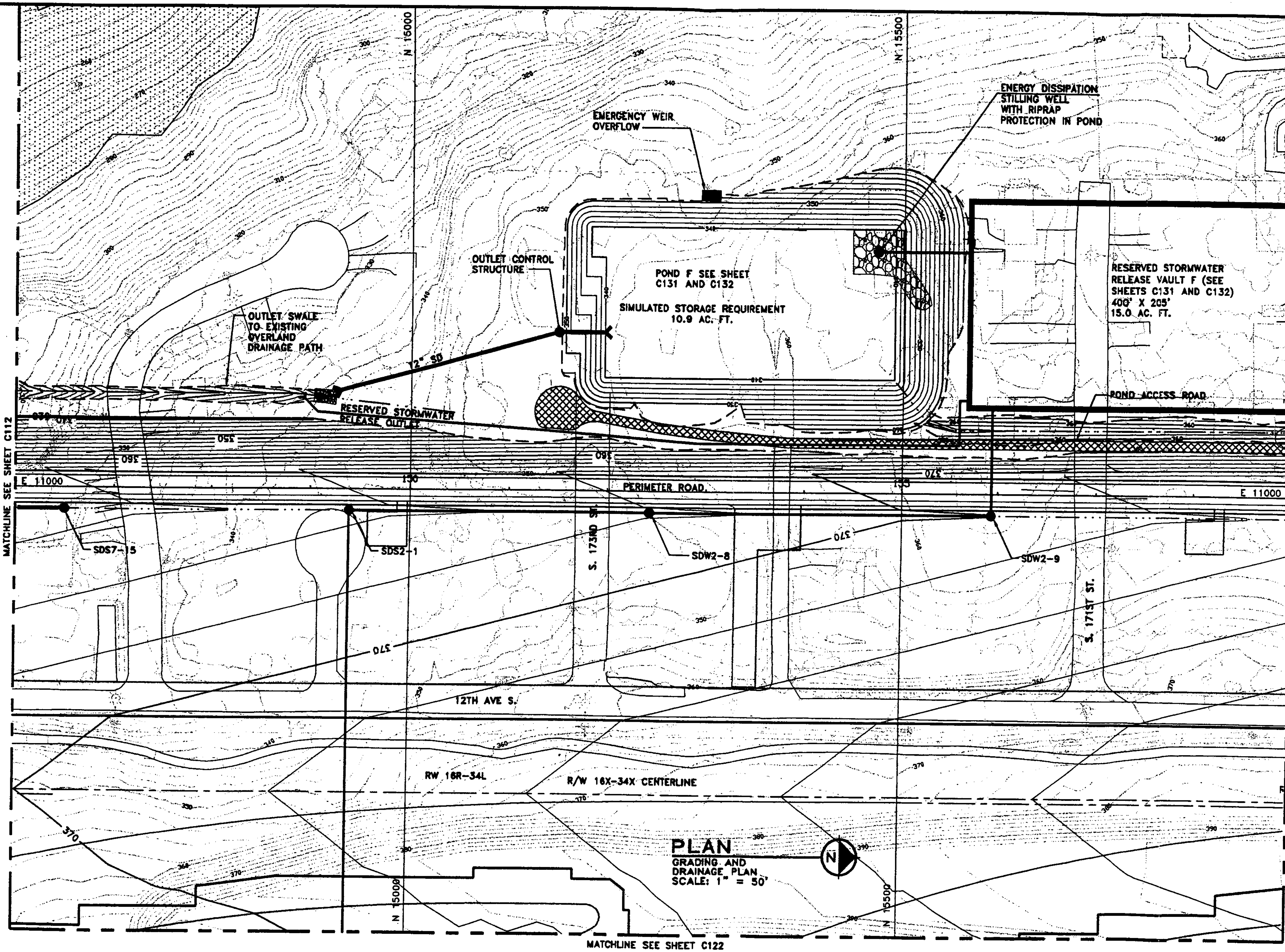
Available Pumping Rate x Estimated Months of Water Use Per Year x 0.5 (daily pumping duration)

The time series was constructed using the available pumping rate for 12 hours per day (6 am to 6 pm each day).

Estimated months of water use per year was assumed as follows:

6 Months = April 1 - Sep 30
4 Months = June 1 - Sep 30

RESERVE STORMWATER
RELEASE STORAGE DRAWINGS



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

AR 011399

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

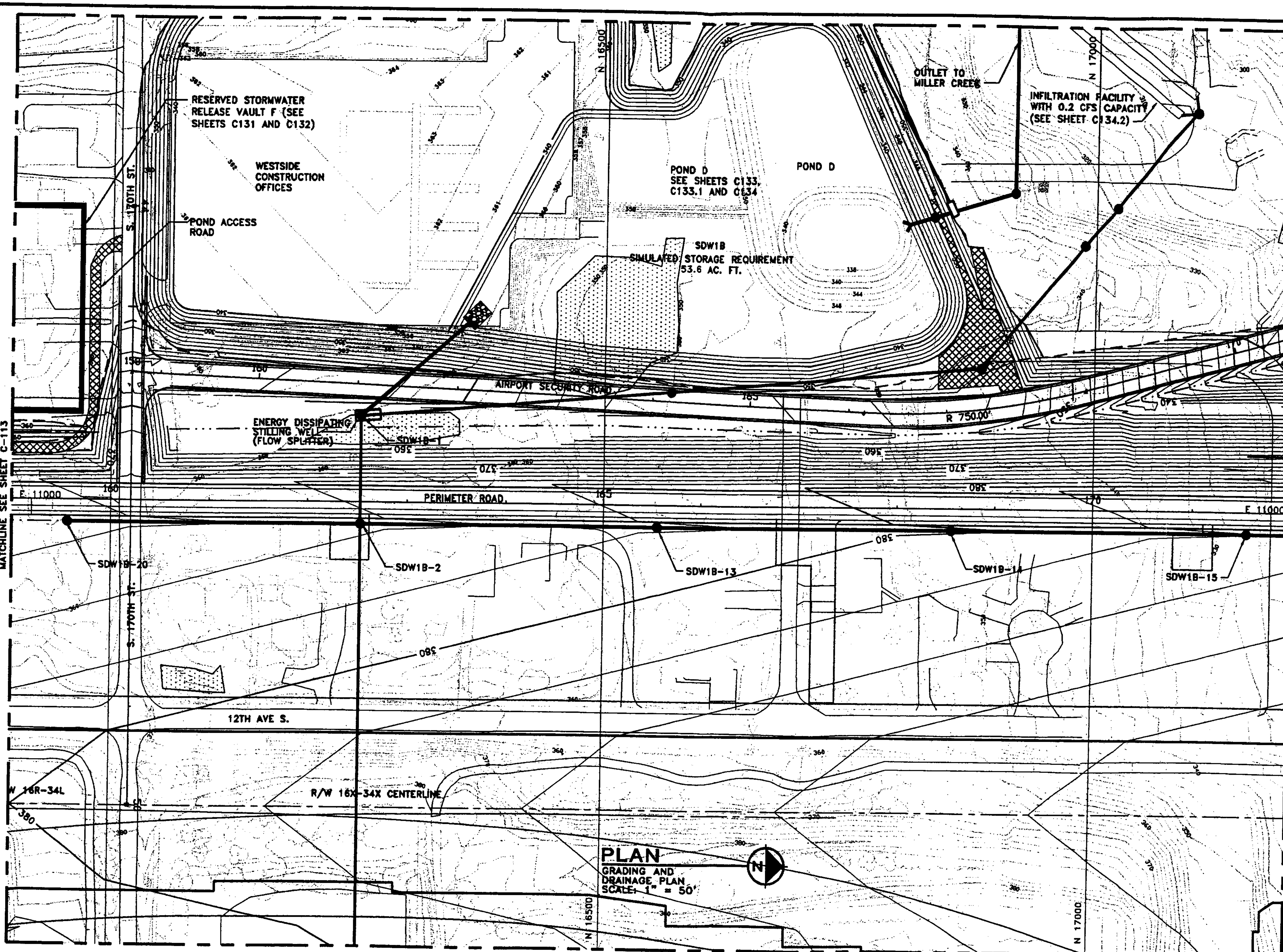
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: JULY 30, 2001

EXHIBIT_ C113

N:\20764\d 1005\permit\BV_C113.dwg, 07/30/01 08:15:10 AM, GMatsushita



NOTES:

LEGEND:

- STORM DRAIN PIPE
- WETLANDS

AR 011400

SCALE: 1"=50' (50' 0 50' 100')

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: JULY 30, 2001

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C114

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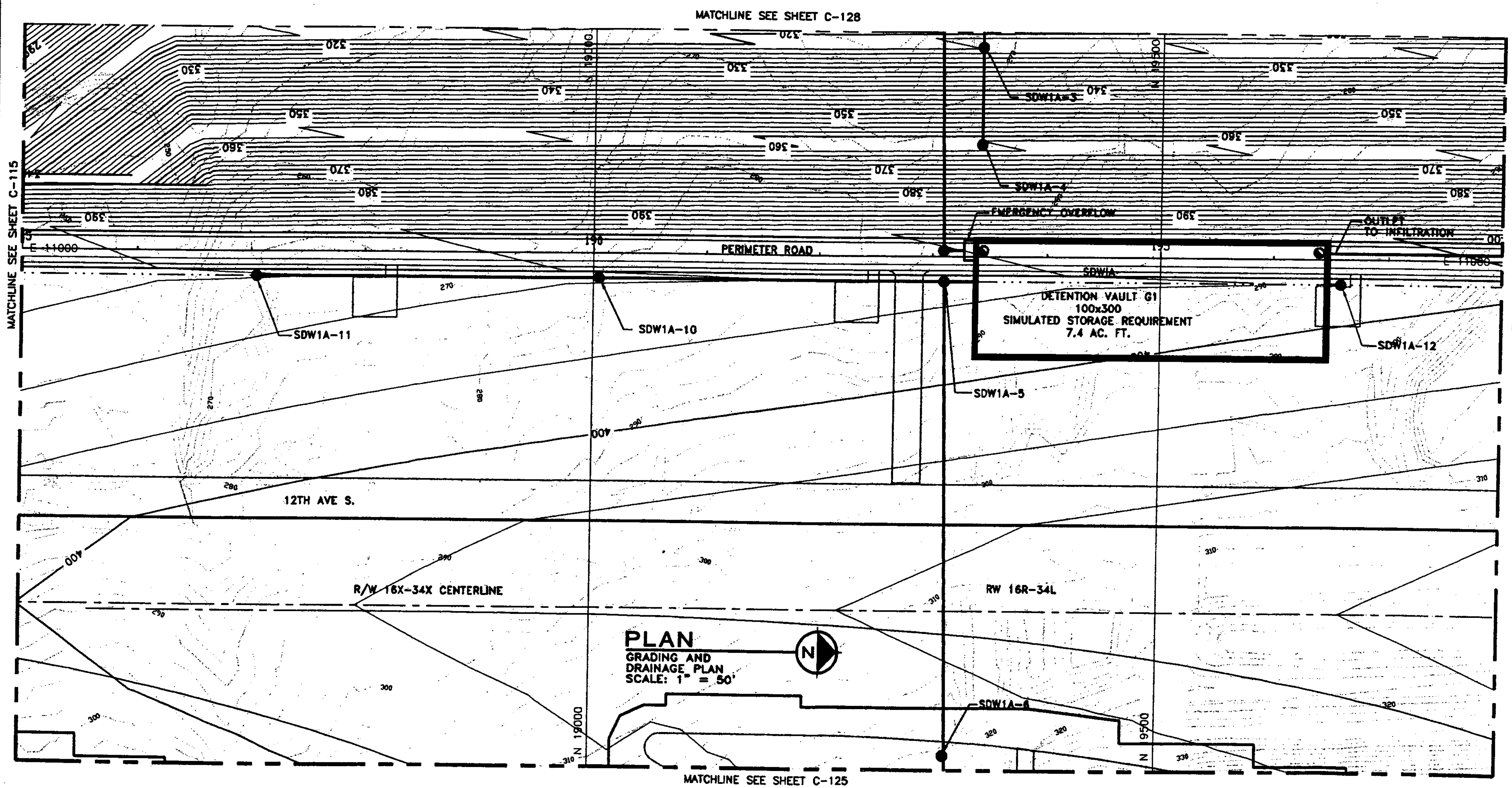
NOTES:



LEGEND:

- STORM DRAIN PIPE
- WETLANDS

AR 011401

SCALE: 1"=50'

					128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

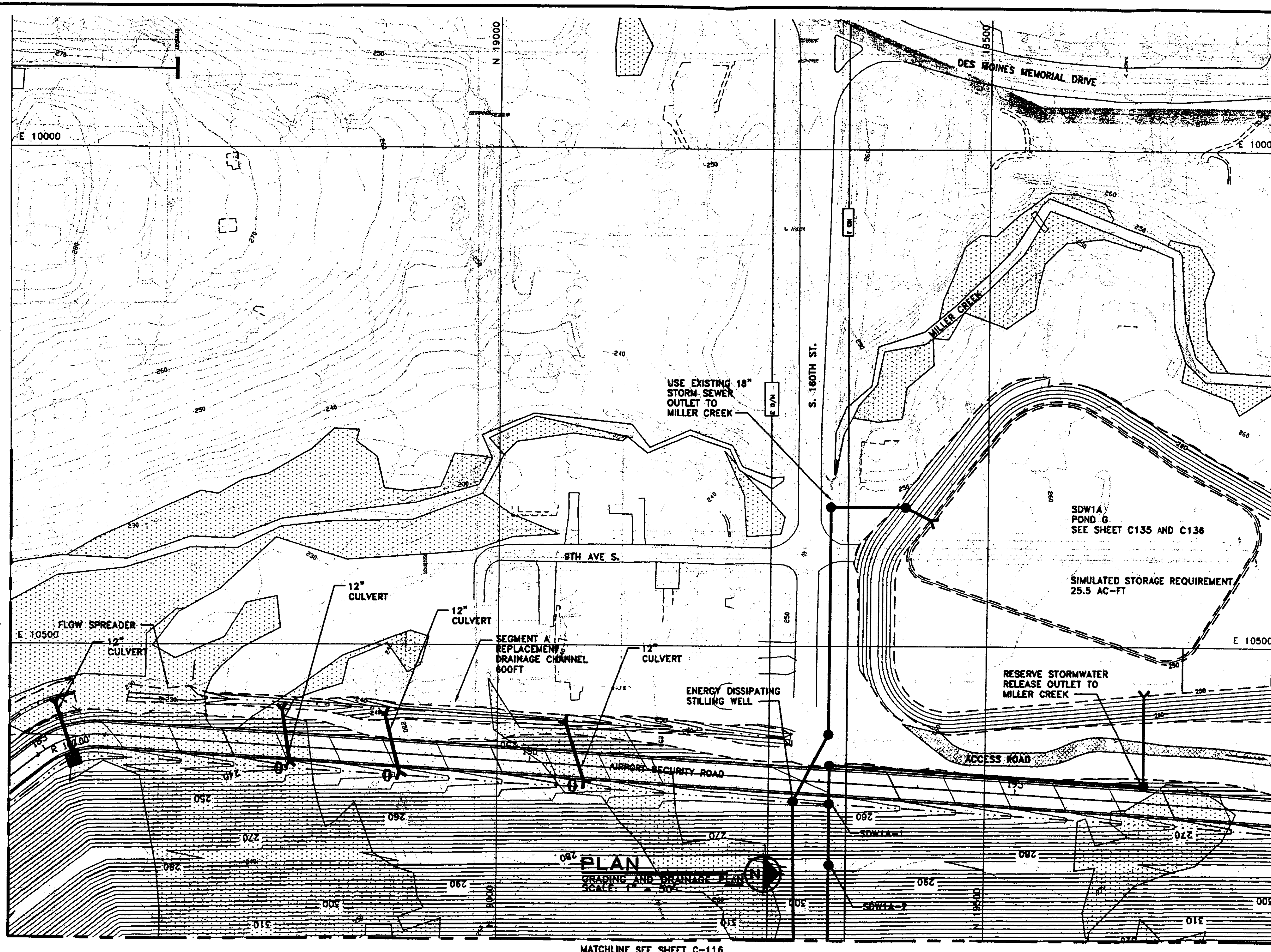
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: JULY 30, 2001

EXHIBIT_ C116



NOTES:

LEGEND:

- STORM DRAIN PIPE
- WETLANDS

AR 011402

SCALE: 1"=50'

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

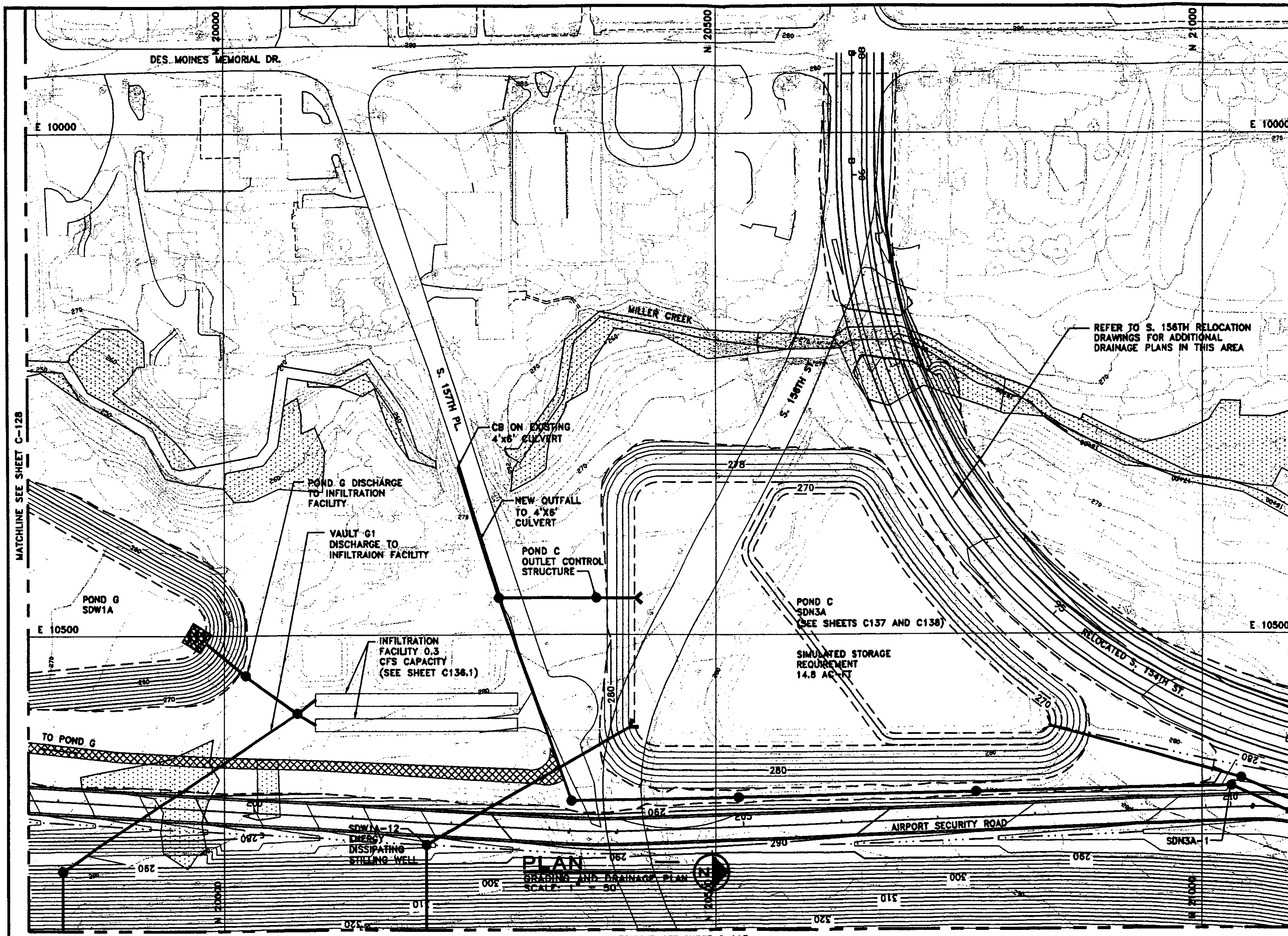
SHEET TITLE: **GRADING AND DRAINAGE PLAN**

DATE: JULY 30, 2001

CONSULTANT'S NO.

PORT OF SEATTLE NO.

EXHIBIT_ C128



NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

SCALE: 1"=50'

AR 011403

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 6

SHEET TITLE: GRADING AND DRAINAGE PLAN

DATE: JULY 30, 2001

EXHIBIT_ C129

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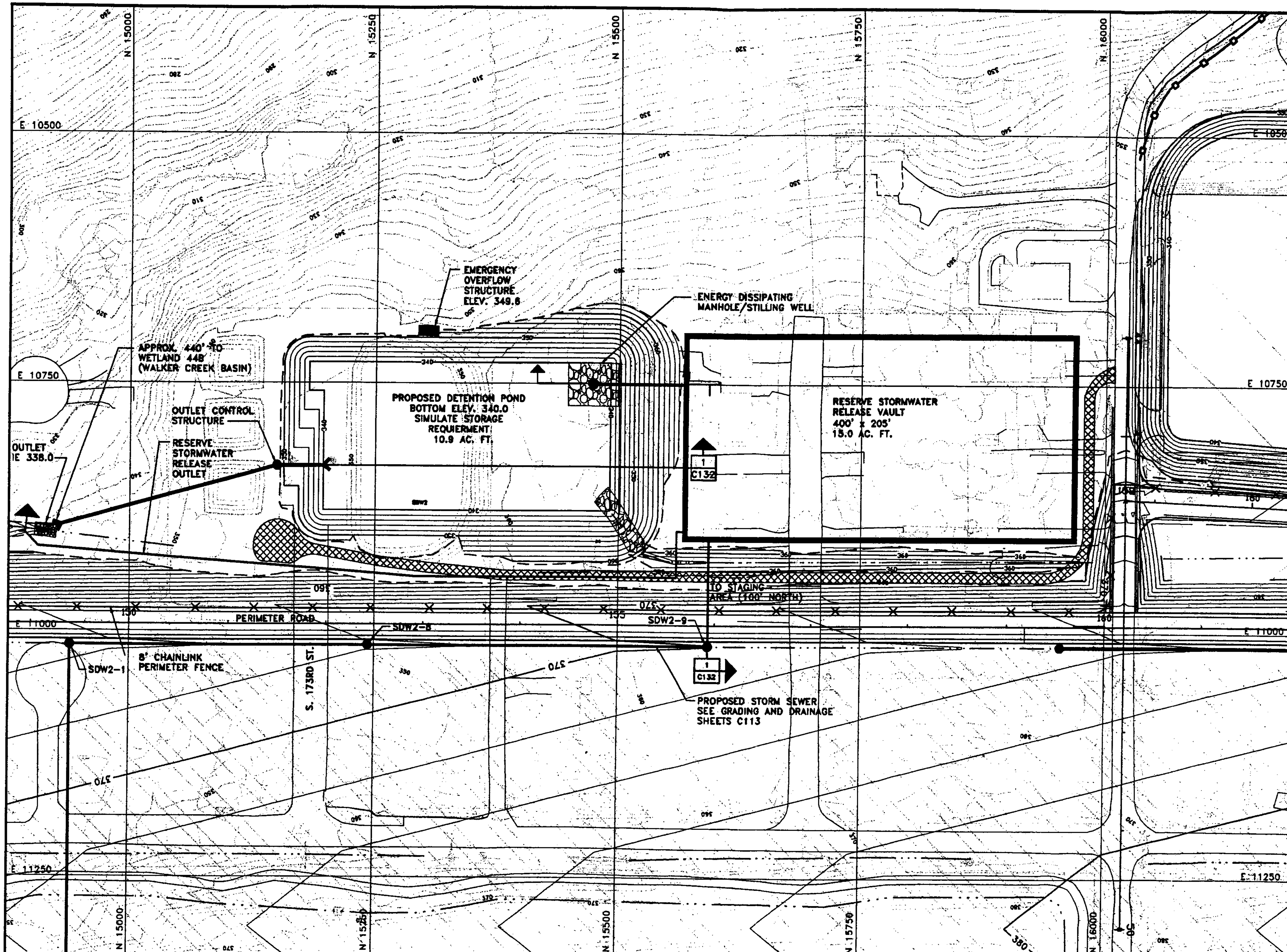


NOTE:

THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.

LEGEND:

- CHAINLINK FENCE
- PROPOSED STORM DRAIN
- ACCESS ROAD
- SUBJECT TO CHANGE PENDING FINAL AIRFIELD DESIGN

SCALE: 1"=50'

AR 011404

PLAN
POND F PLAN
SDW2 BASIN POND
SCALE: 1" = 50'

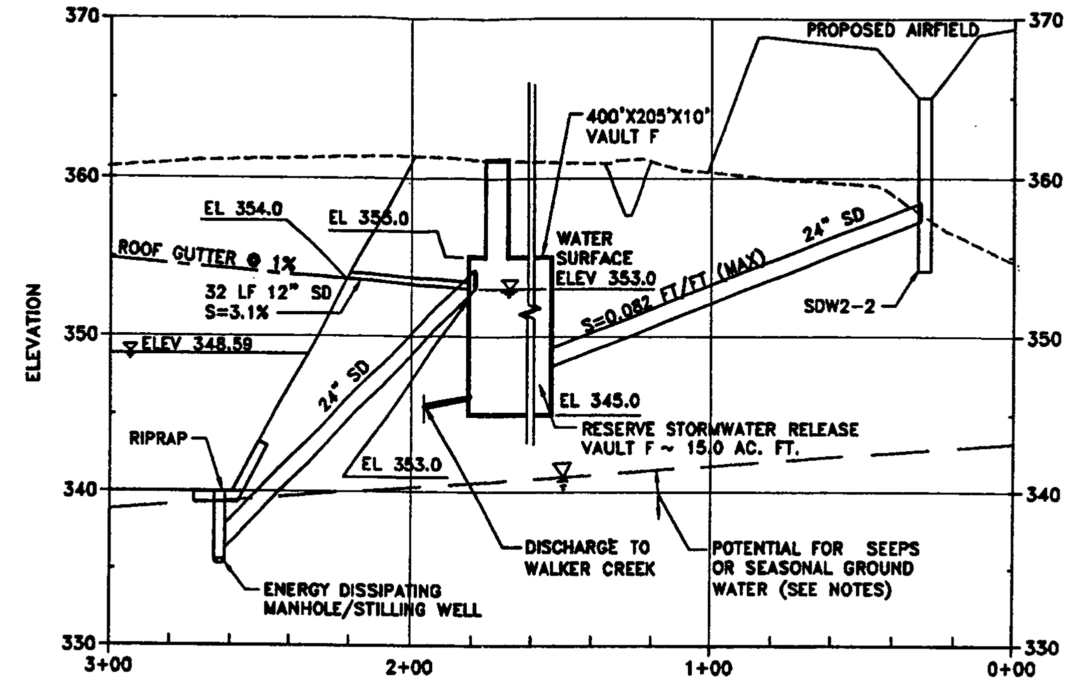
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: POND F PLAN
SDW2 BASIN POND

DATE: JULY 30, 2001

EXHIBIT_ C131

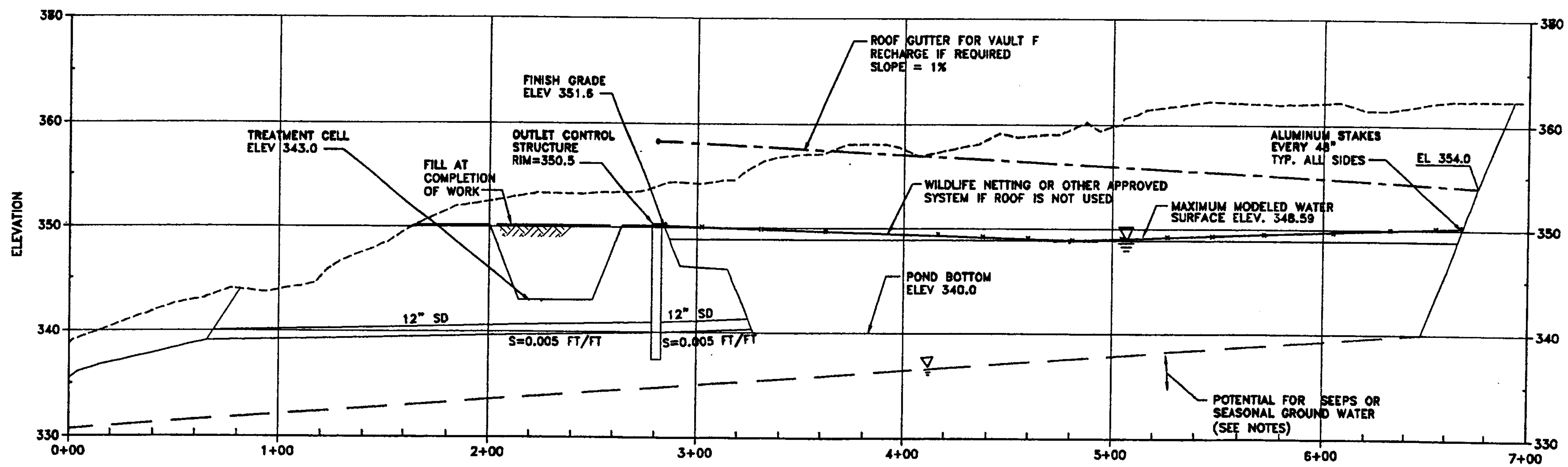


NOTES:

1. GROUND WATER ELEVATIONS ARE APPROXIMATE BASED ON AVAILABLE GEOTECHNICAL INVESTIGATIONS AND HYDROGEOLOGIC ELEVATION WILL BE INCLUDED AS PART OF THE FINAL DESIGN ANALYSIS.
2. FINAL POND CONFIGURATION MAY VARY TO MAINTAIN STORM WATER STORAGE ABOVE THE OBSERVED GROUND WATER.

PROFILE 2 / C131

STORM DRAIN AND RESERVE STORMWATER RELEASE VAULT PROFILE
SCALE: HORZ 1" = 30'
VERT 1" = 6'



GROUND WATER AT ELEV. 260±

PROFILE 1 / C131

POND F PROFILE
SDW-2 BASIN POND
SCALE: HORZ 1" = 30'
VERT 1" = 6'

AR 011405

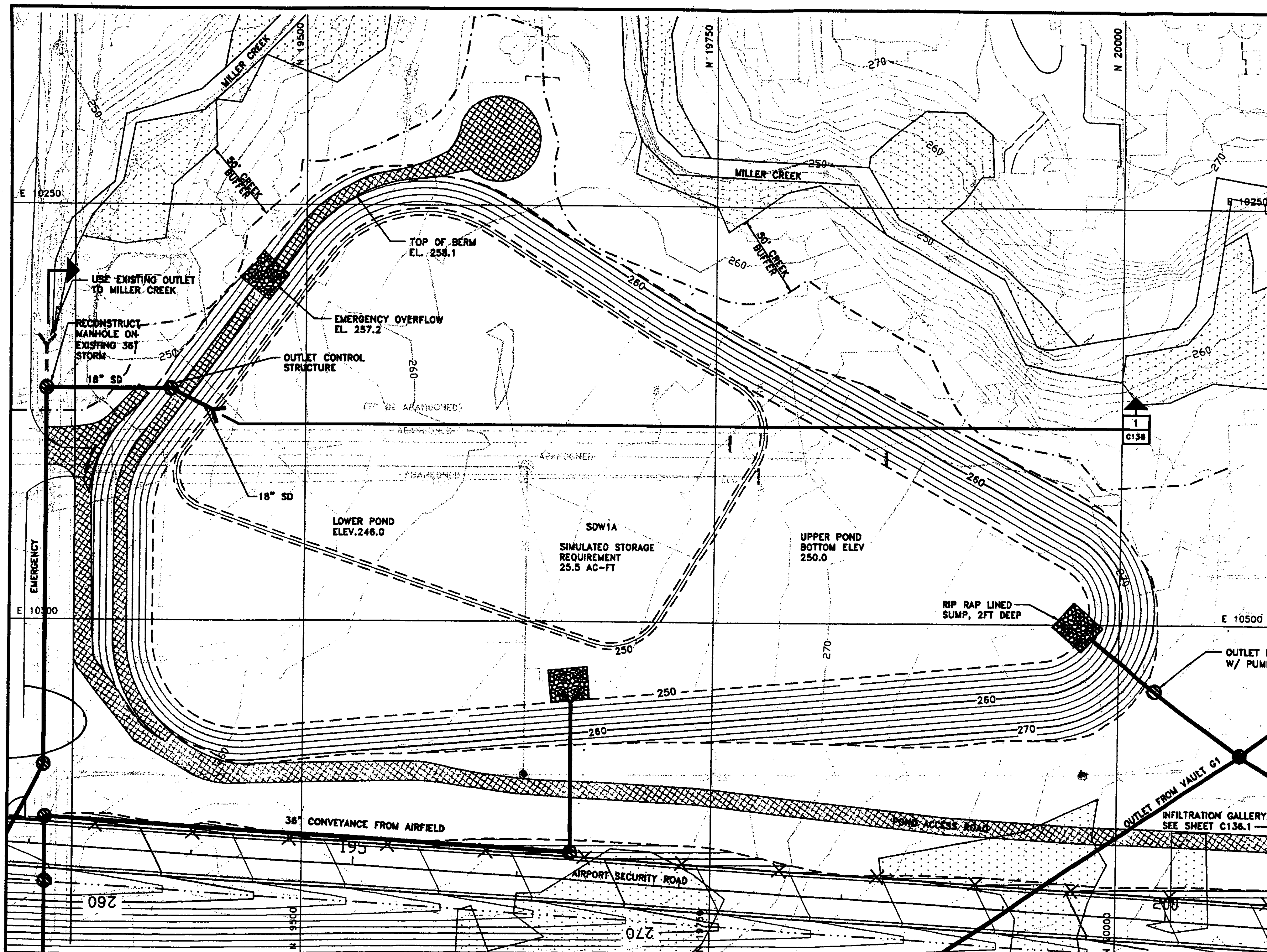
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: **POND F PROFILE SDW2 BASIN POND**

DATE: JULY 30, 2001

EXHIBIT_C132



LEGEND:

	CHAINLINK FENCE
	BUFFER
	PROPOSED STORM DRAIN
	ACCESS ROAD
	WETLANDS

SCALE: 1"=30'

AR 011406

PLAN
POND G PLAN
SDW1A BASIN POND
SCALE: 1" = 30'

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

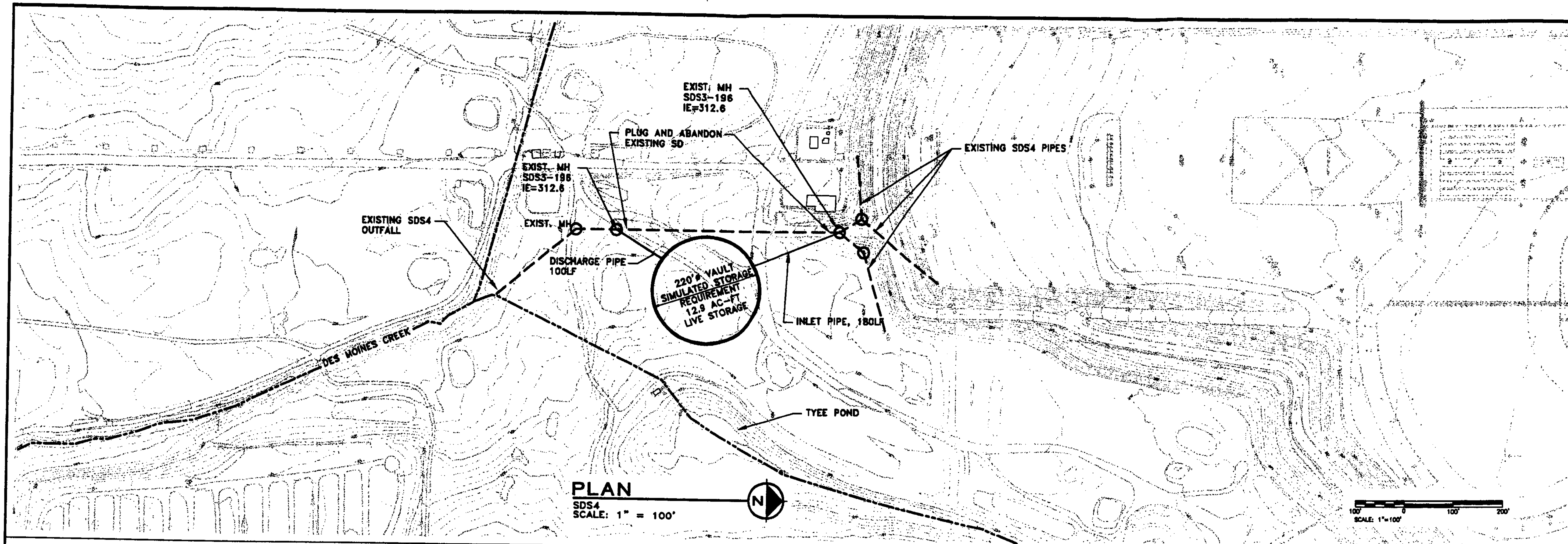
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: POND G PLAN
SDWIA BASIN POND

JULY 30, 2001

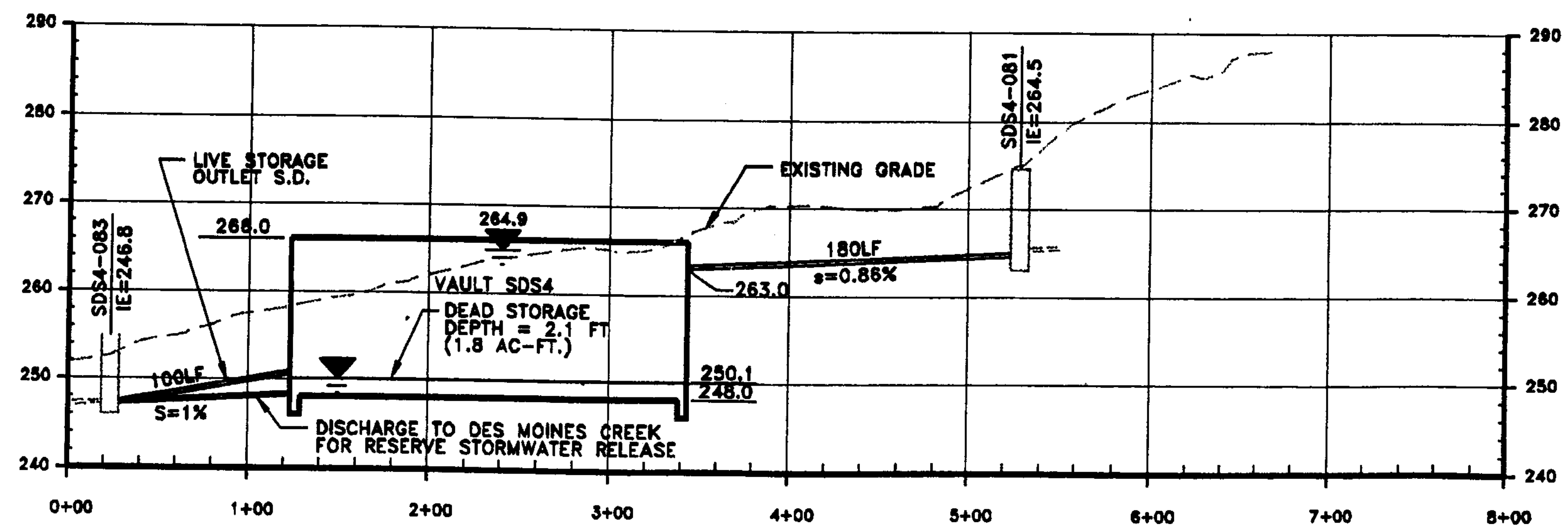
EXHIBIT_ C135

N:\20764\c J1005\permit\BV_C135.dwg, 07/27/01 01:48:16 PM, GMatsushita



PLAN

SDS4
SCALE: 1" = 100'



AR 011407

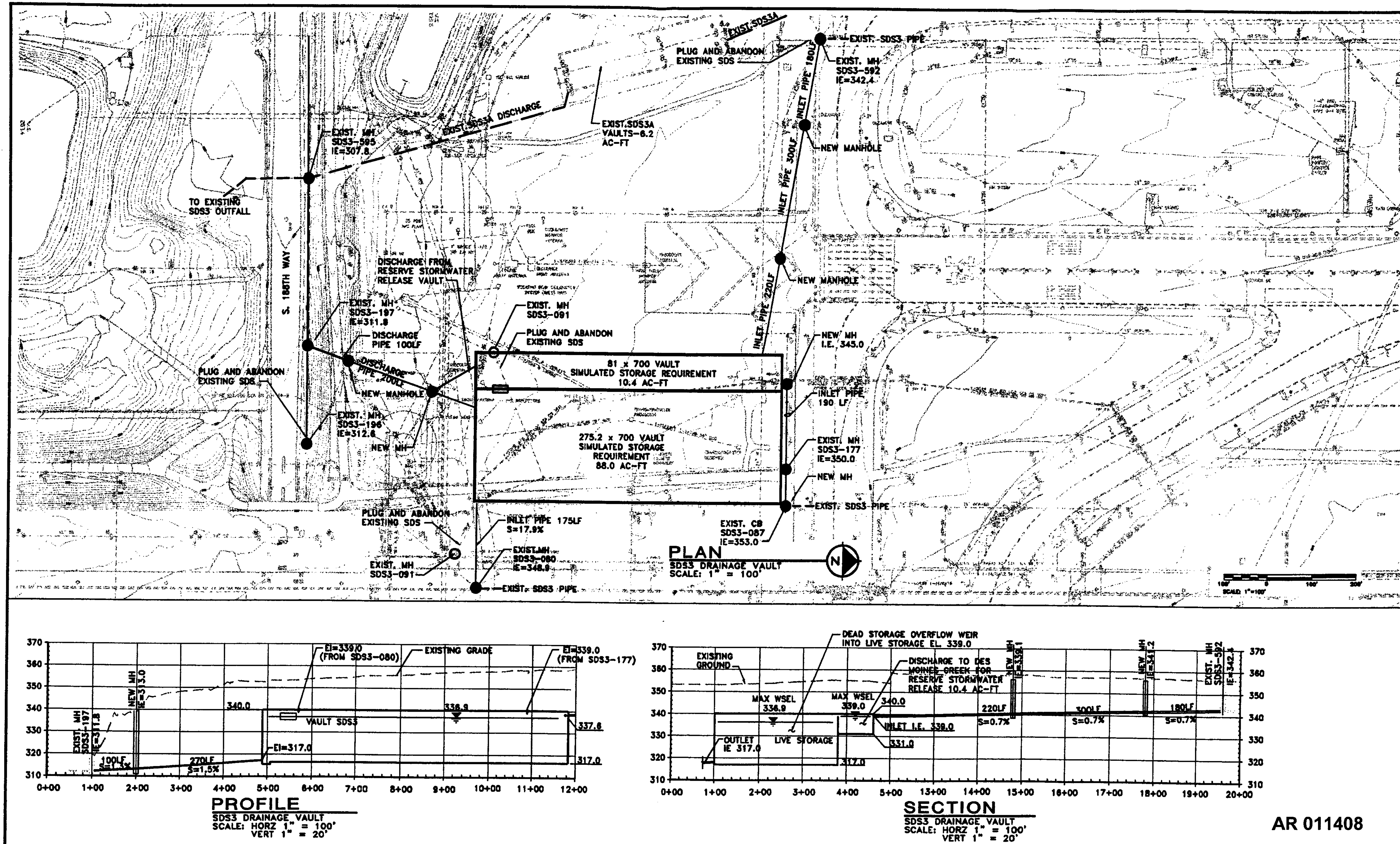
PROFILE

SDS4
SCALE: 1" = 50'

July 2001
556-2912-001 (28)

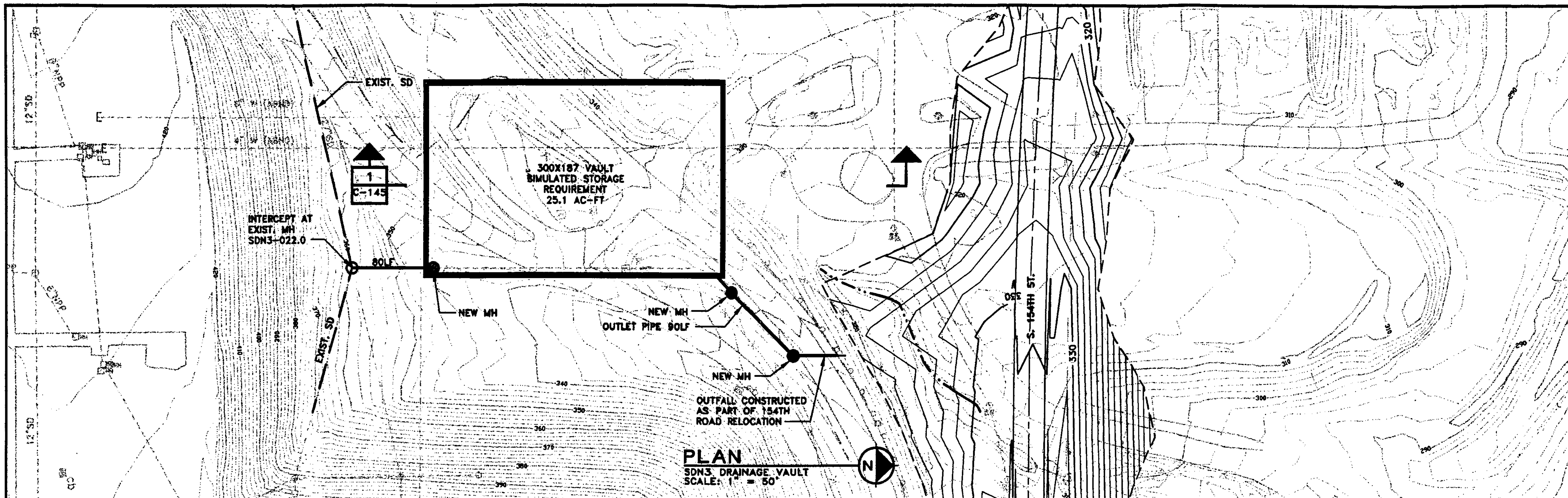
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5
SHEET TITLE: **SDS4 BASIN VAULT PLAN AND PROFILE**

DATE: APRIL 18, 2001
CONSULTANT'S NO.
PORT OF SEATTLE NO.
EXHIBIT_ C139



AR 011408

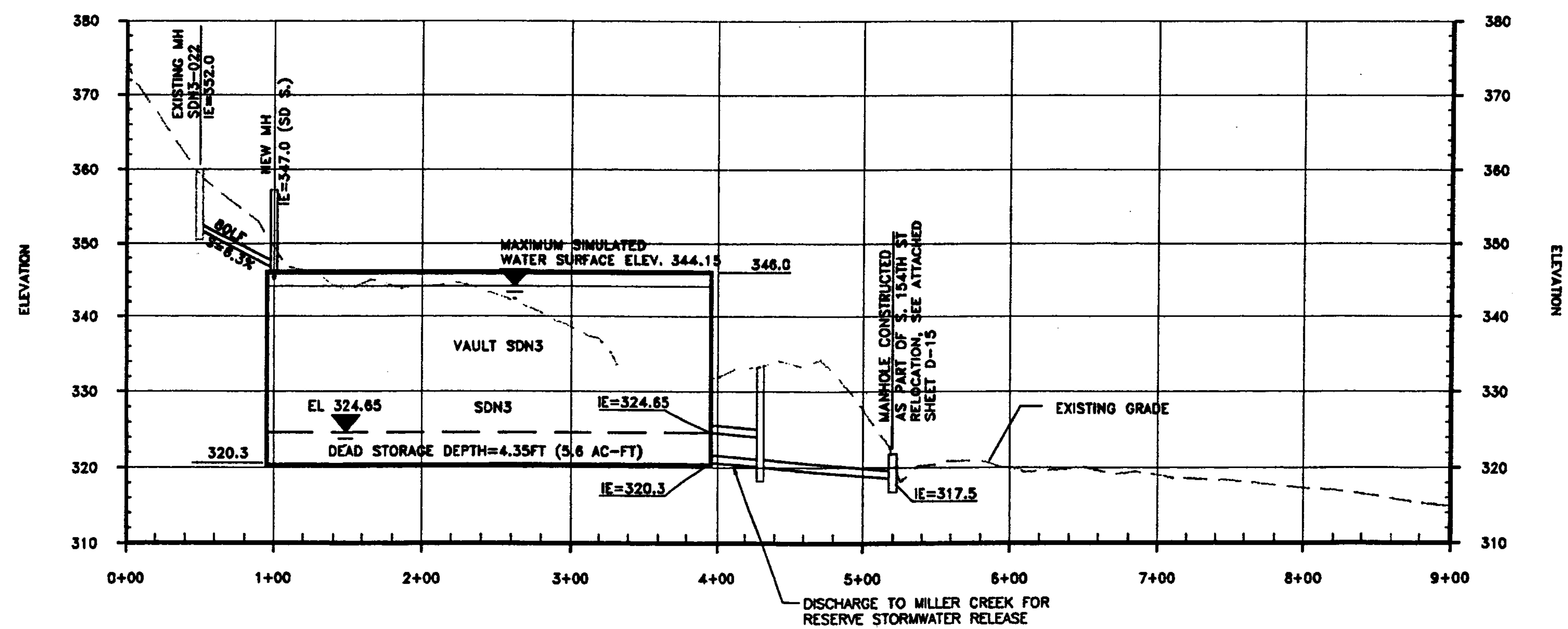
Port of Seattle SEA-TAC INTERNATIONAL AIRPORT		JULY 30, 2001
PROJECT:	THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 8	
SHEET TITLE:	SDS3, SDS3A AND SDS5 BASIN VAULT / PLAN AND PROFILE	EXHIBIT_C141



PLAN
SDN3 DRAINAGE VAULT
SCALE: 1" = 50'

NOTE:

THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.



SECTION A 1 C-145
SDN3 DRAINAGE VAULT
SCALE: HORZ 1" = 50'
VERT 1" = 10'

SCALE: 1" = 50'

AR 011409

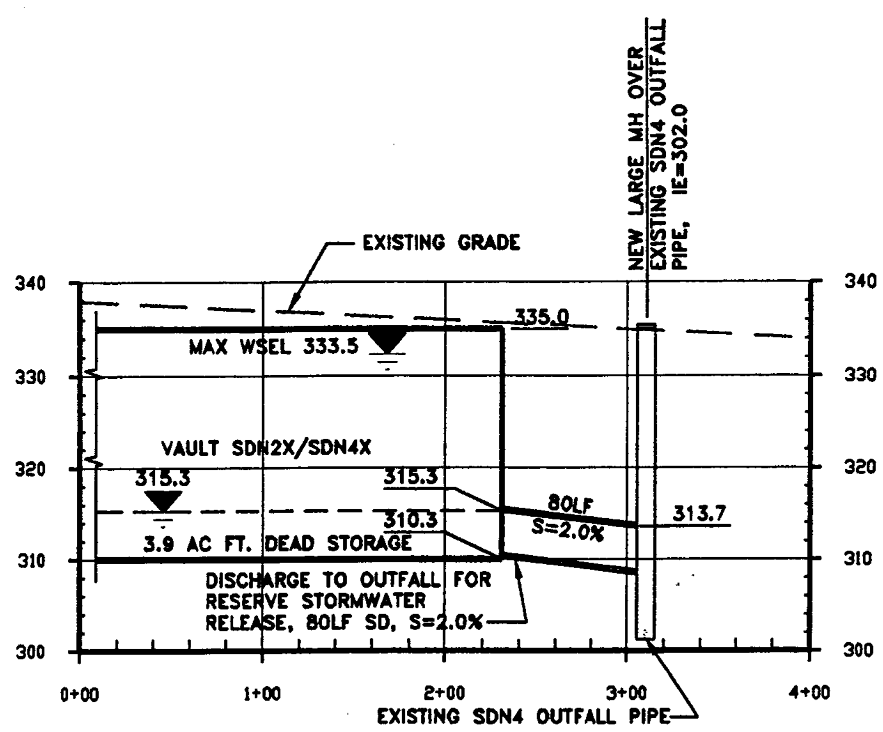
Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

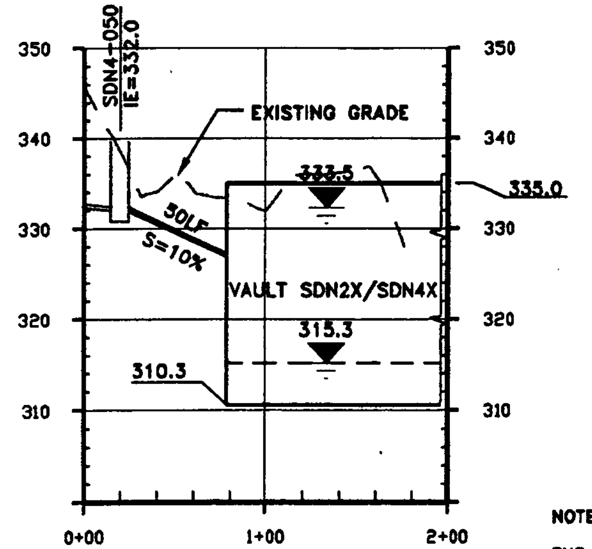
SHEET TITLE: SDN3 BASIN VAULT PLAN AND PROFILE

DATE: JULY 30, 2001

EXHIBIT_ C145



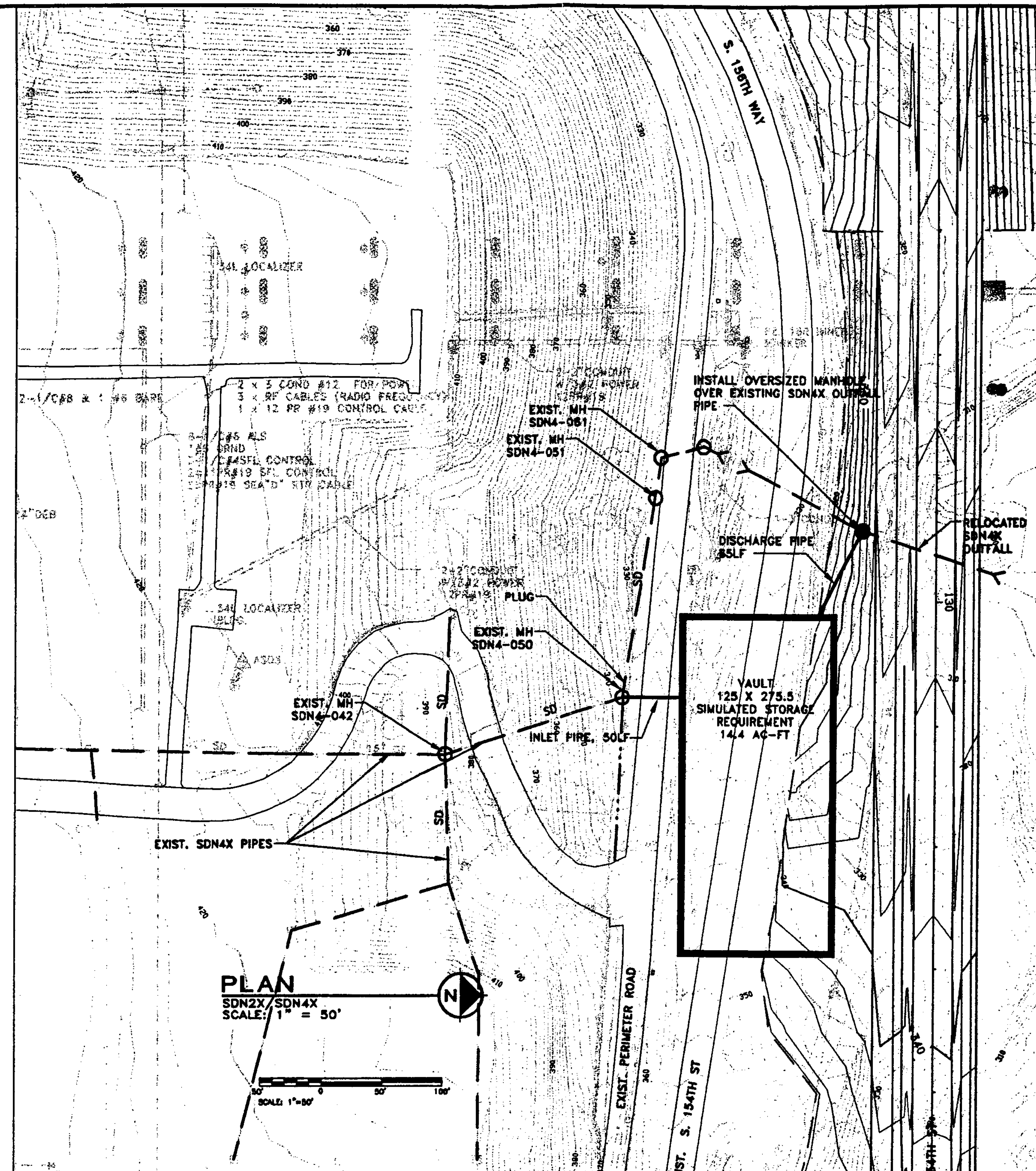
PROFILE
SDN2X/SDN4X
SCALE: HORZ 1" = 50'
VERT 1" = 10'



PROFILE
SDN2X/SDN4X
SCALE: HORZ 1" = 50'
VERT 1" = 10'

NOTE:

THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.



PLAN
SDN2X/SDN4X
SCALE: 1" = 50'

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

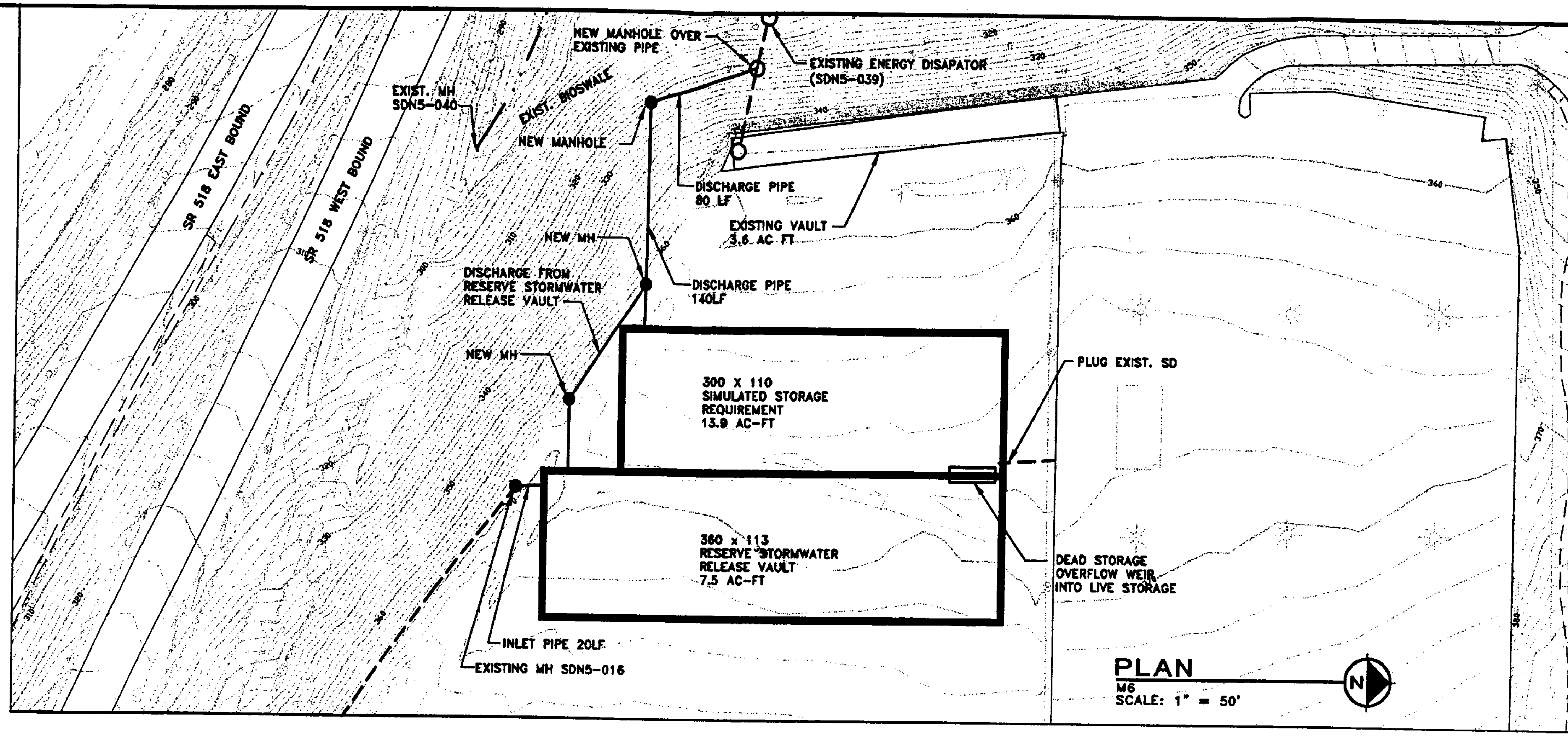
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: SDN2X/SDN4X BASIN VAULT PLAN AND PROFILE

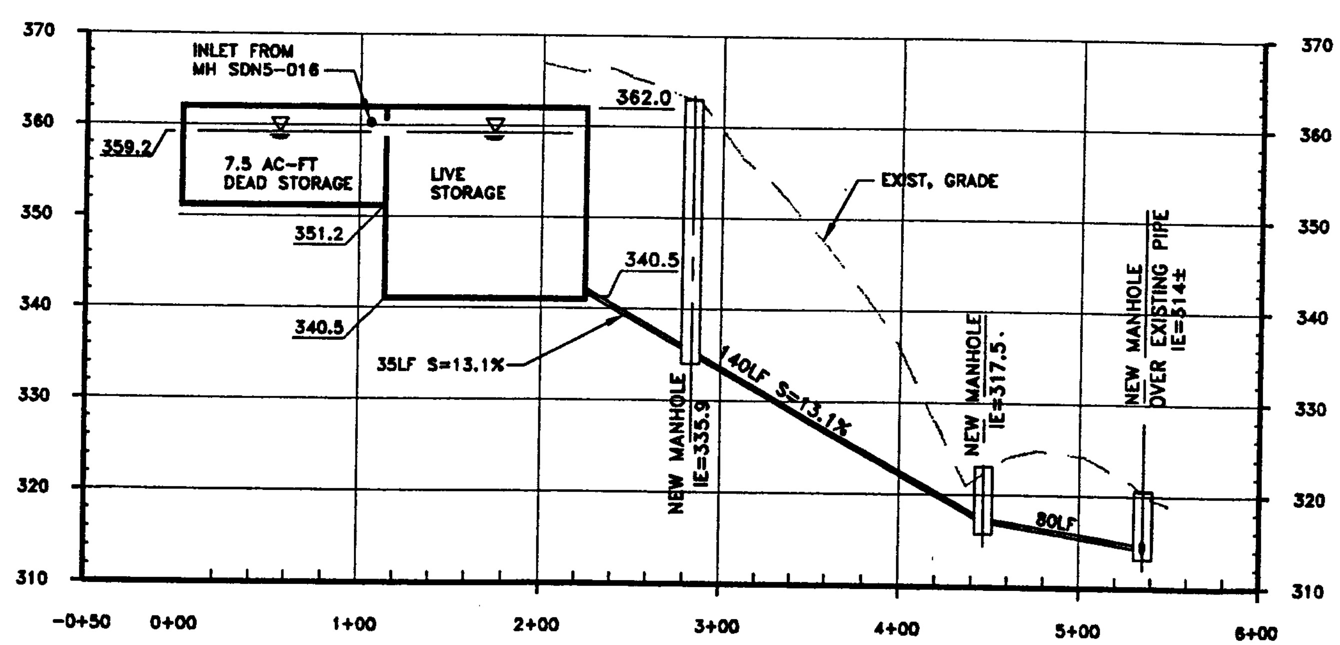
JULY 30, 2001

EXHIBIT_ C146

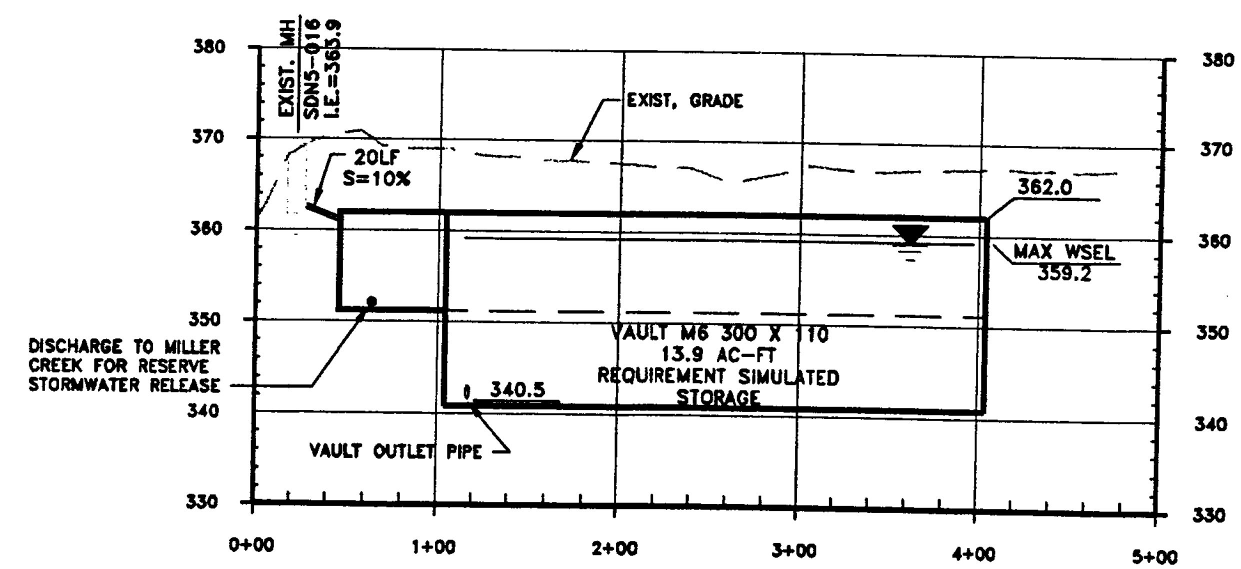
AR 011410



PLAN
M6
SCALE: 1" = 50'



PROFILE
M6
SCALE: HORZ 1" = 50'
VERT 1" = 10'



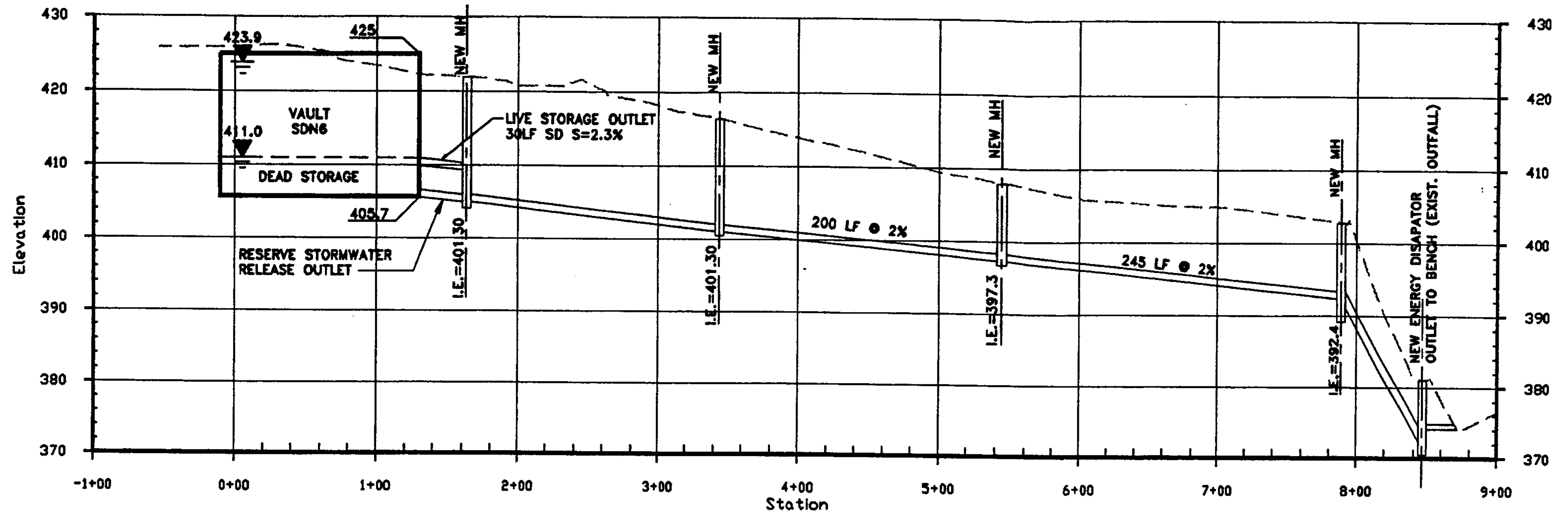
PROFILE
M6
SCALE: HORZ 1" = 50'
VERT 1" = 10'

AR 011411

NOTE:

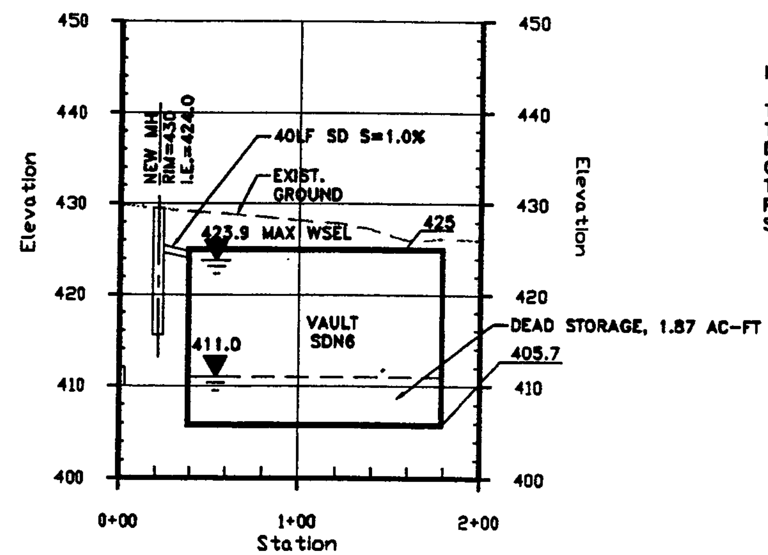
THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5
SHEET TITLE: M6 BASIN VAULT (NEPL) PLAN AND PROFILE
DATE: JULY 30, 2001
EXHIBIT_ C147



PROFILE

SDN6
SCALE: HORZ 1" = 50'
VERT 1" = 10'

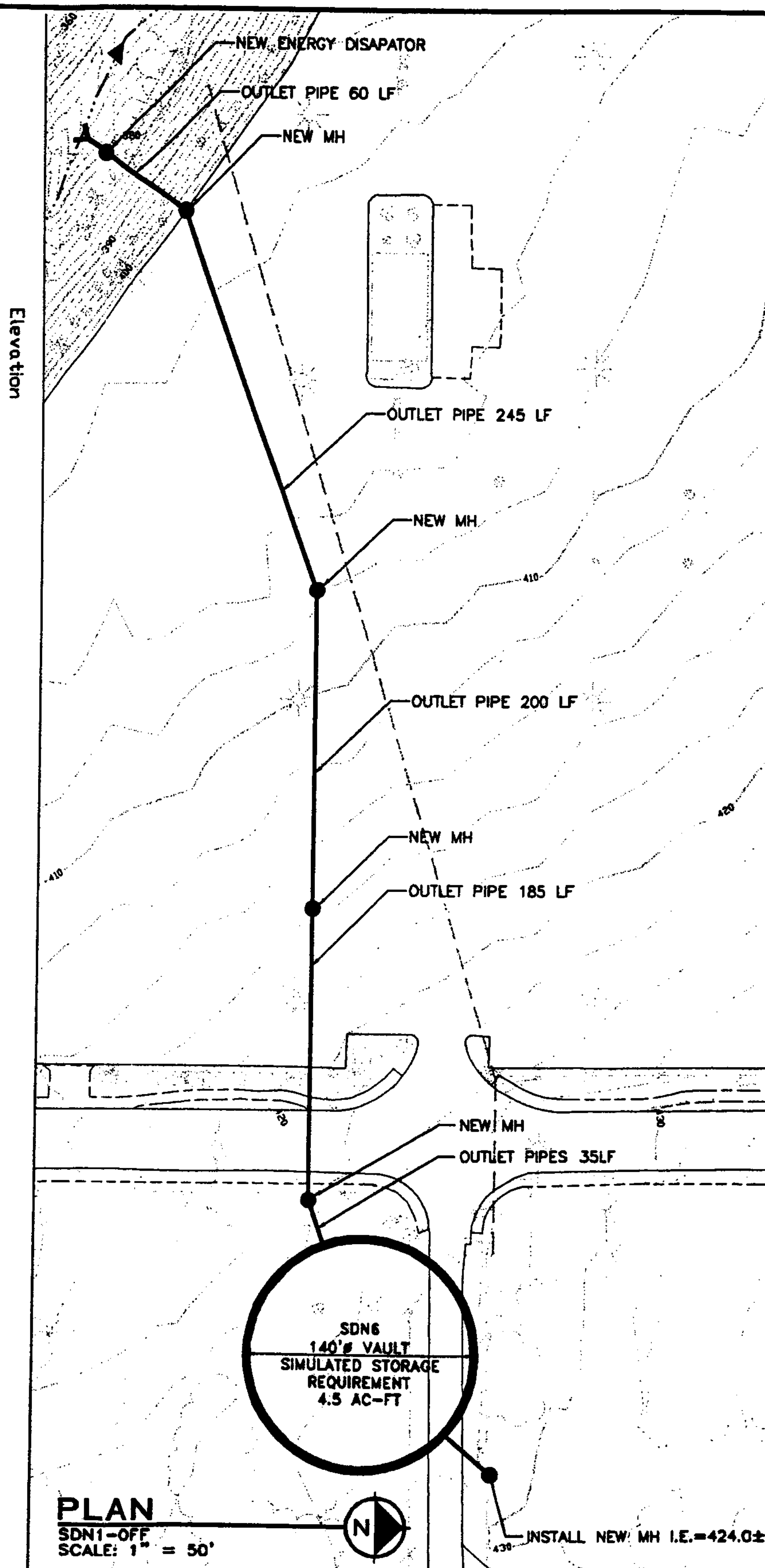


PROFILE

SDN6
SCALE: HORZ 1" = 50'
VERT 1" = 10'

NOTE:

THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.



PLAN

SDN1-OFF
SCALE: 1" = 50'

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

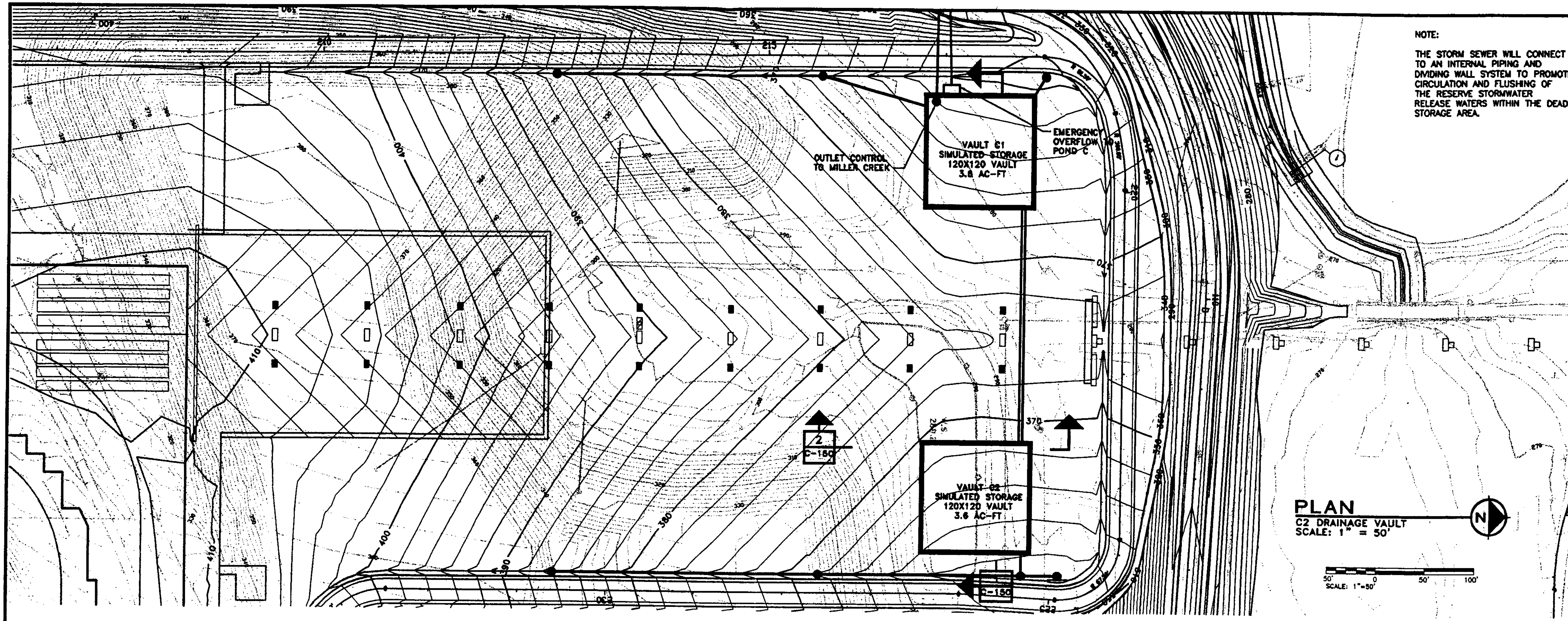
SHEET TITLE: SDN6 (CARGO) BASIN VAULT PLAN AND PROFILE

DATE: JULY 30, 2001

EXHIBIT_ C149

NOTE:

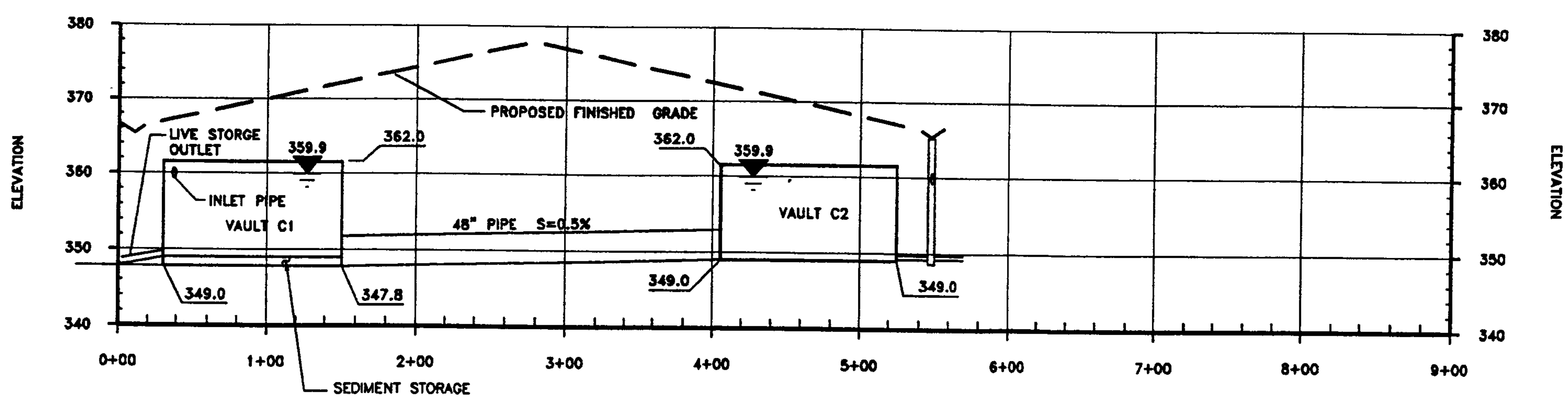
THE STORM SEWER WILL CONNECT TO AN INTERNAL PIPING AND DIVIDING WALL SYSTEM TO PROMOTE CIRCULATION AND FLUSHING OF THE RESERVE STORMWATER RELEASE WATERS WITHIN THE DEAD STORAGE AREA.



PLAN

C2 DRAINAGE VAULT
SCALE: 1" = 50'

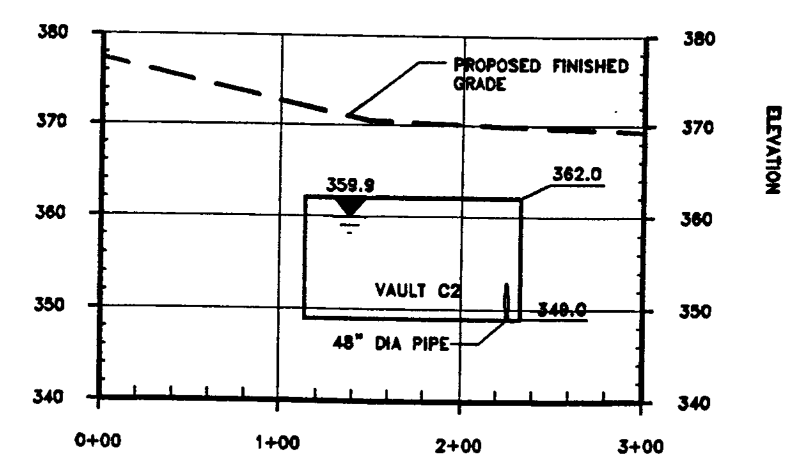
SCALE: 1"=50'



SECTION A

1
C-150

C2 DRAINAGE VAULT
SCALE: HORZ 1" = 50'
VERT 1" = 10'



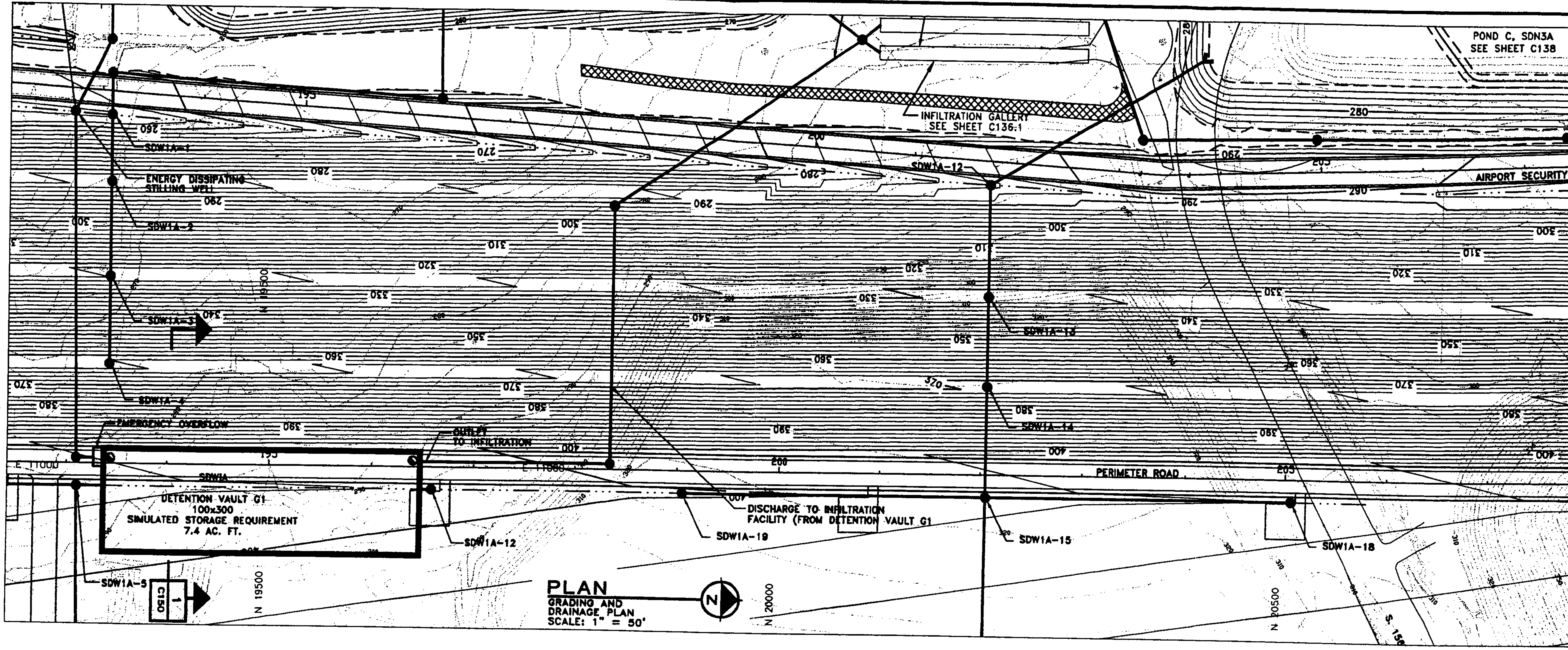
SECTION B

2
C-150

C2 DRAINAGE VAULT
SCALE: HORZ 1" = 50'
VERT 1" = 10'

AR 011413

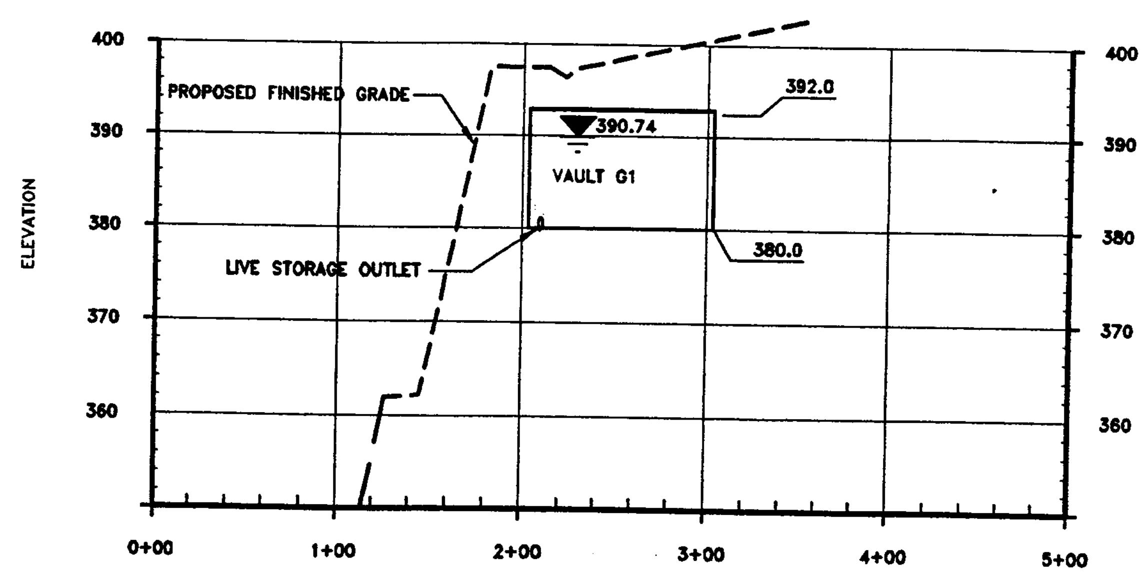
Port of Seattle SEA-TAC INTERNATIONAL AIRPORT	DATE: JULY 30, 2001
PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5	CONSULTANT'S NO.
SHEET TITLE: SDN3A BASIN VAULT C1/C2 PLAN AND PROFILE	PORT OF SEATTLE NO. EXHIBIT_ C150



PLAN

GRADING AND DRAINAGE PLAN
SCALE: 1" = 50'

AR 011414



SECTION A

1 / C-150

SDW1A DRAINAGE VAULT
SCALE: HORZ 1" = 50'
VERT 1" = 10'

NOTES:

LEGEND:

STORM DRAIN PIPE

WETLANDS

SCALE: 1"=50' (50' 0 50' 100')

						128	129	130
110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127

KEY PLAN

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT

PROJECT: THIRD RUNWAY - EMBANKMENT CONSTRUCTION PHASE 5

SHEET TITLE: SDW1A BASIN VAULT G1 PLAN AND SECTION

DATE: JULY 30, 2001

EXHIBIT_ C151

```
RUN
GLOBAL
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF MILLER CREEK
  ***  FILE: MLOWFLOW2.INP - 2006 future condition
  ***  LOW FLOW ANALYSIS
  ***  BASED ON MILL65.INP FILE FROM AQUA TERRA
  ***  REMOVED FILL AREAS
  ***  PERLND 80 is the groundwater PERLND for the Fill area.
  ***  FOLLOWING STATEMENTS MAY NOT APPLY
  ***  ADDED PERLND 47,57,
  ***  ADDED GROUND WATER INFILTRATION TO WDM FOR USE WITH MCAGWO.INP
  ***  FK revised SDW1A and SDW1B with flow splitters, storages at SDN3/3X,
SDN2X/4X;
  ***  FK revised MC-1 and SDN-2X land uses, added POC at Lake Reba, removed
run-of-river tables
  ***  FOUR YEAR RUN USING LONG TERM 1990 INITIAL CONDITIONS
MILLER CREEK BASIN HSPF MODEL
***  START       1994  1  1  0  0  END    1996  8 30 24  0
  START       1990 10  1  0  0  END    1994  9 30 24  0
  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname------------------------------------------->
MESSU      24   D:\PARA\SEATAC\MILLER\LOWFLOW\MLOWFLOW3.MES
WDM        25   D:\PARA\SEATAC\MILLER\LOWFLOW\MLOWFLOW.WDM
           61   D:\PARA\SEATAC\MILLER\LOWFLOW\PER.L61
           62   D:\PARA\SEATAC\MILLER\LOWFLOW\RCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      16
      PERLND      26
      PERLND      34
      PERLND      44
      PERLND      45
  *** special PERLND for infiltration SDW1A
      PERLND      47
      PERLND      54
  *** special PERLND for infiltration SDW1B
      PERLND      57
  *** PERLNDS FOR INFLOW OF LOW FLOW FROM FILL PGG
      PERLND      80
      IMPLND      14
      RCHRES       1
      RCHRES      23
      RCHRES      24
      RCHRES       2
      RCHRES       3
      RCHRES      33
      RCHRES       4
      RCHRES       5
      RCHRES      50
      RCHRES     242
      RCHRES     240
```

```
    COPY        61
    COPY        44
    RCHRES      51
    RCHRES      43
    RCHRES     451
    RCHRES     452
    COPY        45
    COPY       645
    RCHRES      46
    RCHRES     552
    RCHRES      52
    RCHRES      53
    COPY        53
    RCHRES      54
    RCHRES      37
    RCHRES     237
    COPY        37
    RCHRES     147
    RCHRES     247
    COPY        66
    COPY        69
    RCHRES      47
    COPY        62
    COPY        63
    COPY        67
    COPY        68
*** output special PERLND outflow to check
    COPY        47
    COPY        70
    RCHRES      34
    RCHRES     135
    RCHRES     570
    RCHRES      57
    RCHRES     257
    COPY        64
    COPY        65
    COPY       357
    COPY        56
*** output special PERLND outflow to check
    COPY        57
    COPY        71
    RCHRES      35
    COPY        55
    RCHRES      10
    RCHRES      16
    RCHRES      11
    RCHRES      13
    RCHRES      12
    RCHRES      15
    RCHRES      14
    RCHRES      17
  END INGRP
END OPN SEQUENCE
                                                                             ***
PERLND
  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer                 ***
```

```
  # -  #                              User  t-series Engl Metr                    ***
                                                in   out                          ***
 16      TFM- TILL FOR MOD       1     1     1     1   61     0
 26      TGM- TILL GR MOD        1     1     1     1   61     0
 34      OF - OUTWASH FOR        1     1     1     1   61     0
 44      OG - OUTWASH GR         1     1     1     1   61     0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
 45      AIRPORT FILL            1     1     1     1   61     0
 47      OG - INFILTRATION 1     1     1     1     1   61     0
 54      SA - WETLANDS           1     1     1     1   61     0
 57      OG - INFILTRATION 3     1     1     1     1   61     0
 80      LOW FLOW                1     1     1     1   61     0
END GEN-INFO
ACTIVITY
  <PLS > ************* Active Sections *****************************
  # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC         ***
 14  200    0    0    1    0    0    0    0    0    0    0    0    0
END ACTIVITY
PRINT-INFO
  <PLS > ******************** Print-flags *********************** PIVL  PYR
  # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
 14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
END PRINT-INFO
PWAT-PARM1
  <PLS > **************** Flags *******************
  # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                          ***
 14  200    0    0    0    0    0    0    0    0    0
END PWAT-PARM1
PWAT-PARM2
  <PLS > ***
  # -  # ***FOREST        LZSN     INFILT      LSUR     SLSUR     KVARY     AGWRC
 16                     9.0000     0.3200    400.00    0.1000    0.5000    0.9960
 26                     9.0000     0.1200    400.00    0.1000    0.5000    0.9960
 34                    10.0000     2.0000    400.00    0.0500    0.3000    0.9960
 44                    10.0000     0.8000    400.00    0.0500    0.3000    0.9960
 45                     7.5000     0.0200    300.00    0.0700    0.0000    0.9960
 47                    10.0000     0.8000    400.00    0.0500    0.3000    0.9960
 54                     8.0000     2.0000    100.00    0.0010    0.5000    0.9960
 57                    10.0000     0.8000    400.00    0.0500    0.3000    0.9960
 80                     9.0000     0.1200    400.00    0.1000    0.5000    0.9960
END PWAT-PARM2
PWAT-PARM3
  <PLS >***
  # -  #*** PETMAX    PETMIN     INFEXP    INFILD    DEEPFR    BASETP    AGWETP
 16                              2.0000    2.0000      0.33      0.00       0.0
 26                              2.0000    2.0000      0.33        0.        0.
 34                              2.0000    2.0000      0.33      0.00       0.0
 44                              2.0000    2.0000      0.33        0.        0.
 47                              2.0000    2.0000      0.33        0.        0.
 45                              2.0000    2.0000      0.33        0.        0.
 54                              10.000    2.0000      0.33        0.       0.7
 57                              2.0000    2.0000      0.33        0.        0.
 80                              2.0000    2.0000      0.33        0.        0.
END PWAT-PARM3
PWAT-PARM4
  <PLS >                                                             ***
  # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
```

```
  16          0.2000     0.7500     0.3500      9.000     0.7000     0.7000
  26          0.1000     0.3750     0.2500      9.000     0.7000     0.2500
  34          0.2000     0.7500     0.3500      0.000     0.7000     0.7000
  44          0.1000     0.7500     0.2500      0.000     0.7000     0.2500
  47          0.1000     0.7500     0.2500      0.000     0.7000     0.2500
  45          0.1000     0.2800     0.2500      6.000     0.1500     0.6000
  54          0.1000     2.2500     0.5000      1.000     0.7000     0.8000
  57          0.1000     0.7500     0.2500      0.000     0.7000     0.2500
  80          0.1000     0.3750     0.2500      9.000     0.7000     0.2500

 END PWAT-PARM4
 PWAT-STATE1
   <PLS >  PWATER state variables***
   # -  #***    CEPS      SURS       UZS       IFWS       LZS      AGWS      GWVS
  16          0.000        0.    0.0010      0.00     0.941     3.108     0.048
  26          0.000        0.    0.0010      0.00     7.672     3.341     0.071
  34          0.000        0.    0.0010      0.00     1.187     3.776     0.052
  44          0.000        0.    0.0040      0.00     9.402     4.905     0.104
  45          0.000        0.    0.0000      0.00     2.000     2.000     0.000
  54          0.000        0.    0.0960      0.00     3.211     0.000     0.000
  47          0.000        0.    0.0000      0.00     2.000     2.000     0.000
  57          0.000        0.    0.0000      0.00     2.000     2.000     0.000
  80          0.000        0.    0.0000      0.00     7.672     3.341     0.071
 END PWAT-STATE1
END PERLND

IMPLND
 GEN-INFO
   <ILS >      Name              Unit-systems   Printer                      ***
   # -  #                      User  t-series Engl Metr                     ***
                                      in  out                                ***
  14      IMPERVIOUS             1     1    1   60    0
 END GEN-INFO
 ACTIVITY
   <ILS > ************* Active Sections ****
   # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  14         0    0    1    0    0    0
 END ACTIVITY
 PRINT-INFO
   <ILS > ******** Print-flags ******** PIVL  PYR
   # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
  14         0    0    6    0    0    0    1    9
 END PRINT-INFO
 IWAT-PARM1
   <ILS >            Flags            ***                                    ***
   # -  # CSNO RTOP  VRS  VNN RTLI    ***                                    ***
  14         0    0    0    0    0
 END IWAT-PARM1
 IWAT-PARM2
   <ILS >                                                                    ***
   # -  #       LSUR     SLSUR      NSUR      RETSC                          ***
  14          100.00    0.0100    0.1000     0.1000
 END IWAT-PARM2
 IWAT-PARM3
   <ILS >                                                                    ***
   # -  #     PETMAX    PETMIN                                               ***
  14
```

```
  END IWAT-PARM3
  IWAT-STATE1
    <ILS >  IWATER state variables                                                ***
    # -  #       RETS      SURS                                                   ***
   14       1.0000E-3 1.0000E-3
  END IWAT-STATE1
END IMPLND                                                                         ***

EXT SOURCES                                                                        ***

*** NOTE: The only RCHRES that precip and PET are applied to are lakes and ponds
*** FOLLOWING RCHRES ARE PONDS: 57, 247, 237
                                                                                   ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>    # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #   ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM   1002 PREC      ENGLZERO  1.00          PERLND  14   65 EXTNL  PREC
WDM   1002 PREC      ENGLZERO  0.0           PERLND  80      EXTNL  PREC
WDM   1002 PREC      ENGLZERO  1.00          IMPLND  14      EXTNL  PREC
WDM      1 EVAP      ENGLZERO  0.8           PERLND  14   65 EXTNL  PETINP
WDM      1 EVAP      ENGLZERO  0.0           PERLND  80      EXTNL  PETINP
WDM      1 EVAP      ENGLZERO  0.8           IMPLND  14      EXTNL  PETINP
  ***  --> lateral inflow from reinfiltration chamber for SDW1A
*** WDM       5 FLOW     ENGLZERO  1.0          PERLND  47      EXTNL  AGWLI
  ***  --> lateral inflow from reinfiltration chamber for SDW1B
*** WDM       6 FLOW     ENGLZERO  1.0          PERLND  57      EXTNL  AGWLI
*** PRECIP/EVAP TO LAKES
WDM   1002 PREC      ENGLZERO                RCHRES   1      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES   1      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES   4      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES   4      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES  11      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES  11      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES  13      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES  13      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES  23      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES  23      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES  34      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES  34      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES  53      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES  53      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES  54      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES  54      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES 237      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES 237      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES 247      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES 247      EXTNL  POTEV
WDM   1002 PREC      ENGLZERO                RCHRES  57      EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8         RCHRES  57      EXTNL  POTEV
*** till seapage groundwater flow from Fill area.  PGG time series
WDM   7001 FLOW      ENGLZERO.000000099     PERLND  80      EXTNL  AGWLI
*** Fill flow directly to stream
WDM   7000 FLOW      ENGL     .000000957     RCHRES  35      INFLOW IVOL

 END EXT SOURCES

 EXT TARGETS
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #         <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
***PROJECT CONDITION FLOWS
*** RCHRES=LOCATION:
*** 54=MCDF       47=SDW1A INFILTRATION TANK      43=SDN3X      247=SDW1A POND G
*** 17=MOUTH      49=SDW2          44=SDN4X        52=SDN1       451= EXISTING NEPL
*** 61=SDN2X      57=SDW1B         51=SDN2X+SDN4X   53=Lake Reba 452=NEW NEPL
*** 45=NEPL POC   55=SR509         39=SDN3A/SDW1A POC
*** 46=CARGO      37=SDN3AI VAULT 237=SDN3AO POND
*** GAUGE POINTS (17=MOUTH, 54=MILLER RDF, 55=SR509)
RCHRES  17 HYDR   RO      1 1                 WDM   7017 FLOW     ENGL      REPL
RCHRES  35 HYDR   RO      1 1                 WDM   7036 FLOW     ENGL      REPL
***COPY   55 OUTPUT MEAN   1 1 12.1              WDM    118 FLOW     ENGL      REPL
RCHRES  54 HYDR   RO      1 1                 WDM   7054 FLOW     ENGL      REPL
*** DETENTION POND FLOWS
***COPY   61 OUTPUT MEAN   1 1 12.1              WDM    101 FLOW     ENGL      REPL
***RCHRES 552 HYDR   RO      1 1                 WDM    102 FLOW     ENGL      REPL
***RCHRES 451 HYDR   RO      1 1                 WDM    105 FLOW     ENGL      REPL
***RCHRES 452 HYDR   RO      1 1                 WDM    119 FLOW     ENGL      REPL
***RCHRES  46 HYDR   RO      1 1                 WDM    106 FLOW     ENGL      REPL
*** write RCHRES 47 (Inf. Area # 1)outlet 1 and 2 to WDM 107 and 108 like so:
***COPY   62 OUTPUT MEAN   1 1 12.1              WDM    107 FLOW     ENGL      REPL
***COPY   63 OUTPUT MEAN   1 1 12.1              WDM    108 FLOW     ENGL      REPL
***COPY   66 OUTPUT MEAN   1 1 12.1              WDM    112 FLOW     ENGL      REPL
***COPY   69 OUTPUT MEAN   1 1 12.1              WDM   1120 FLOW     ENGL      REPL
*** write SDW1a vault flows to WDM:
***COPY   67 OUTPUT MEAN   1 1 12.1              WDM    109 FLOW     ENGL      REPL
***COPY   68 OUTPUT MEAN   1 1 12.1              WDM   1090 FLOW     ENGL      REPL
*** write RCHRES 570 outlet 1 and 2 to WDM 110 and 115 like so:
***RCHRES 570 HYDR   RO      1 1                 WDM    210 FLOW     ENGL      REPL
***COPY   64 OUTPUT MEAN   1 1 12.1              WDM    110 FLOW     ENGL      REPL
***COPY   65 OUTPUT MEAN   1 1 12.1              WDM    115 FLOW     ENGL      REPL
***COPY  357 OUTPUT MEAN   1 1 12.1              WDM    211 FLOW     ENGL      REPL
***COPY   56 OUTPUT MEAN   1 1 12.1              WDM    121 FLOW     ENGL      REPL
*** write RCHRES 37 vault to WDM 111
***RCHRES  37 HYDR   RO      1 1                 WDM    111 FLOW     ENGL      REPL
***RCHRES 237 HYDR   RO      1 1                 WDM    122 FLOW     ENGL      REPL
***RCHRES  43 HYDR   RO      1 1                 WDM    103 FLOW     ENGL      REPL
***COPY   44 OUTPUT MEAN   1 1 12.1              WDM    104 FLOW     ENGL      REPL
***RCHRES  51 HYDR   RO      1 1                 WDM    139 FLOW     ENGL      REPL
*** DETENTION STAGES
***RCHRES  47 HYDR   STAGE                       WDM    652 STAG     ENGL      REPL
***RCHRES 147 HYDR   STAGE                       WDM    657 STAG     ENGL      REPL
***RCHRES 247 HYDR   STAGE                       WDM    654 STAG     ENGL      REPL
***RCHRES 552 HYDR   STAGE                       WDM    601 STAG     ENGL      REPL
***RCHRES  57 HYDR   STAGE                       WDM    651 STAG     ENGL      REPL
***RCHRES 257 HYDR   STAGE                       WDM    655 STAG     ENGL      REPL
***RCHRES 237 HYDR   STAGE                       WDM    656 STAG     ENGL      REPL
***RCHRES  37 HYDR   STAGE                       WDM    650 STAG     ENGL      REPL
***RCHRES  54 HYDR   STAGE                       WDM     61 STAG     ENGL      REPL
***RCHRES 451 HYDR   STAGE                       WDM    662 STAG     ENGL      REPL
***RCHRES 452 HYDR   STAGE                       WDM    667 STAG     ENGL      REPL
***RCHRES  46 HYDR   STAGE                       WDM    663 STAG     ENGL      REPL
***RCHRES  43 HYDR   STAGE                       WDM    664 STAG     ENGL      REPL
***RCHRES  44 HYDR   STAGE                       WDM    665 STAG     ENGL      REPL
***RCHRES  51 HYDR   STAGE                       WDM    666 STAG     ENGL      REPL
*** DETENTION VOLUMES
```

```
***RCHRES  47 HYDR   VOL                            WDM    752 VOL     ENGL     REPL
***RCHRES 147 HYDR   VOL                            WDM    757 VOL     ENGL     REPL
***RCHRES 247 HYDR   VOL                            WDM    754 VOL     ENGL     REPL
***RCHRES 552 HYDR   VOL                            WDM    602 VOL     ENGL     REPL
***RCHRES  57 HYDR   VOL                            WDM    751 VOL     ENGL     REPL
***RCHRES 257 HYDR   VOL                            WDM    755 VOL     ENGL     REPL
***RCHRES 237 HYDR   VOL                            WDM    756 VOL     ENGL     REPL
***RCHRES  37 HYDR   VOL                            WDM    750 VOL     ENGL     REPL
***RCHRES  54 HYDR   VOL                            WDM     62 VOL     ENGL     REPL
***RCHRES 451 HYDR   VOL                            WDM    762 VOL     ENGL     REPL
***RCHRES 452 HYDR   VOL                            WDM    767 VOL     ENGL     REPL
***RCHRES  46 HYDR   VOL                            WDM    763 VOL     ENGL     REPL
***RCHRES  43 HYDR   VOL                            WDM    764 VOL     ENGL     REPL
***RCHRES  44 HYDR   VOL                            WDM    765 VOL     ENGL     REPL
***RCHRES  51 HYDR   VOL                            WDM    766 VOL     ENGL     REPL
*** POINT OF COMPLIANCE (POC)FLOWS
***COPY     37 OUTPUT MEAN    1 1 12.1              WDM    125 FLOW    ENGL     REPL
***COPY     45 OUTPUT MEAN    1 1 12.1              WDM    199 FLOW    ENGL     REPL
***COPY     53 OUTPUT MEAN    1 1 12.1              WDM    399 FLOW    ENGL     REPL
***COPY     70 OUTPUT MEAN    1 1 12.1              WDM   7000 FLOW    ENGL     REPL
***COPY     71 OUTPUT MEAN    1 1 12.1              WDM   7001 FLOW    ENGL     REPL
*** SPECIAL PERLND REINFILTRATION RESULTS
  ***  --> output special PERLND parameters to check operations:
  ***  --> PERLND 47 active ground water storage depth (in)
*** PERLND  47 PWATER AGWS                          WDM    471 AGWS    ENGL
REPL
  ***  --> PERLND 47 active ground water outflow (acft/2ac -> in/acre)
***COPY     47 OUTPUT MEAN    1 1 12                WDM    472 FLOW    ENGL     REPL
  ***  --> PERLND 57 active ground water storage depth (in)
***PERLND   57 PWATER AGWS                          WDM    571 AGWS    ENGL     REPL
  ***  --> PERLND 57 active ground water outflow (acft/2ac -> in/acre)
***COPY     57 OUTPUT MEAN    1 1 12                WDM    572 FLOW    ENGL     REPL

END EXT TARGETS

SCHEMATIC
<-Source->                  <--Area-->    <-Target->   MBLK    ***
<Name>   #                  <-factor->    <Name>   #   Tbl#    ***
  *** SUB-CATCHMENT 1 all agwo goes to sound
PERLND  16                        3.41    RCHRES   1      6
PERLND  26                      232.36    RCHRES   1      6
PERLND  34                        3.07    RCHRES   1      6
PERLND  44                       38.03    RCHRES   1      6
PERLND  54                        3.87    RCHRES   1      6
IMPLND  14                       56.14    RCHRES   1      2
 *** SUB-CATCHMENT 2 10% of area GW goes to vaca 90% goes to sound
PERLND  16                        5.56    RCHRES   2      6
PERLND  26                      200.05    RCHRES   2      6
PERLND  34                        0.46    RCHRES   2      6
PERLND  44                       38.71    RCHRES   2      6
PERLND  16                        0.56    RCHRES 135      7
PERLND  26                       20.00    RCHRES 135      7
PERLND  34                        0.05    RCHRES 135      7
PERLND  44                        3.87    RCHRES 135      7
IMPLND  14                       42.22    RCHRES   2      2
 *** SUB-CATCHMENT 23 New subbasin 15 % OF GW GOES TO VACCA 85% TO SOUND
PERLND  16                        3.09    RCHRES  23      6
```

```
PERLND  26                    156.15      RCHRES  23        6
PERLND  34                      2.25      RCHRES  23        6
PERLND  44                     45.84      RCHRES  23        6
PERLND  16                      0.46      RCHRES 135        7
PERLND  26                     23.42      RCHRES 135        7
PERLND  34                      0.34      RCHRES 135        7
PERLND  44                      6.88      RCHRES 135        7
IMPLND  14                     58.44      RCHRES  23        2
 *** SUB-CATCHMENT 24 New subbasin 60 % OF GW GOES TO 11 40% TO SOUND
PERLND  26                    135.43      RCHRES  24        6
PERLND  34                      2.02      RCHRES  24        6
PERLND  44                     69.29      RCHRES  24        6
PERLND  26                     81.26      RCHRES  11        7
PERLND  34                      1.21      RCHRES  11        7
PERLND  44                     41.57      RCHRES  11        7
IMPLND  14                     79.98      RCHRES  24        2
  *** SUB-CATCHMENT 3 agwo goes to vaca(135)
PERLND  16                      8.26      RCHRES   3        6
PERLND  26                    108.38      RCHRES   3        6
PERLND  34                     16.02      RCHRES   3        6
PERLND  44                    102.89      RCHRES   3        6
PERLND  54                      0.04      RCHRES   3        6
PERLND  16                      8.26      RCHRES 135        7
PERLND  26                    108.38      RCHRES 135        7
PERLND  34                     16.02      RCHRES 135        7
PERLND  44                    102.89      RCHRES 135        7
PERLND  54                      0.04      RCHRES 135        7
IMPLND  14                     27.30      RCHRES   3        2
  *** SUB-CATCHMENT 4 10% of agwo goes to rchres 90% goes to sound
PERLND  16                      2.95      RCHRES   4        6
PERLND  26                     85.95      RCHRES   4        6
PERLND  34                      3.75      RCHRES   4        6
PERLND  44                     92.06      RCHRES   4        6
PERLND  16                      0.30      RCHRES   4        7
PERLND  26                      8.59      RCHRES   4        7
PERLND  34                      0.38      RCHRES   4        7
PERLND  44                      9.21      RCHRES   4        7
IMPLND  14                     18.43      RCHRES   4        2
  *** SUB-CATCHMENT 4a 70% of agwo goes to rchres 30% goes to sound
PERLND  16                      8.66      RCHRES   4        6
PERLND  26                     61.64      RCHRES   4        6
PERLND  34                     22.06      RCHRES   4        6
PERLND  44                     78.09      RCHRES   4        6
PERLND  54                     12.50      RCHRES   4        6
PERLND  16                      6.06      RCHRES   4        7
PERLND  26                     43.15      RCHRES   4        7
PERLND  34                     15.44      RCHRES   4        7
PERLND  44                     54.66      RCHRES   4        7
PERLND  54                      8.75      RCHRES   4        7
IMPLND  14                     29.14      RCHRES   4        2
  *** SUB-CATCHMENT 5
PERLND  26                     10.29      RCHRES   5        1
PERLND  44                     50.05      RCHRES   5        1
PERLND  54                     10.74      RCHRES   5        1
IMPLND  14                     16.31      RCHRES   5        2
  *** SUB-CATCHMENT 6
PERLND  16                      1.42      COPY    645      26
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PERLND  26                              20.38     COPY    645       26
PERLND  34                              13.44     COPY    645       26
PERLND  44                              11.79     COPY    645       26
PERLND  54                               0.82     COPY    645       26
PERLND  16                               1.42     RCHRES   53        7
PERLND  26                              20.38     RCHRES   53        7
PERLND  34                              13.44     RCHRES   53        7
PERLND  44                              11.79     RCHRES   53        7
PERLND  54                               0.82     RCHRES   53        7
IMPLND  14                               6.23     COPY    645       22
  *** SUB-CATCHMENT 8
PERLND  44                              22.21     RCHRES   35        1
IMPLND  14                               6.60     RCHRES   35        2
  *** SUB-CATCHMENT 9
PERLND  16                               4.98     RCHRES   34        1
PERLND  26                              14.38     RCHRES   34        1
PERLND  34                               0.05     RCHRES   34        1
PERLND  44                              56.71     RCHRES   34        1
PERLND  54                               0.01     RCHRES   34        1
IMPLND  14                              22.47     RCHRES   34        2
  *** SUB-CATCHMENT 10
PERLND  16                               4.15     RCHRES   10        1
PERLND  26                              31.94     RCHRES   10        1
PERLND  44                              95.22     RCHRES   10        1
IMPLND  14                              71.98     RCHRES   10        2
  *** SUB-CATCHMENT 11 25% OF AGWO GOES TO 15
PERLND  16                               0.89     RCHRES   11        6
PERLND  26                             217.92     RCHRES   11        6
PERLND  34                               1.32     RCHRES   11        6
PERLND  44                              65.65     RCHRES   11        6
PERLND  16                               0.67     RCHRES   11        7
PERLND  26                             163.44     RCHRES   11        7
PERLND  34                               0.99     RCHRES   11        7
PERLND  44                              49.24     RCHRES   11        7
PERLND  16                               0.22     RCHRES   15        7
PERLND  26                              54.48     RCHRES   15        7
PERLND  34                               0.33     RCHRES   15        7
PERLND  44                              16.41     RCHRES   15        7
IMPLND  14                             230.80     RCHRES   11        2
  *** SUB-CATCHMENT 12
PERLND  16                               0.39     RCHRES   12        1
PERLND  26                             101.18     RCHRES   12        1
PERLND  34                               5.64     RCHRES   12        1
PERLND  44                              54.98     RCHRES   12        1
PERLND  54                               0.64     RCHRES   12        1
IMPLND  14                              79.83     RCHRES   12        2
  *** SUB-CATCHMENT 13
PERLND  16                               0.79     RCHRES   13        1
PERLND  26                             197.68     RCHRES   13        1
IMPLND  14                              27.66     RCHRES   13        2
  *** SUB-CATCHMENT 14 50% OF AGWO GOES TO SOUND
PERLND  16                               0.24     RCHRES   14        6
PERLND  26                             118.67     RCHRES   14        6
PERLND  34                              13.46     RCHRES   14        6
PERLND  44                              41.91     RCHRES   14        6
PERLND  16                               0.12     RCHRES   14        7
PERLND  26                              59.34     RCHRES   14        7
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PERLND  34                    6.73     RCHRES  14       7
PERLND  44                   20.95     RCHRES  14       7
IMPLND  14                   20.66     RCHRES  14       2
  *** SUB-CATCHMENT 15
PERLND  16                    6.59     RCHRES  15       1
PERLND  26                   49.55     RCHRES  15       1
PERLND  34                   50.09     RCHRES  15       1
PERLND  44                   86.52     RCHRES  15       1
IMPLND  14                   19.47     RCHRES  15       2
  *** SUB-CATCHMENT 16
PERLND  16                   10.93     RCHRES  16       1
PERLND  26                   29.93     RCHRES  16       1
PERLND  34                   20.03     RCHRES  16       1
PERLND  44                   31.83     RCHRES  16       1
IMPLND  14                   15.58     RCHRES  16       2
  *** SUB-CATCHMENT 17 AGWO GOES TO SOUND
PERLND  16                    0.90     RCHRES  17       6
PERLND  26                   16.31     RCHRES  17       6
PERLND  34                   34.82     RCHRES  17       6
PERLND  44                   82.11     RCHRES  17       6
PERLND  54                    2.19     RCHRES  17       6
IMPLND  14                   10.49     RCHRES  17       2
  *** SUB-CATCHMENT MC-1
PERLND  26                    0.14     RCHRES  52       1
PERLND  44                    9.44     RCHRES  52       1
PERLND  45                    0.14     RCHRES  52       1
PERLND  54                    0.27     RCHRES  52       1
IMPLND  14                    1.98     RCHRES  52       2
  *** SUB-CATCHMENT MC-2
PERLND  16                    0.08     RCHRES  53       1
PERLND  26                    0.53     RCHRES  53       1
PERLND  34                    3.60     RCHRES  53       1
PERLND  44                    9.20     RCHRES  53       1
PERLND  45                    2.22     RCHRES  53       1
PERLND  54                   15.14     RCHRES  53       1
IMPLND  14                    2.54     RCHRES  53       2
  *** SUB-CATCHMENT MC-3
PERLND  34                    3.70     RCHRES  54       1
PERLND  44                    4.91     RCHRES  54       1
PERLND  45                    1.07     RCHRES  54       1
PERLND  54                    1.84     RCHRES  54       1
IMPLND  14                    1.42     RCHRES  54       2
  *** SUB-CATCHMENT MC-4
PERLND  34                    0.27     RCHRES 135       1
PERLND  44                   16.51     RCHRES 135       1
PERLND  45                    4.23     RCHRES 135       1
PERLND  54                   11.98     RCHRES 135       1
IMPLND  14                    3.31     RCHRES 135       2
  *** SUB-CATCHMENT MC-5
PERLND  26                   13.43     RCHRES  35       1
PERLND  44                   33.84     RCHRES  35       1
PERLND  54                    7.44     RCHRES  35       1
IMPLND  14                    0.02     RCHRES  35       2
  *** SUB-CATCHMENT MC-6
  ***  --> reduce by 2 acres to make special PERLND 47 for SDW1A
***PERLND  44                     14.10     RCHRES  35       1
PERLND  44                   12.10     RCHRES  35       1
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PERLND  45                              0.09     RCHRES  35        1
PERLND  54                              0.90     RCHRES  35        1
IMPLND  14                              0.26     RCHRES  35        2
  ***  --> add 2 acres from special PERLND 47 for SDW1A
PERLND  47                              2.00     RCHRES  35        1
  ***  --> output outflow from special PERLND 47 (acft/ac)
PERLND  47                              1.00     COPY     47      21

  *** SUB-CATCHMENT MC-7
  ***  --> reduce by 2 acres to make special PERLND 57 for SDW1B
PERLND  26                             11.26     COPY     55      21
  ***  --> reduce by 2 acres to make special PERLND 57 for SDW1B
***PERLND  44                              31.80     COPY     55      21
  ***  --> add 2 acres from special PERLND 57 for SDW1B
PERLND  57                              2.00     COPY     55      21
  ***  --> output outflow from special PERLND 57 (acft/ac)
PERLND  57                              1.00     COPY     57      21
PERLND  44                             29.80     COPY     55      21
PERLND  54                              3.20     COPY     55      21
IMPLND  14                              0.03     COPY     55      22

***note: SDN AGWO TO VACCA FARMS (135)NOT TO PONDS

  *** SUB-CATCHMENT SDN-1
PERLND  26                              1.97     RCHRES 552        6
PERLND  44                              1.29     RCHRES 552        6
PERLND  54                              0.20     RCHRES 552        6
PERLND  26                              1.97     RCHRES 135        7
PERLND  44                              1.29     RCHRES 135        7
PERLND  54                              0.20     RCHRES 135        7
IMPLND  14                             12.68     RCHRES 552        2

  *** SUB-CATCHMENT SDN-1-LWR
PERLND  44                              4.79     RCHRES 552        6
PERLND  54                              0.07     RCHRES 552        6
PERLND  44                              4.79     RCHRES 135        7
PERLND  54                              0.07     RCHRES 135        7
IMPLND  14                              0.56     RCHRES 552        2

  *** SUB-CATCHMENT SDN-1-OFF
PERLND  26                             23.01     RCHRES  52        6
PERLND  44                              3.58     RCHRES  52        6
PERLND  54                              1.67     RCHRES  52        6
PERLND  26                             23.01     RCHRES 135        7
PERLND  44                              3.58     RCHRES 135        7
PERLND  54                              1.67     RCHRES 135        7
IMPLND  14                              8.00     RCHRES  52        2

  *** SUB-CATCHMENT SDN-2X (TO POND)
PERLND  26                              0.63     COPY     61      26
PERLND  44                              2.40     COPY     61      26
PERLND  45                              0.86     COPY     61      26
PERLND  26                              0.63     RCHRES 135        7
PERLND  44                              2.40     RCHRES 135        7
PERLND  45                              0.86     RCHRES 135        7
IMPLND  14                              0.36     COPY     61      22
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  *** SUB-CATCHMENT SDN-3 (TO POND)
PERLND  26                          23.56     RCHRES  43      6
PERLND  26                          23.56     RCHRES 135      7
IMPLND  14                          24.30     RCHRES  43      2

  *** SUB-CATCHMENT SDN-3X (TO POND)
PERLND  26                           1.61     RCHRES  43      6
***original PERLND area
***PERLND  45                          23.77     RCHRES  43      6
***PERLND AREA TO BE REMOVED = 0.29 AC
PERLND  45                          23.48     RCHRES  43      6
PERLND  80                           0.29     RCHRES 135      7
PERLND  26                           1.61     RCHRES 135      7
PERLND  45                          23.48     RCHRES 135      7

  *** SUB-CATCHMENT SDN-4 (TO POND)
PERLND  26                          15.75     COPY    44     26
PERLND  44                           1.31     COPY    44     26
PERLND  45                           0.99     COPY    44     26
PERLND  26                          15.75     RCHRES 135      7
PERLND  44                           1.31     RCHRES 135      7
PERLND  45                           0.99     RCHRES 135      7
IMPLND  14                          12.26     COPY    44     22

  *** SUB-CATCHMENT SDN-4X (TO POND)
PERLND  26                           1.92     COPY    44     26
PERLND  44                           0.75     COPY    44     26
PERLND  45                           8.31     COPY    44     26
PERLND  26                           1.92     RCHRES 135      7
PERLND  44                           0.75     RCHRES 135      7
PERLND  45                           8.31     RCHRES 135      7
IMPLND  14                           4.21     COPY    44     22

  *** SUB-CATCHMENT IWS-NCPS (TO POND)
PERLND  26                           4.78     RCHRES 242      6
PERLND  26                           4.78     RCHRES 135      7
IMPLND  14                          30.93     RCHRES 242      2

  *** SUB-CATCHMENT IWS-NSMPS (TO POND)
PERLND  26                           2.69     RCHRES 240      6
PERLND  44                           1.97     RCHRES 240      6
PERLND  45                           0.01     RCHRES 240      6
PERLND  26                           2.69     RCHRES 135      7
PERLND  44                           1.97     RCHRES 135      7
PERLND  45                           0.01     RCHRES 135      7
IMPLND  14                           1.95     RCHRES 240      2

  *** SUB-CATCHMENT NEPL (TO POND)
PERLND  26                          10.00     RCHRES 452      6
PERLND  26                          10.00     RCHRES 135      7
IMPLND  14                           6.00     RCHRES 451      2
IMPLND  14                          26.29     RCHRES 452      2

  *** SUB-CATCHMENT CARGO (TO POND)
IMPLND  14                           8.12     RCHRES  46      2

  *** SUB-CATCHMENT SDN3AI (TO VAULT)
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***original IMPLND area
***IMPLND  14                       5.87     RCHRES  37        2
***IMPLND AREA TO BE REMOVED = 5.69 AC
IMPLND  14                        0.18     RCHRES  37      2
PERLND  80                        5.69     RCHRES 135      7

  *** SUB-CATCHMENT SDN3AO (TO POND)
PERLND  26                        0.08     RCHRES 237      6
PERLND  44                        0.03     RCHRES 237      6
***original PERLND area
***PERLND  45                      22.12     RCHRES 237        6
***PERLND AREA TO BE REMOVED = 11.16 AC
***PERLND AREA TO BE REMOVED = 4.56 AC
PERLND  45                        6.40     RCHRES 237      6
PERLND  80                       11.16     RCHRES 135      7
PERLND  80                        4.56     RCHRES 135      7
PERLND  26                        0.08     RCHRES 135      7
PERLND  44                        0.03     RCHRES 135      7
PERLND  45                        6.40     RCHRES 135      7
***original IMPLND area
***IMPLND  14                       2.35     RCHRES 237        2
***IMPLND AREA TO BE REMOVED = 2.19 AC
IMPLND  14                        0.16     RCHRES 237      2
PERLND  80                        2.19     RCHRES 135      7

  *** SUB-CATCHMENT SDW1AO (TO POND)
***original PERLND area
***PERLND  26                       4.28     RCHRES 247        6
***PERLND AREA TO BE REMOVED = 0.67 AC
PERLND  26                        3.61     RCHRES 247      6
PERLND  80                        0.67     RCHRES 135      7
PERLND  44                        0.69     RCHRES 247      6
***original PERLND area
***PERLND  45                      32.44     RCHRES 247        6
***PERLND AREA TO BE REMOVED = 18.06 AC
***PERLND AREA TO BE REMOVED = 0.60 AC
PERLND  45                       13.78     RCHRES 247      6
PERLND  80                       18.06     RCHRES 135      7
PERLND  80                        0.60     RCHRES 135      7
PERLND  26                        3.61     RCHRES 135      7
PERLND  44                        0.69     RCHRES 135      7
PERLND  45                       13.78     RCHRES 135      7
***original IMPLND area
***IMPLND  14                       1.64     RCHRES 247        2
***IMPLND AREA TO BE REMOVED = 0.93 AC
IMPLND  14                        0.71     RCHRES 247      2
PERLND  80                        0.93     RCHRES 135      7
  *** PERVIOUS AREA FOR 1AI IS IN 1AO
  *** SUB-CATCHMENT SDN1AI (TO VAULT)
***original IMPLND area
***IMPLND  14                      13.78     RCHRES 147        2
***IMPLND AREA TO BE REMOVED = 13.07 AC
IMPLND  14                        0.71     RCHRES 147      2
PERLND  80                       13.07     RCHRES  35      7
  *** CONTAINS BOTH I AND O
  *** SUB-CATCHMENT SDW1B (TO POND)
  *** AGWO TO 35, AS 57 IS D/S OF VACCA FARMS (135)
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***original PERLND area
***PERLND  26                          21.25     RCHRES 570       6
***PERLND AREA TO BE REMOVED = 0.54 AC
PERLND  26                          20.71     RCHRES 570      6
PERLND  80                           0.54     RCHRES  35      7
PERLND  44                           2.39     RCHRES 570      6
***original PERLND area
***PERLND  45                          46.26     RCHRES 570       6
***PERLND AREA TO BE REMOVED = 34.71 AC
***PERLND AREA TO BE REMOVED =  1.34 AC
PERLND  45                          10.21     RCHRES 570      6
PERLND  80                          34.71     RCHRES  35      7
PERLND  80                           1.34     RCHRES  35      7
PERLND  26                          20.71     RCHRES  35      7
PERLND  44                           2.39     RCHRES  35      7
PERLND  45                          10.21     RCHRES  35      7
***original IMPLND area
***IMPLND  14                          26.95     RCHRES 570       2
***IMPLND AREA TO BE REMOVED = 20.79 AC
***IMPLND AREA TO BE REMOVED =  1.62 AC
IMPLND  14                           4.54     RCHRES 570      2
PERLND  80                          20.79     RCHRES  35      7
PERLND  80                           1.62     RCHRES  35      7

  *** ADD SUB-CATCHMENT IWS-PRIMARY TO PREDEVELOPEMENT ONLY

***ROUTING FOR MILLER CREEK
 *** M1 TO M2 TO M3 TO STORAGE 50.  M4 TO M5 TO STORAGE 50
RCHRES   1                                RCHRES   2      4
RCHRES  23                                RCHRES  24      4
RCHRES  24                                RCHRES   3      3
RCHRES   2                                RCHRES   3      3
RCHRES   3                                RCHRES  33      3
RCHRES  33                                RCHRES  50      3
RCHRES   4                                RCHRES   5      4
RCHRES   5                                RCHRES  50      3
 *** PONDS TO 52, 53 & 54
RCHRES 242                                RCHRES 240      5
 *** OVERFLOW ONLY TO 61
RCHRES 240                                RCHRES  51      5
COPY    61                                RCHRES  51     12
COPY    44                                RCHRES  51     12
RCHRES  51                                RCHRES  52      3
RCHRES  43                                RCHRES  54      3
 *** 2 NEPL VAULTS* (FK-Changed to eliminate run-of-river tables)
RCHRES 451                                COPY    45     11
RCHRES 452                                COPY    45     11
COPY    45                                COPY   645     10
COPY   645                                RCHRES  53     12
RCHRES  46                                RCHRES  53      3
 *** NEW STREAM REACH 52 TO LAKE REBA 53 TO RDF 54 (FK-changed to insert new POC
at Lake Reba)
RCHRES 552                                RCHRES  52      3
RCHRES  52                                RCHRES  53      3
RCHRES  53                                COPY    53     11
COPY    53                                RCHRES  54     12
RCHRES  50                                RCHRES  54      3
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 *** RDF 54 TO 35
RCHRES  54                                         RCHRES 135      3
<-Source->                      <--Area-->         <-Target->    MBLK    ***
<Name>   #                      <-factor->         <Name>   #    Tbl#    ***
 *** PONDS TO 34
RCHRES  37                                         COPY     37     11
RCHRES 237                                         COPY     37     11
COPY    37                                         RCHRES 135      12
 *** SDW1A flow to bypass added (FK, June 2001)
SDW1AI VAULT FLOW TO INFILTRATION 1                                      ***
RCHRES 147                                         RCHRES  47       4
SDW1AI VAULT FLOW TO BYPASS                                              ***
RCHRES 147                                         COPY     70     15
STORMWATER Q 1ST EXIT AT POND G (Bypass)                                 ***
RCHRES 247                                         COPY     70     14
RCHRES 247                                         COPY     66     14
RCHRES 247                                         COPY     69     15
2ND EXIT TO INFILTRATION TANK-MILLER CREEK                               ***
RCHRES 247                                         RCHRES  47       5
STORMWATER Q 1ST EXIT TO BYPASS                                          ***
RCHRES  47                                         COPY     70     14
*** 2ND EXIT TO SOIL AND MILLER CREEK (2nd exit intr. as AGWLI)***
*** RCHRES  47                                         COPY    70      15
COPY BLOCK FOR OUTPUT PURPOSES                                           ***
RCHRES  47                                         COPY     62     14
RCHRES  47                                         COPY     63     15
RCHRES 147                                         COPY     67     14
RCHRES 147                                         COPY     68     15
COPY    70                                         RCHRES 135      12
RCHRES  34                                         RCHRES 135       4
RCHRES  34                                         RCHRES 135       5
RCHRES 135                                         RCHRES  35       3
RCHRES  10                                         RCHRES  16       3
 *** PONDS TO 35
 *** Configuration changed to flow splitter to Pond D and Infiltration Basin 3
(FK, June 2001)
STORM Q - 1ST EXIT OF FLOW SPLITTER TO POND D                            ***
RCHRES 570                                         RCHRES  57       4
***INFILTRATION Q - 2ND EXIT OF FLOW SPLITTER TO SOIL                    ***
*** RCHRES 570                                         RCHRES 257        5
STORM Q EXIT OF POND D TO MILLER CREEK                               ***
RCHRES  57                                         COPY     71     11
COPY BLOCK FOR OUTPUT PURPOSES                                           ***
RCHRES 570                                         COPY     64     14
RCHRES 570                                         COPY     65     15
RCHRES  57                                         COPY    357     11
RCHRES 257                                         COPY     56     14
RCHRES 257                                         COPY     71     14
RCHRES 257                                         COPY     71     15
COPY    71                                         RCHRES  35      12
RCHRES  35                                         COPY     55     11
COPY    55                                         RCHRES  16      12
RCHRES  11                                         RCHRES  15       3
RCHRES  13                                         RCHRES  12       4
RCHRES  13                                         RCHRES  12       5
RCHRES  12                                         RCHRES  15       3
RCHRES  16                                         RCHRES  15       3
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RCHRES  14                                   RCHRES  17       3
RCHRES  15                                   RCHRES  17       3
END SCHEMATIC

NETWORK
***         <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>       <-MEMBER->
<NAME>   # <NAME>    TEM STRG<-FACTOR->STRG <NAME>    #    # <-GRP> <NAME> # # ***
END NETWORK
                                                                            ***
RCHRES
  GEN-INFO
    RCHRES          Name          Nexits   Unit Systems   Printer              ***
    # -   #<------------------><---> User T-series  Engl Metr LKFG            ***
                                                in  out                        ***
    1     Arbor Lake  M 1          2     1     1    1    62     0     0
    2     Arbor Ck -03710 M 2      1     1     1    1    62     0     0
    3     Arbor Ck    M 3          1     1     1    1    62     0     0
    4     Tub Lake    M 4          2     1     1    1    62     0     0
    5     Miller Ck SR518 M5       1     1     1    1    62     0     0
   10     Trib (0371G)    M 10     1     1     1    1    62     0     0
   11     M11 Ambaum Detention     1     1     1    1    62     0     0
   12     Trib(0354)  M 12         1     1     1    1    62     0     0
   13     Burien Lake M 13         2     1     1    1    62     0     0
   14     Trib (0353) M 14         1     1     1    1    62     0     0
   15     M/S U/S OF 17            1     1     1    1    62     0     0
   16     U/S OF 15 M/S            1     1     1    1    62     0     0
   17     GAGE                     1     1     1    1    62     0     0
   23     BASIN M23                2     1     1    1    62     0     0
   24     BASIN M24                1     1     1    1    62     0     0
   33     detention m3             1     1     1    1    62     0     0
   34     LORA LAKE                2     1     1    1    62     0     0
   35     D/S OF VACA FARM         1     1     1    1    62     0     0
   37     sdn3ai vault             1     1     1    1    62     0     0
   38     MC basins                1     1     1    1    62     0     0
***   39     SDN3A/SDW1A POC          1     1     1    1    62     0     0
   43     sdn3 pond                1     1     1    1    62     0     0
***   44     sdn4 pond                1     1     1    1    62     0     0
***   45     nepl poc                 1     1     1    1    62     0     0
   46     cargo pond               1     1     1    1    62     0     0
   47     sdw1a infiltration       2     1     1    1    62     0     0
   50     sr 518                   1     1     1    1    62     0     0
   51     SDN2X+SDN4X              1     1     1    1    62     0     0
   52     U/S OF LAKE REBA         1     1     1    1    62     0     0
   53     Reba outflow             1     1     1    1    62     0     0
   54     Miller RDF outflow       1     1     1    1    62     0     0
   57     sdw1b pond               1     1     1    1    62     0     0
  135     VACA FARMS               1     1     1    1    62     0     0
  147     sdw1a vault              2     1     1    1    62     0     0
  237     sdn3ao-pond c            1     1     1    1    62     0     0
  240     iws-ncps                 2     1     1    1    62     0     0
  242     iws-nsmps                2     1     1    1    62     0     0
  247     sdw1a pond g             2     1     1    1    62     0     0
  257     sdw1b infiltration       2     1     1    1    62     0     0
  451     nepl VAULT               1     1     1    1    62     0     0
  452     nepl VAULT               1     1     1    1    62     0     0
  552     SDN1 POC                 1     1     1    1    62     0     0
  570     SDW1B flow splitter      2     1     1    1    62     0     0
```

```
*** 645     nepl POC                    1     1     1     1    62     0     0
 END GEN-INFO

 ACTIVITY
   RCHRES *************** Active Sections *****************               ***
   # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG
   1  999    1    0    0    0    0    0    0    0    0    0
 END ACTIVITY

 PRINT-INFO
   RCHRES *************** Printout Flags ***************** PIVL  PYR
   # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
   1  999    5    0    0    0    0    0    0    0    0    0    1    9
 END PRINT-INFO

 HYDR-PARM1                                                                  ***
   RCHRES  Flags for each HYDR Section
   # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each      FUNCT  for each
           FG FG FG FG  possible   exit  *** possible   exit      possible  exit
            *  *  *  *    *  *  *  *  *         *  *  *  *  *          ***
   1        0  1  0  0    4  5  0  0  0         0  0  0  0  0      2  2  2  2  2
   2        0  0  0  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
   3        0  0  0  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
   4        0  1  0  0    4  5  0  0  0         0  0  0  0  0      2  2  2  2  2
   5   12   0  0  0  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
  13        0  1  0  0    4  5  0  0  0         0  0  0  0  0      2  2  2  2  2
  14   22   0  0  0  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
  23        0  1  0  0    4  5  0  0  0         0  0  0  0  0      2  2  2  2  2
  24   33   0  0  0  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
  34        0  1  0  0    4  5  0  0  0         0  0  0  0  0      2  2  2  2  2
  35   46   0  1  0  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
  47        0  1  0  0    4  5  0  0  0         0  0  0  0  0      2  2  2  2  2
  48  146   0  1  0  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
 147        0  1  1  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
 148  239   0  1  1  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
 240  257   0  1  1  0    4  5  0  0  0         0  0  0  0  0      2  2  2  2  2
 258  552   0  1  0  0    4  0  0  0  0         0  0  0  0  0      2  2  2  2  2
 553  570   0  1  1  0    4  5  0  0  0         0  0  0  0  0      2  2  2  2  2
 END HYDR-PARM1

 HYDR-PARM2                                                                  ***
   RCHRES                                                                    ***
   # -  #     FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
 <------><--------><--------><--------><--------><--------><-------->        ***
   1              1     0.010                            0.3
   2              2     0.776                            0.3
   3              3     0.980                            0.3
   4              4     0.010                            0.3
   5              5     0.380                            0.3
  10             10     0.380                            0.3
  11             11     0.010                            0.3
  12             12     1.000                            0.3
  13             13     0.015                            0.3
  14             14     0.450                            0.3
  15             15     0.735                            0.3
  16             16     0.587                            0.3
  17             17     0.379                            0.3
```

```
  23             23   0.379                    0.0         0.3
  24             24   0.379                                0.3
  33             33   0.200                                0.3
  34             34   0.852                                0.3
  35             35   0.663                                0.3
  37             37   0.010                    0.0         0.3
  38             38   0.010                                0.3
  43             43   0.010                                0.3
  46             46   0.010                                0.3
  47             47   0.010                    0.0         0.3
  50             50   0.010                                0.3
  51             51   0.010                                0.3
  52             52   0.010                                0.3
  53             53   0.010                                0.3
  54             54   0.010                    0.0         0.3
  57             57   0.010                    0.0         0.3
 135            135   0.350                                0.3
 147            147   0.010                                0.3
 237            237   0.010                    0.0         0.3
 240            240   0.010                                0.3
 242            242   0.010                                0.3
 247            247   0.010                    0.0         0.3
 257            257   0.010                    0.0         0.3
 451            451   0.010                    0.0         0.3
 452            452   0.010                    0.0         0.3
 552            552   0.010                    0.0         0.3
 570            570   0.010                    0.0         0.3
END HYDR-PARM2

HYDR-INIT
  RCHRES  Initial conditions for each HYDR section                             ***
  # -  # ***   VOL     Initial  value  of COLIND    Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
<------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  1     2.0              4.0  5.0
  2     0.0              4.0
  3     0.0              4.0
  4     2.0              4.0  5.0
  5     0.0              4.0
 10     0.0              4.0
 11     0.0              4.0
 12     0.0              4.0
 13    10.0              4.0  5.0
 14     0.0              4.0
 15     0.0              4.0
 16     0.0              4.0
 17     0.0              4.0
 23     6.0              4.0  5.0
 24     0.0              4.0
 33     0.0              4.0
 34     9.0              4.0  5.0
 35     0.1              4.0
 37     0.0              4.0
 38     0.1              4.0
 43     0.0              4.0
 46     0.0              4.0
 47     0.0              4.0  5.0
```

```
   50     0.0               4.0
   51     0.0               4.0
   52     0.0               4.0
   53     0.1               4.0
   54     2.25              4.0
   57     0.0               4.0
  237     0.00              4.0
  147     0.00              4.0  5.0
  135     0.00              4.0
  240     0.0               4.0  5.0
  242     0.0               4.0  5.0
  247     0.0               4.0  5.0
  257     0.0               4.0  5.0
  451     0.0               4.0
  452     0.0               4.0
  552     0.0               4.0
  570     0.0               4.0  5.0
  END HYDR-INIT
END RCHRES

FTABLES
***UPPER BASIN
***===========

  FTABLE      1
          *** REVISED 8/16/00 ADDED 2ND OUTFLOW
 ROWS COLS ***
   11    5
    DEPTH      AREA    VOLUME    OUTFLOW OUTFLOW2***
    0.00       3.00     0.00       0.00     0.00
    2.50       3.00     7.50       0.00     0.11
    3.00       3.00     9.00       1.80     0.11
    3.50       3.30    10.58       5.00     0.11
    4.00       3.60    12.30      10.90     0.11
    4.50       3.90    14.18      17.50     0.11
    5.00       4.10    16.18      26.20     0.11
    5.50       4.30    18.28      32.50     0.11
    6.00       4.50    20.48      35.90     0.11
    7.00       5.00    25.23      38.10     0.11
    8.00       5.50    30.48      46.40     0.11
  END FTABLE  1

  FTABLE      2
 ROWS COLS ***
    9    4
    DEPTH      AREA    VOLUME    OUTFLOW    ***
    0.000    0.0000    0.0000       0.00
    0.100    0.2571    0.0129       0.16
    0.500    0.3873    0.1417       6.53
    1.000    0.5501    0.3761      25.95
    1.500    0.7128    0.6918      59.86
    2.000    0.8756    1.0889     110.67
    3.000    1.2011    2.1273     272.24
    3.500    1.3639    2.7685     387.38
    4.000    1.5266    3.4912     528.19
  END FTABLE  2
```

```
 FTABLE       3
ROWS COLS ***
  12    4
    DEPTH       AREA     VOLUME   OUTFLOW    ***
    0.000     0.0000     0.0000      0.00
    0.100     0.9669     0.0483      0.13
    0.500     1.0637     0.4545      4.92
    1.000     1.1846     1.0165     17.12
    1.500     1.3055     1.6390     34.92
    2.000     1.4264     2.3220     57.95
    2.500     1.5473     3.0654     86.14
    3.000     1.6682     3.8693    119.53
    3.500     1.7891     4.7336    158.24
    4.000     1.9100     5.6584    202.41
    4.500     2.0294     6.6310    251.52
    5.000     2.1488     7.6624    306.28
 END FTABLE  3

 FTABLE       4
          *** REVISED 8/16/00 ADDED 2ND OUTFLOW
ROWS COLS ***
   7    5
    DEPTH       AREA     VOLUME   OUTFLOW OUTFLOW2***
     0.00     3.00     0.00       0.00       0.00
     2.50     4.50     9.38       0.00       0.11
     3.00     6.00     12.00      6.00       0.11
     4.00     10.00    20.00      13.00      0.11
     5.00     15.00    32.50      20.00      0.11
     6.00     20.00    50.00      26.00      0.11
     7.00     25.00    72.50      168.00     0.11
 END FTABLE  4

 FTABLE       5
ROWS COLS ***
  10    4
    DEPTH       AREA     VOLUME   OUTFLOW    ***
    0.000     0.0000     0.0000      0.00
    0.100     0.1010     0.0051      0.03
    0.500     0.1754     0.0603      1.46
    1.000     0.2684     0.1713      6.16
    1.500     0.3614     0.3288     14.89
    2.000     0.4544     0.5327     28.48
    2.500     0.5474     0.7832     47.70
    3.000     0.6404     1.0801     73.29
    3.500     0.7334     1.4236    105.94
    4.000     0.8264     1.8136    146.33
 END FTABLE  5

 FTABLE      10
ROWS COLS ***
   9    4
    DEPTH       AREA     VOLUME   OUTFLOW    ***
    0.000     0.0000     0.0000      0.00
    0.100     0.1010     0.0051      0.06
    0.500     0.1660     0.0585      2.27
    1.000     0.2472     0.1618      9.32
    1.500     0.3285     0.3057     22.08
```

```
  2.000     0.4097     0.4902      41.66
  2.500     0.4909     0.7154      69.09
  3.000     0.5722     0.9811     105.37
  4.000     0.6887     1.6116     209.70
END FTABLE 10

POST AMBAUM DETENTION ***
FTABLE      11
ROWS COLS ***
 12    4
   DEPTH       AREA      VOLUME    OUTFLOW    ***
   0.000     0.0000     0.0000       0.00
   1.000     0.1000     0.2300       3.90
   2.000     0.2000     0.6000       6.30
   3.000     0.3000     0.9700       8.10
   4.000     0.4000     1.3400      11.10
   5.000     0.5000     1.8200      16.00
   6.000     0.6000     2.2700      19.10
   7.000     0.7000     2.8300      21.60
   8.000     0.8000     3.3700      30.80
   9.000     0.9000     4.0000      38.10
  10.000     1.0000     4.6500      74.10
  10.500     1.1000     5.2000     133.00
  11.000     1.1500     6.0000     500.00
  11.500     1.3000     11.000    1300.00
END FTABLE 11

FTABLE      12
ROWS COLS ***
  6    4
   DEPTH       AREA      VOLUME    OUTFLOW    ***
   0.000     0.0000     0.0000       0.00
   0.100     0.6327     0.0316       0.15
   0.500     0.7960     0.3174       5.87
   1.000     1.0002     0.7664      21.53
   1.500     1.2043     1.3176      46.43
   2.000     1.4085     1.9708      81.20
   3.000     1.8168     3.5834     183.79
   4.000     2.2251     5.6044     336.22
   5.000     2.6335     8.0337     545.30
   6.000     3.0418    10.8713     817.51
END FTABLE 12

FTABLE      13
          *** REVISED 8/16/00 ADDED 2ND OUTFLOW
ROWS COLS ***
  7    5
   DEPTH       AREA      VOLUME    OUTFLOW OUTFLOW2***
   0.000     40.000     0.0000       0.00      0.00
   1.000     41.400     40.000       0.00      0.11
   1.500     42.000     60.000      10.00      0.11
   2.000     42.700     80.000      16.00      0.11
   2.500     43.300     100.00      20.00      0.11
   3.000     44.000     120.00      28.00      0.11
   5.000     45.000     210.00      45.00      0.11
END FTABLE 13
```

```
 FTABLE     14
ROWS COLS ***
   6    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0000     0.0000       0.00
     0.100     0.3361     0.0168       0.24
     0.500     0.3809     0.1602       9.04
     1.000     0.4370     0.3647      31.61
     1.500     0.4930     0.5972      65.00
     2.000     0.5491     0.8577     108.85
     2.500     0.6051     1.1462     163.33
     3.000     0.6612     1.4628     228.78
 END FTABLE 14

 FTABLE     15
ROWS COLS ***
   4    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
      0.00       0.10       0.00       0.00
      1.00       1.00       0.55      91.00
      2.00       1.10       1.60     268.00
      3.00       1.20       2.75     493.00
 END FTABLE 15

 FTABLE     16
ROWS COLS ***
   4    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
      0.00       0.10       0.00       0.00
      1.00       1.00       0.55      74.00
      2.00       1.10       1.60     219.00
      3.00       1.20       2.75     403.00
 END FTABLE 16

 FTABLE     17
ROWS COLS ***
   5    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
      0.00       0.10       0.00       0.00
      1.00       1.00       0.55      59.00
      2.00       1.10       1.60     173.00
      3.00       1.20       2.75     318.00
      4.00       1.30       4.00     484.00
 END FTABLE 17

 FTABLE     23
ROWS COLS ***   HERMES
   9    5
     DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW    ***
      0.00       0.00       0.00       0.00    0.00            0.00
      5.00       0.50       1.91       0.00    0.00          305.00
     11.00       0.79       5.79       0.00    0.00          311.00
     15.00       1.13       9.64       0.50    0.01          315.00
     19.00       1.72      15.34       0.50    0.05          319.00
     29.00       2.86      38.25       0.50    0.10          329.00
     39.00       4.40      74.55       0.50    0.20          339.00
     50.00       6.22     132.98       0.50    0.30          350.00
```

```
   60.00    10.00   1212.98       0.50     0.40        360.00
 END FTABLE 23

 FTABLE     24
ROWS COLS ***
   9    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.2571     0.0129       0.16
    0.500     0.3873     0.1417       6.53
    1.000     0.5501     0.3761      25.95
    1.500     0.7128     0.6918      59.86
    2.000     0.8756     1.0889     110.67
    3.000     1.2011     2.1273     272.24
    3.500     1.3639     2.7685     387.38
    4.000     1.5266     3.4912     528.19
 END FTABLE 24

 FTABLE     33
ROWS COLS ***
  11    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.00       1.00       0.00       0.00
     0.50       1.20       0.55       2.00
     1.00       1.40       1.20       6.00
     1.50       1.60       1.95       9.00
     2.00       1.80       2.80      13.00
     2.50       2.00       3.75      16.50
     3.00       2.20       4.80      20.00
     3.50       2.40       5.95      23.00
     4.00       2.60       7.20      26.00
     5.00       2.80       9.90     104.00
     6.00       3.00      12.80     246.00
 END FTABLE 33

 FTABLE     34
ROWS COLS *** REVISED 11/19/97 BASED ON HEC-RAS MODEL
          *** REVISED 8/16/00 ADDED 2ND OUTFLOW
   6    5
    DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
     0.00       3.00       0.00       0.00      0.00
     3.00       3.05       9.08       0.00      0.11
     4.00       3.10      12.15       0.00      0.11
     5.00       3.15      15.28       0.00      0.11
     6.00       3.20      18.45       72.0      0.11
     7.00       3.25      21.68      225.0      0.11
 END FTABLE 34

 FTABLE     35
ROWS COLS *** REVISED 11/19/97 BASED ON HECRAS MODEL
   5    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.00       0.10       0.00       0.00
     1.00       1.10       0.60      38.00
     2.00       1.20       1.75     108.00
     3.00       1.30       3.00     194.00
     4.00       1.40       4.35     290.00
```

```
 END FTABLE 35


 FTABLE     38
ROWS COLS ***
   7    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    1.000     0.4000     0.4000       2.00
    1.500     0.5000     1.0000       4.00
    2.000     0.9000     1.3000      11.00
    2.500     1.3000     1.6000      15.00
    3.000     1.6000     2.0000      18.00
    3.500     1.9000     2.5000      20.80
 END FTABLE 38

 FTABLE     45
ROWS COLS ***
   4    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0010     0.0000       0.00
    0.000     0.0100     0.0100      10.00
    0.100     0.1000     0.1000     100.00
    1.000     1.0000     1.0000    1000.00
   10.000    10.0000    10.0000   10000.00
 END FTABLE 45

 FTABLE    645
ROWS COLS ***
   4    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0010     0.0000       0.00
    0.000     0.0100     0.0100      10.00
    0.100     0.1000     0.1000     100.00
    1.000     1.0000     1.0000    1000.00
   10.000    10.0000    10.0000   10000.00
 END FTABLE645

 FTABLE     50
ROWS COLS ***
  10    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.00       1.00       0.00       0.00
     0.50       1.10       0.53       5.00
     1.00       1.20       1.10      15.00
     1.50       1.30       1.73      25.00
     2.00       1.40       2.40      35.00
     2.50       1.50       3.13      52.00
     3.00       1.60       3.90      70.00
     3.50       1.70       4.73      87.00
     4.00       1.80       5.60     105.00
     6.00       1.90       9.30     165.00
 END FTABLE 50

 FTABLE     52
ROWS COLS ***
   6    4
```

```
    DEPTH        AREA      VOLUME    OUTFLOW   ***
    0.000      0.0000     0.0000       0.00
    0.100      0.3680     0.0184       0.25
    0.500      0.3717     0.1664       9.39
    1.000      0.3763     0.3534      31.06
    2.000      0.3819     0.7325      94.37
    3.000      0.3874     1.1171     174.33
 END FTABLE 52

 FTABLE     552
ROWS COLS ***  SDN1 VAULT EFFECTIVE DEPTH=12 FT  RISER=24 INCHES
  15    4
    DEPTH        AREA      VOLUME    OUTFLOW   ***
    0.000      0.4308     0.0000       0.00
    1.290      0.4308     0.6520      0.111
    2.130      0.4308     1.0760      0.143
    3.530      0.4308     1.7830      0.184
    4.640      0.4308     2.3430      0.211
    5.200      0.4308     2.6260      0.223
    6.320      0.4308     3.1920      0.246
    7.430      0.4308     3.7530      0.267
    8.200      0.4308     4.1410      0.280
    9.220      0.4308     4.6570      0.407
   10.190      0.4308     5.1460      0.567
   11.250      0.4308     5.6820      0.954
   12.100      0.4308     6.1110      2.130
   12.300      0.4308     6.2120      4.730
   13.700      0.4308     6.9190     21.360
 END FTABLE552

 FTABLE      53
OLD LAKE REBA                                 ***
MAX DEPTH = 4.9 FEET                          ***
30" CMP, 40 CFS DISCHARGE AT MAX DEPTH        ***
ROWS COLS ***
   7    4
    DEPTH        AREA      VOLUME    OUTFLOW   ***
    0.000      2.4000     0.0000       0.00
    1.000      2.5800     2.5000      18.00
    2.000      2.9400     5.3000      26.00
    3.000      3.4100     8.4000      31.00
    4.000      3.8800     12.100      36.00
    4.900      4.3000     15.800      40.00
    6.000      4.3000     15.810     500.00
 END FTABLE 53

 FTABLE      54
EXISTING MILLER CREEK DETENTION FACILITY*** REVISED STORAGE/Q DATA
GATE SETTING: 2.0 FEET***  BASED ON CALIBRATION FILE
ROWS COLS ***
  12    4
    DEPTH        AREA      VOLUME    OUTFLOW   ***
    0.000        0.00        0.00       0.00
    1.300        0.01        0.01      10.00
    2.000        0.01        0.02      20.00
    2.900        0.70        0.40      30.00
    4.000        1.50        1.50      40.00
```

```
     5.400       3.50       4.90      50.00
     7.000       8.60      13.30      60.00
     8.800      15.60      34.80      70.00
    10.000      19.90      57.30      76.00
    10.500      21.50      68.00      92.00
    11.000      23.10      78.80     179.00
    11.500      24.70      88.60     303.00
  END FTABLE 54

  FTABLE    104
 MILLER CREEK DETENTION FACILITY*** WITH ADD'L AREA 1+AREA 2 55.5 ACFT @ 10FT
 GATE SETTING: 2.0 FEET*** EXISTING OUTLET NO LOW FLOW CONTROL
 ROWS COLS ***
   17    4
     DEPTH      AREA     VOLUME    OUTFLOW    ***
     0.000    0.0000     0.0000       0.00
     0.500    0.0100     0.0100       2.50
     1.500    0.0300     0.2800      14.29
     2.500    1.1100     1.3900      24.88
     3.500    2.6100     4.0000      34.51
     4.500    4.6100     9.1400      43.20
     5.500    7.1200     19.600      50.98
     6.000    8.3600     21.180      54.53
     6.500    11.870     30.060      57.87
     7.000    15.370     38.930      61.00
     7.500    18.870     47.800      63.91
     8.000    21.860     59.160      66.62
     8.500    24.850     70.510      69.12
     9.000    27.340     84.160      71.42
     9.500    29.820     97.820      73.53
    10.000    32.050     112.83      75.44
    10.500    34.275     127.84      90.74
    11.500    38.220     161.54     320.00
  END FTABLE104

  FTABLE     69
 PRE-MILLER CREEK DETENTION FACILITY***
 ROWS COLS ***
   12    4
     DEPTH      AREA     VOLUME    OUTFLOW    ***
     0.000    0.0000     0.0000       0.00
     0.100    0.1860     0.0093       0.12
     0.500    0.2552     0.0975       4.84
     1.000    0.3417     0.2467      18.49
     1.500    0.4282     0.4392      41.30
     2.000    0.5148     0.6750      74.40
     2.500    0.6013     0.9540     119.01
     3.000    0.6878     1.2763     176.30
     3.500    0.7744     1.6418     247.41
     4.000    0.8609     2.0506     333.43
     4.500    0.9470     2.4992     434.59
     5.000    1.0331     2.9905     552.33
  END FTABLE 69

*** PROJECT CONDITION PONDS/VAULTS
  FTABLE    452
 ROWS COLS ***
```

*** NEW NORTH EMPLOYEE PARKING LOT VAULT (NEPL)
*** PARALLEL VAULT BASED ON KCRTS EFFECTIVE DEPTH=20 FT
20 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.00	3.214	0.000	0.000
1.11	3.214	0.826	0.129
1.57	3.214	1.168	0.154
3.43	3.214	2.551	0.227
4.83	3.214	3.593	0.269
8.08	3.214	6.010	0.348
10.41	3.214	7.743	0.395
12.74	3.214	9.476	0.437
14.00	3.214	10.413	0.458
14.65	3.214	10.897	0.557
16.09	3.214	11.968	0.665
16.23	3.214	12.072	0.754
17.92	3.214	13.329	1.140
18.22	3.214	13.552	1.310
18.81	3.214	13.991	1.860
19.11	3.214	14.214	2.190
20.00	3.214	14.876	3.350
20.20	3.214	15.025	5.110
20.70	32.14	15.397	14.820
21.00	32.14	15.620	18.560

END FTABLE452

FTABLE 451
ROWS COLS ***
*** NORTH EMPLOYEE PARKING LOT VAULT (NEPL)
*** EXISTING VAULT W/MODIFIED OUTLET EFFECTIVE DEPTH= 18.0 FT
14 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.2240	0.0000	0.00
2.170	0.2240	0.4860	0.031
4.260	0.2240	0.9550	0.043
5.930	0.2240	1.3290	0.051
8.030	0.2240	1.8000	0.059
10.120	0.2240	2.2680	0.066
12.210	0.2240	2.7360	0.073
14.040	0.2240	3.1460	0.109
15.510	0.2240	3.4760	0.166
16.220	0.2240	3.6350	0.295
18.000	0.2240	4.0340	1.080
18.400	0.2240	4.1240	5.400
19.000	0.2240	4.2580	12.680
19.900	0.2240	4.4600	17.080

END FTABLE451

FTABLE 46
ROWS COLS ***
SDN-6: 24TH STREET CARGO VAULT *** EFFECTIVE DEPTH=14 FT RISER DIA=12 IN
20 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.00	0.35	0.000	0.000
0.37	0.35	0.131	0.021
1.19	0.35	0.421	0.037

3.39	0.35	1.198	0.063
5.03	0.35	1.778	0.077
7.23	0.35	2.556	0.092
9.15	0.35	3.235	0.104
10.25	0.35	3.624	0.110
10.53	0.35	3.723	0.111
10.92	0.35	3.861	0.128
12.00	0.35	4.242	0.165
12.13	0.35	4.288	0.190
12.95	0.35	4.578	0.245
13.77	0.35	4.868	0.282
14.00	0.35	4.949	0.291
14.10	0.35	4.985	0.910
14.20	0.35	5.020	2.040
14.30	0.35	5.056	3.500
14.50	0.35	5.126	7.200
14.70	0.35	5.197	11.720

END FTABLE 46

*** SDW-1A: 3RD RUNWAY POND G TO MILLER CREEK (LEVEL 2): ***

FTABLE 47

*** PROJECT SDW1A EFFECTIVE DIAMETER=3.0 FT

ROWS COLS *** INFILTRATION TANK TO OBTAIN 0.3 CFS

14 5

DEPTH	AREA	VOLUME	STORMQ	INFILTRQ ***
0.000	0.000	0.000	0.000	0.000
0.250	0.002	0.002	0.000	0.027
0.500	0.004	0.004	0.000	0.054
1.000	0.012	0.012	0.000	0.109
1.500	0.020	0.020	0.000	0.164
2.000	0.029	0.029	0.000	0.218
2.500	0.036	0.036	0.000	0.272
3.000	0.041	0.0406	0.000	0.327
3.100	0.041	0.0419	0.596	0.338
3.200	0.041	0.0420	1.685	0.349
3.300	0.041	0.0421	3.096	0.360
3.400	0.041	0.0422	4.766	0.371
3.500	0.041	0.0423	6.661	0.382
3.750	0.041	0.0424	12.237	0.409

END FTABLE 47

*** SDW-1A: 3RD RUNWAY NORTH POND G TO MILLER CREEK (LEVEL 2): ***

FTABLE 147

*** PROJECT SDW1A EFFECTIVE DEPTH=14.0 FT RISER DIA 24 INCHES

ROWS COLS *** VAULT BASED ON INFILTRATION=0.15CFS

17 5

DEPTH	AREA	VOLUME	INFILTRQ	BYPASS Q***
0.000	0.689	0.000	0.0000	0.0000
0.010	0.689	0.007	0.1400	0.0000
1.000	0.689	0.689	0.1408	0.0000
2.000	0.689	1.377	0.1417	0.0000
4.000	0.689	2.755	0.1432	0.0000
6.000	0.689	4.132	0.1446	0.0000
8.000	0.689	5.510	0.1461	0.0000
10.000	0.689	6.887	0.1475	0.0000
12.000	0.689	8.264	0.1489	0.0000

14.000	0.689	9.642	0.1503	0.0000
16.000	0.689	11.019	0.1517	0.0000
16.750	0.689	11.536	0.1517	10.7600
16.900	0.689	11.639	0.1517	13.9600
17.000	0.689	11.708	0.1517	16.1000
17.100	0.689	11.777	0.1517	18.5700
17.300	0.689	11.915	0.1517	23.8600
18.000	0.689	12.397	0.1517	45.5400

END FTABLE147

*** SDW-1A: 3RD RUNWAY NORTH POND G TO MILLER CREEK (LEVEL 2): ***

FTABLE 247

*** PROJECT SDW1A EFFECTIVE DEPTH=12.0 FT RISER DIA 12 INCHES

ROWS COLS *** POND BASED ON INFILTRATION=0.15CFS

17 5

DEPTH	AREA	VOLUME	STORMQ	INFILTRQ ***
0.000	1.300	0.000	0.00	0.00
0.010	1.310	0.010	0.001	0.15
1.000	1.320	1.320	0.007	0.15
2.000	1.342	2.650	0.010	0.15
3.000	1.363	4.000	0.012	0.15
4.000	1.385	5.370	0.013	0.15
5.000	2.672	8.000	0.015	0.15
6.000	2.739	10.700	0.017	0.15
7.000	2.807	13.470	0.018	0.15
8.000	2.876	16.300	0.019	0.15
8.300	2.896	17.176	0.031	0.15
9.000	2.945	19.210	0.041	0.15
10.000	3.014	22.180	0.051	0.15
11.000	3.084	25.228	0.058	0.15
11.100	3.092	25.540	0.675	0.15
11.300	3.106	26.162	3.260	0.15
12.000	3.155	28.340	15.190	0.15

END FTABLE247

*** SDN3A: 3RD RUNWAY VAULT TO MILLER CREEK (LEVEL 2): ***

FTABLE 37

*** PROJECT C SDN3A EFFECTIVE DEPTH=11.0FT RISER DIA=24 INCHES

ROWS COLS *** VAULT BASED ON IMPERVIOUS TOP SURO

14 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.644	0.000	0.000
0.010	0.644	0.006	0.001
1.000	0.644	0.643	0.016
3.980	0.644	2.558	0.033
6.030	0.644	3.876	0.041
9.010	0.644	5.792	0.050
10.00	0.644	6.428	0.052
10.46	0.644	6.724	0.072
11.00	0.644	7.071	0.082
11.10	0.644	7.135	0.699
11.20	0.644	7.199	1.830
11.30	0.644	7.264	3.290
11.40	0.644	7.328	5.020
11.60	0.644	7.456	9.140

END FTABLE 37

*** SDN3A: 3RD RUNWAY POND C TO MILLER CREEK (LEVEL 2): ***

FTABLE 237

*** PROJECT C SDN3A EFFECTIVE DEPTH= 9.0FT RISER DIA=24 INCHES

ROWS COLS *** POND BASED ON INTERFLOW AND PERVIOUS TOP SURO

19 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	1.3090	0.000	0.00
0.020	1.3120	0.026	0.009
1.020	1.3550	1.358	0.070
2.070	1.4030	2.806	0.100
3.130	1.4530	4.320	0.123
4.020	1.4980	5.632	0.139
5.070	1.5460	7.229	0.156
7.750	1.6720	11.549	0.193
7.800	1.6800	11.633	0.199
7.850	1.6840	11.718	0.213
8.250	1.7050	12.395	0.249
8.340	1.7090	12.549	0.270
8.570	1.7210	12.944	0.313
8.950	1.7410	13.601	0.354
9.500	1.7690	14.567	0.399
9.600	1.7740	14.744	0.714
9.800	1.7850	15.100	2.020
10.300	1.8110	15.999	3.840
10.900	1.8430	17.095	4.960

END FTABLE237

*** SDN-3X: 3RD RUNWAY NORTH VAULT (LEVEL 2): ***

FTABLE 43

ROWS COLS *** EFFECTIVE DEPTH=20 FT RISER DIA=24 INCHES

21 4

DEPTH (FT)	AREA (ACRES)	VOLUME (ACRE-FT)	FLOW (FT3/S) ***
0.00	1.288	0.00	0.00
0.14	1.288	0.180	0.067
1.39	1.288	1.790	0.216
3.35	1.288	4.314	0.336
5.31	1.288	6.839	0.423
8.06	1.288	10.380	0.521
8.84	1.288	11.385	0.545
10.02	1.288	12.905	0.580
11.98	1.288	15.429	0.635
12.37	1.288	15.931	0.645
14.00	1.288	18.030	0.686
14.10	1.288	18.159	0.705
14.91	1.288	19.202	0.757
16.09	1.288	20.722	0.810
18.00	1.288	23.182	0.881
18.32	1.288	23.594	1.150
18.76	1.288	24.161	1.360
20.00	1.288	25.758	1.680
20.10	1.288	25.886	2.320
20.50	1.288	26.402	8.620
20.80	1.288	26.788	15.370

END FTABLE 43

*** SDN-4X/2X: 3RD RUNWAY NORTH VAULT (COMBINED FACILITY)

FTABLE 51
ROWS COLS *** EFFECTIVE DEPTH=19FT RISER DIA=24 INCHES
20 4

DEPTH (FT)	AREA (ACRES)	VOLUME (ACRE-FT)	OUTFLOW (FT3/S)	***
0.00	0.789	0.000	0.000	
0.16	0.789	0.126	0.056	
1.51	0.789	1.192	0.169	
3.28	0.789	2.588	0.249	
5.49	0.789	4.332	0.322	
7.26	0.789	5.729	0.370	
10.35	0.789	8.168	0.442	
12.12	0.789	9.564	0.478	
13.44	0.789	10.606	0.503	
14.33	0.789	11.308	0.520	
15.57	0.789	12.287	0.654	
16.72	0.789	13.194	0.828	
17.19	0.789	13.565	0.950	
17.63	0.789	13.913	1.030	
18.00	0.789	14.205	1.080	
19.00	0.789	14.994	1.960	
19.10	0.789	15.073	2.580	
19.40	0.789	15.309	6.930	
19.60	0.789	15.467	11.080	
20.00	0.789	15.783	17.190	

END FTABLE 51

*** SDW-1B:3RD RUNWAY CENTRAL SOUTH POND D TO MILLER CREEK (LEVEL 2): ***
FTABLE 57
ROWS COLS *** EFFECTIVE DEPTH = 14.0 FT
17 4

DEPTH (FT)	AREA (ACRES)	VOLUME (ACRE-FT)	STORMQ (FT3/S)	***
0.00	2.430	0.000	0.000	
0.01	2.430	0.041	0.010	
1.00	2.680	2.411	0.183	
2.00	2.760	4.860	0.257	
3.00	2.818	7.370	0.319	
4.00	3.079	9.945	0.366	
5.00	5.832	15.320	0.411	
6.00	5.927	20.742	0.450	
7.00	6.022	26.264	0.481	
8.00	6.118	31.888	0.518	
9.00	6.210	37.613	0.550	
10.00	6.311	43.441	0.583	
11.00	6.408	49.372	0.609	
12.00	6.607	55.406	0.634	
13.00	6.405	61.543	0.764	
14.00	6.504	67.786	1.320	
15.00	7.000	70.000	16.600	

END FTABLE 57

*** SDW-1B:3RD RUNWAY CENTRAL SOUTH POND D TO MILLER CREEK (LEVEL 2): ***
FTABLE 257
*** PROJECT SDW1B EFFECTIVE DIAMETER=3.0 FT
ROWS COLS *** INFILTRATION TANK TO OBTAIN 0.2 CFS
15 5

```
     DEPTH       AREA     VOLUME      STORMQ   INFILTRQ ***
     0.000      0.001     0.000       0.000     0.000
     0.010      0.001     0.001       0.000     0.002
     0.250      0.002     0.002       0.000     0.017
     0.500      0.004     0.004       0.000     0.035
     1.000      0.012     0.012       0.000     0.071
     1.500      0.020     0.020       0.000     0.106
     2.000      0.029     0.029       0.000     0.142
     2.500      0.036     0.036       0.000     0.178
     3.000      0.041    0.0406       0.000     0.213
     3.100      0.041    0.0420       0.596     0.220
     3.200      0.041    0.0421       1.685     0.227
     3.300      0.041    0.0422       3.096     0.233
     3.400      0.041    0.0423       4.766     0.241
     3.500      0.041    0.0424       6.661     0.248
     3.750      0.041    0.0425      12.237     0.266
  END FTABLE257

  FTABLE    570
  *** PROJECT  SDW1B   FLOW SPLITTER (to 257 and 57)
 ROWS COLS ***
   15    5
     DEPTH       AREA     VOLUME      STORMQ   INFILTRQ ***
     0.000      0.00     0.000        0.000     0.000
     0.100      0.01     0.0002       0.000     0.050
     0.400      0.01     0.0009       0.000     0.110
     0.600      0.01     0.0014       0.000     0.130
     0.750      0.01     0.0017       0.000     0.150
     0.800      0.01     0.0018       0.720     0.150
     1.000      0.01     0.0023       8.050     0.170
     1.100      0.01     0.0025      13.330     0.180
     1.200      0.01     0.0027      19.440     0.190
     1.300      0.01     0.0030      26.270     0.190
     1.400      0.01     0.0032      33.750     0.200
     1.420      0.01     0.0033      35.320     0.200
     1.440      0.01     0.0033      36.910     0.200
     1.450      0.01     0.0034      37.920     0.200
     1.460      0.01     0.0035      38.530     0.200
  END FTABLE570

  FTABLE     61
 ROWS COLS ***
*** SDN-2X: DETAIN OVERFLOW FROM NCPS AND NSMPS-
   17    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000    0.5740     0.0000       0.00
     1.200    0.5740     0.7710      0.151
     2.220    0.5740     1.4270      0.205
     3.240    0.5740     2.0830      0.247
     3.650    0.5740     2.3460      0.262
     4.260    0.5740     2.7380      0.283
     4.660    0.5740     2.9950      0.296
     5.680    0.5740     3.6510      0.327
     6.640    0.5740     4.2680      0.517
     7.650    0.5740     4.9170      0.644
     8.670    0.5740     5.9710      0.739
     9.810    0.5740     6.3570      0.836
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   10.700     0.5740     6.8780      0.894
   12.000     0.5740     7.7130      0.978
   12.100     0.5740     7.7780      1.600
   12.300     0.5740     7.9060      4.200
   12.800     0.5740     8.2280     14.560
 END FTABLE 61

 PRE AMBAUM DETENTION ***
 FTABLE     111
ROWS COLS ***
  15    4
    DEPTH        AREA      VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.500     0.2160     0.0750       5.30
    1.000     0.2730     0.1990      21.10
    1.500     0.2890     0.3410      43.90
    2.000     0.2900     0.4830      68.80
    2.500     0.2910     0.6070      89.10
    3.000     0.2950     0.6820      90.00
    3.500     0.3000     2.1000     100.00
    4.000     0.3050     2.5000     105.00
    4.500     0.3100     3.0000     110.00
    5.000     0.3200     3.5000     120.00
    5.500     0.3300     4.0000     130.00
    6.000     0.3800     5.0530     166.48
    6.500     0.3980     5.9430     225.31
    7.000     0.4150     6.9040     320.10
 END FTABLE111

 FTABLE     135
ROWS COLS *** VACA FARM
  6    4
    DEPTH        AREA      VOLUME    OUTFLOW    ***
     0.00       0.10       0.00       0.00
     1.00       0.10       0.10       4.00
     2.00       0.11       0.21       8.00
     2.50       1.00       0.48      13.00
     3.50       6.50       4.23      86.00
     4.50      13.00      13.98     235.00
 END FTABLE135

 FTABLE     240
*** NORTH SNOWMELT PUMP STATION (SDN-2) (INSTALLED IN LATE 1997/1998)
ROWS COLS                                                              ***
  14    5
    DEPTH       AREA     VOLUME       (IWS)       (SDS)                  ***
     (FT)    (ACRES)  (ACRE-FT)       (CFS)       (CFS)                  ***
      0.0      0.002       0.00        0.00        0.00
     1.00      0.002     0.0023        0.00        0.00
     2.00      0.002     0.0046        1.67        0.00
     3.00      0.002     0.0069        1.67        0.00
     4.00      0.002     0.0092        1.67        0.00
     5.00      0.002     0.0115        1.67        0.00
     5.25      0.002     0.0121        1.67        1.53
     5.50      0.002     0.0126        1.67        6.06
     5.75      0.002     0.0132        1.67       12.65
     6.00      0.002     0.0138        1.67       19.83
```

```
       6.25      0.002     0.0144       1.67       25.66
       6.50      0.002     0.0149       1.67       25.70
       6.75      0.002     0.0155       1.67       26.70
       7.00      0.002     0.0161       1.67       50.00
  END FTABLE240

  FTABLE    242
*** NORTH CARGO PUMP STATION (SDN-2) (INSTALLED IN OCTOBER 1997)
 ROWS COLS                                                               ***
   14    5
     DEPTH      AREA    VOLUME       (IWS)      (SDS)                    ***
      (FT)   (ACRES) (ACRE-FT)       (CFS)      (CFS)                    ***
       0.0     0.002      0.00        0.00       0.00
      1.00     0.002    0.0023        0.00       0.00
      2.00     0.002    0.0046        6.13       0.00
      3.00     0.002    0.0069        6.13       0.00
      4.00     0.002    0.0092        6.13       0.00
      5.00     0.002    0.0115        6.13       0.00
      5.25     0.002    0.0121        6.13       0.28
      5.50     0.002    0.0126        6.13       1.16
      5.75     0.002    0.0132        6.13       2.53
      6.00     0.002    0.0138        6.13       4.23
      6.25     0.002    0.0144        6.13       6.05
      6.50     0.002    0.0149        6.13       7.72
      6.75     0.002    0.0155        6.13       8.50
      7.00     0.002    0.0161        6.13       20.0
  END FTABLE242

END FTABLES

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        1
  conversion from acre-inches to acre-ft (1/12)               ***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
RCHRES     ROFLOW                          RCHRES         INFLOW
  END MASS-LINK    3

  MASS-LINK        4
RCHRES     OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK    4

  MASS-LINK        5
RCHRES     OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        6
PERLND     PWATER SURO       0.0833333     RCHRES         INFLOW IVOL
PERLND     PWATER IFWO       0.0833333     RCHRES         INFLOW IVOL
```

```
  END MASS-LINK    6

  MASS-LINK        7
PERLND     PWATER AGWO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        10
COPY       OUTPUT MEAN                     COPY            INPUT  MEAN
  END MASS-LINK    10

  MASS-LINK        11
RCHRES     ROFLOW                          COPY            INPUT  MEAN
  END MASS-LINK    11

  MASS-LINK        12
COPY       OUTPUT MEAN                     RCHRES          INFLOW IVOL
  END MASS-LINK    12

  MASS-LINK        14
RCHRES     OFLOW  OVOL   1                 COPY            INPUT  MEAN
  END MASS-LINK    14

  MASS-LINK        15
RCHRES     OFLOW  OVOL   2                 COPY            INPUT  MEAN
  END MASS-LINK    15

  MASS-LINK        21
PERLND     PWATER PERO       0.0833333     COPY            INPUT  MEAN
  END MASS-LINK    21

  MASS-LINK        22
IMPLND     IWATER SURO       0.0833333     COPY            INPUT  MEAN
  END MASS-LINK    22

  MASS-LINK        26
PERLND     PWATER SURO       0.0833333     COPY            INPUT  MEAN
PERLND     PWATER IFWO       0.0833333     COPY            INPUT  MEAN
  END MASS-LINK    26

  MASS-LINK        27
PERLND     PWATER AGWO       0.0833333     COPY            INPUT  MEAN
  END MASS-LINK    27

END MASS-LINK

COPY
  TIMESERIES
  Copy-opn                                                                ***
    # -  #  NPT  NMN                                                      ***
   37   71         1
  240  242         1
  357  357         1
  645  645         1
  END TIMESERIES
END COPY

END RUN
```

```
RUN
GLOBAL
  ***  FILE: mill65F.inp REVISED Aug 2000  Joe Brascher(atc)
  *** for parameterix
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF MILLER CREEK
  ***  - POST-MILLER CK DETENTION FACIITY 10/92-6/93
  *** m23 AND M24 new area west of m2.  Flows to rdf
  *** Calibration file run for full length of record
  MILLER CREEK BASIN HSPF MODEL
  START       1948 10  1  0  0  END    1996  9 30 24  0
  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname------------------------------------------->
MESSU       24    D:\PARA\SEATAC\MILLER\lowflow\MILL.MES
WDM         25    D:\PARA\SEATAC\MILLER\lowflow\Mlowflow.wdm
            61    D:\PARA\SEATAC\MILLER\lowflow\PER.L61
            62    D:\PARA\SEATAC\MILLER\lowflow\RCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      14
      PERLND      16
      PERLND      18
      PERLND      24
      PERLND      26
      PERLND      28
      PERLND      34
      PERLND      44
      PERLND      54
      IMPLND      14
      RCHRES       1
      RCHRES      23
      RCHRES      24
      RCHRES       2
      RCHRES       3
      RCHRES      33
      RCHRES       4
      RCHRES       5
      RCHRES      50
      RCHRES      52
      RCHRES      53
      RCHRES      54
      RCHRES      34
      RCHRES     135
      RCHRES      35
      RCHRES      10
      RCHRES      16
      RCHRES      11
      RCHRES      13
      RCHRES      12
      RCHRES      15
      RCHRES      14
      RCHRES      17
```

```
    END INGRP
END OPN SEQUENCE                                                                ***

COPY
  TIMESERIES                                                                    ***
  Copy-opn                                                                      ***
    # -  #  NPT  NMN
    1    5         1
  END TIMESERIES
END COPY

PERLND
  GEN-INFO
    <PLS >        Name           NBLKS   Unit-systems   Printer                ***
    # -  #                              User  t-series Engl Metr               ***
                                              in   out                         ***
   14       TFF- TILL FOR FLT        1     1     1    1   61     0
   16       TFM- TILL FOR MOD        1     1     1    1   61     0
   18       TFS- TILL FOR STP        1     1     1    1   61     0
   24       TGF- TILL GR FLT         1     1     1    1   61     0
   26       TGM- TILL GR MOD         1     1     1    1   61     0
   28       TGS- TILL GR STP         1     1     1    1   61     0
   34       OF - OUTWASH FOR         1     1     1    1   61     0
   44       OG - OUTWASH GR          1     1     1    1   61     0
 ***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
   45       AIRPORT FILL             1     1     1    1   61     0
   54       SA - WETLANDS            1     1     1    1   61     0
   64       RES- GROUNDWATER         1     1     1    1   61     0
  END GEN-INFO
  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC       ***
   14  200    0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    <PLS > ******************** Print-flags ************************ PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
   14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  PWAT-PARM1
    <PLS > **************** Flags *******************
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                       ***
   14         0    0    0    0    0    0    0    0    0
   16         0    0    0    0    0    0    0    0    0
   18         0    0    0    0    0    0    0    0    0
   24         0    0    0    0    0    0    0    0    0
   26         0    0    0    0    0    0    0    0    0
   28         0    0    0    0    0    0    0    0    0
   34         0    0    0    0    0    0    0    0    0
   44         0    0    0    0    0    0    0    0    0
   45         0    0    0    0    0    0    0    0    0
   54         0    0    0    0    0    0    0    0    0
   64         0    0    0    0    0    0    0    0    0
  END PWAT-PARM1
  PWAT-PARM2
    <PLS > ***
    # -  # ***FOREST      LZSN     INFILT      LSUR      SLSUR      KVARY      AGWRC
```

```
  14                     9.0000     0.3200     400.00     0.0500     0.5000     0.9960
  16                     9.0000     0.3200     400.00     0.1000     0.5000     0.9960
  18                     9.0000     0.3200     200.00     0.2000     0.5000     0.9960
  24                     9.0000     0.1200     400.00     0.0500     0.5000     0.9960
  26                     9.0000     0.1200     400.00     0.1000     0.5000     0.9960
  28                     9.0000     0.1200     200.00     0.2000     0.5000     0.9960
  34                    10.0000     2.0000     400.00     0.0500     0.3000     0.9960
  44                    10.0000     0.8000     400.00     0.0500     0.3000     0.9960
  45                     7.5000     0.0200     300.00     0.0700     0.0000     0.9000
  54                     8.0000     2.0000     100.00     0.0010     0.5000     0.9960
 END PWAT-PARM2
 PWAT-PARM3
   <PLS >***
   # -  #*** PETMAX    PETMIN     INFEXP     INFILD     DEEPFR     BASETP     AGWETP
  14                              2.0000     2.0000       0.33       0.00        0.0
  16                              2.0000     2.0000       0.33       0.00        0.0
  18                              2.0000     2.0000       0.33       0.00        0.0
  24                              2.0000     2.0000       0.33       0.00         0.
  26                              2.0000     2.0000       0.33         0.         0.
  28                              2.0000     2.0000       0.33         0.         0.
  34                              2.0000     2.0000       0.33       0.00        0.0
  44                              2.0000     2.0000       0.33         0.         0.
  54                              10.000     2.0000       0.33         0.        0.7
 END PWAT-PARM3
 PWAT-PARM4
   <PLS >                                                         ***
   # -  #      CEPSC      UZSN       NSUR      INTFW        IRC     LZETP***
  14          0.2000    1.5000     0.3500      9.000     0.7000     0.7000
  16          0.2000    0.7500     0.3500      9.000     0.7000     0.7000
  18          0.2000    0.4500     0.3500      9.000     0.3000     0.7000
  24          0.1000    0.7500     0.2500      9.000     0.7000     0.2500
  26          0.1000    0.3750     0.2500      9.000     0.7000     0.2500
  28          0.1000    0.2250     0.2500      9.000     0.3000     0.2500
  34          0.2000    0.7500     0.3500      0.000     0.7000     0.7000
  44          0.1000    0.7500     0.2500      0.000     0.7000     0.2500
  54          0.1000    2.2500     0.5000      1.000     0.7000     0.8000
 END PWAT-PARM4
 PWAT-STATE1
   <PLS >  PWATER state variables***
   # -  #***    CEPS      SURS        UZS       IFWS        LZS       AGWS       GWVS
  14           0.078        0.     0.2500       0.10      2.000      2.000      0.000
  16           0.078        0.     0.2500       0.10      2.000      2.000      0.000
  18           0.078        0.     0.2500       0.10      2.000      2.000      0.000
  24           0.051        0.     0.2500       0.10      2.000      2.000      0.000
  26           0.051        0.     0.2500       0.10      2.000      2.000      0.000
  28           0.051        0.     0.2500       0.10      2.000      2.000      0.000
  34           0.078        0.     0.2500       0.10      2.000      2.000      0.000
  44           0.051        0.     0.2500       0.10      2.000      2.000      0.000
  45           0.051        0.     0.2500       0.10      2.000      2.000      0.000
  54           0.051        0.     0.2500       0.10      2.000      2.000      0.000
  64           0.051        0.     0.2500       0.10      2.000      2.000      0.000
 END PWAT-STATE1
END PERLND
IMPLND
 GEN-INFO
   <ILS >      Name                Unit-systems   Printer                            ***
   # -  #                        User  t-series Engl Metr                            ***
```

```
                                           in  out                                           ***
  14      IMPERVIOUS            1    1    1   60    0
 END GEN-INFO
 ACTIVITY
   <ILS > ************* Active Sections ****
   # -  # ATMP SNOW IWAT  SLD  IWG IQAL  ***
  14         0    0    1    0    0    0
 END ACTIVITY
 PRINT-INFO
   <ILS > ******** Print-flags ******** PIVL  PYR
   # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
  14         0    0    6    0    0    0    1    9
 END PRINT-INFO
 IWAT-PARM1
   <ILS >           Flags          ***                                                       ***
   # -  # CSNO RTOP  VRS  VNN RTLI    ***                                                    ***
  14         0    0    0    0    0
 END IWAT-PARM1
 IWAT-PARM2
   <ILS >                                                                                    ***
   # -  #      LSUR     SLSUR      NSUR     RETSC                                            ***
  14         100.00    0.0100    0.1000    0.1000
 END IWAT-PARM2
 IWAT-PARM3
   <ILS >                                                                                    ***
   # -  #    PETMAX    PETMIN                                                                ***
  14
 END IWAT-PARM3
 IWAT-STATE1
   <ILS >  IWATER state variables                                                            ***
   # -  #      RETS      SURS                                                                ***
  14      1.0000E-3 1.0000E-3
 END IWAT-STATE1
END IMPLND
                                                                                             ***
EXT SOURCES
                                                                                             ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes.
                                                                                             ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM   1002 PREC      ENGLZERO  1.00         PERLND  14 200 EXTNL  PREC
WDM   1002 PREC      ENGLZERO  1.00         IMPLND  14     EXTNL  PREC
WDM      1 EVAP      ENGLZERO  0.8          PERLND  14  18 EXTNL  PETINP
WDM      1 EVAP      ENGLZERO  0.8          PERLND  24  28 EXTNL  PETINP
WDM      1 EVAP      ENGLZERO  0.8          PERLND  34  54 EXTNL  PETINP
WDM      1 EVAP      ENGLZERO  0.8          PERLND  64     EXTNL  PETINP
WDM      1 EVAP      ENGLZERO  0.8          IMPLND  14     EXTNL  PETINP
*** PRECIP/EVAP TO LAKES
WDM   1002 PREC      ENGLZERO               RCHRES   1     EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8        RCHRES   1     EXTNL  POTEV
WDM   1002 PREC      ENGLZERO               RCHRES   4     EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8        RCHRES   4     EXTNL  POTEV
WDM      1 EVAP      ENGLZERO    0.8        RCHRES   1     EXTNL  POTEV
WDM   1002 PREC      ENGLZERO               RCHRES   1     EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8        RCHRES   4     EXTNL  POTEV
```

```
WDM    1002 PREC      ENGLZERO              RCHRES   4     EXTNL  PREC
WDM    1002 PREC      ENGLZERO              RCHRES  11     EXTNL  PREC
WDM       1 EVAP      ENGLZERO    0.8       RCHRES  11     EXTNL  POTEV
WDM    1002 PREC      ENGLZERO              RCHRES  13     EXTNL  PREC
WDM       1 EVAP      ENGLZERO    0.8       RCHRES  13     EXTNL  POTEV
WDM    1002 PREC      ENGLZERO              RCHRES  23     EXTNL  PREC
WDM       1 EVAP      ENGLZERO    0.8       RCHRES  23     EXTNL  POTEV
WDM    1002 PREC      ENGLZERO              RCHRES  34     EXTNL  PREC
WDM       1 EVAP      ENGLZERO    0.8       RCHRES  34     EXTNL  POTEV
WDM    1002 PREC      ENGLZERO              RCHRES  53     EXTNL  PREC
WDM       1 EVAP      ENGLZERO    0.8       RCHRES  53     EXTNL  POTEV
WDM    1002 PREC      ENGLZERO              RCHRES  54     EXTNL  PREC
WDM       1 EVAP      ENGLZERO    0.8       RCHRES  54     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
*** UPPER MILLER CREEK GROUNDWATER PUMPING
COPY *** 1 OUTPUT MEAN  1    12.1          WDM     18 FLOW      ENGL      REPL
*** GAUGE POINTS (17=MOUTH, 54=MILLER RDF, 50=SR 518, 18=WALKER CK)
RCHRES  35 HYDR   RO                       WDM   7035 FLOW      ENGL      REPL
RCHRES  17 HYDR   RO                       WDM     33 FLOW      ENGL      REPL
RCHRES  54 HYDR   RO                       WDM     34 FLOW      ENGL      REPL
RCHRES  50 HYDR   RO          ***          WDM     35 FLOW      ENGL      REPL
RCHRES  18 HYDR   RO          ***          WDM     36 FLOW      ENGL      REPL
*** MISC (20=WALKER WETLAND, 55=SR509, 56=1ST AVE, 1=ARBOR LAKE)
RCHRES  23 HYDR   STAGE  ***               WDM     91 STAG      ENGL      REPL
RCHRES  20 HYDR   RO     ***               WDM     37 FLOW      ENGL      REPL
RCHRES  55 HYDR   RO     ***               WDM     38 FLOW      ENGL      REPL
RCHRES  62 HYDR   RO     ***               WDM     39 FLOW      ENGL      REPL
RCHRES   1 HYDR   RO     ***               WDM     80 FLOW      ENGL      REPL
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
 ***MOUTH
RCHRES  54 HYDR   RO     1 1 0.000419  *** WDM     60 SIMQ      ENGL      REPL
RCHRES  17 HYDR   RO     1 1 0.000213  *** WDM     70 SIMQ      ENGL      REPL
END EXT TARGETS
                                                                             ***

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK    ***
<Name>   #                  <-factor->     <Name>   #   Tbl#    ***
  *** SUB-CATCHMENT 1 all agwo goes to sound
PERLND  16                        3.41     RCHRES   1      6
PERLND  26                      232.36     RCHRES   1      6
PERLND  34                        3.07     RCHRES   1      6
PERLND  44                       38.03     RCHRES   1      6
PERLND  54                        3.87     RCHRES   1      6
IMPLND  14                       56.14     RCHRES   1      2
 *** SUB-CATCHMENT 2 10% of area GW goes to vaca 90% goes to sound
PERLND  16                        5.56     RCHRES   2      6
PERLND  26                      200.05     RCHRES   2      6
PERLND  34                        0.46     RCHRES   2      6
PERLND  44                       38.71     RCHRES   2      6
PERLND  16                        0.56     RCHRES 135      7
PERLND  26                       20.01     RCHRES 135      7
```

```
PERLND  34                      0.05      RCHRES 135        7
PERLND  44                      3.87      RCHRES 135        7
IMPLND  14                     42.22      RCHRES   2        2
 *** SUB-CATCHMENT 23 New subbasin 15 % OF GW GOES TO VACCA 85% TO SOUND
PERLND  16                      3.09      RCHRES  23        6
PERLND  26                    156.15      RCHRES  23        6
PERLND  34                      2.25      RCHRES  23        6
PERLND  44                     45.84      RCHRES  23        6
PERLND  16                      0.46      RCHRES 135        7
PERLND  26                     23.42      RCHRES 135        7
PERLND  34                      0.34      RCHRES 135        7
PERLND  44                      6.88      RCHRES 135        7
IMPLND  14                     58.44      RCHRES  23        2
 *** SUB-CATCHMENT 24 New subbasin 60 % OF GW GOES TO 11 40% TO SOUND
PERLND  26                    135.43      RCHRES  24        6
PERLND  34                      2.02      RCHRES  24        6
PERLND  44                     69.29      RCHRES  24        6
PERLND  26                     81.26      RCHRES  11        7
PERLND  34                      1.21      RCHRES  11        7
PERLND  44                     41.57      RCHRES  11        7
IMPLND  14                     79.98      RCHRES  24        2
  *** SUB-CATCHMENT 3 agwo goes to vaca(135)
PERLND  16                      8.26      RCHRES   3        6
PERLND  26                    108.38      RCHRES   3        6
PERLND  34                     16.02      RCHRES   3        6
PERLND  44                    102.89      RCHRES   3        6
PERLND  54                      0.04      RCHRES   3        6
PERLND  16                      8.26      RCHRES 135        7
PERLND  26                    108.38      RCHRES 135        7
PERLND  34                     16.02      RCHRES 135        7
PERLND  44                    102.89      RCHRES 135        7
PERLND  54                      0.04      RCHRES 135        7
IMPLND  14                     27.30      RCHRES   3        2
  *** SUB-CATCHMENT 4 10% of agwo goes to rchres 90% goes to sound
PERLND  16                      2.95      RCHRES   4        6
PERLND  26                     85.95      RCHRES   4        6
PERLND  34                      3.75      RCHRES   4        6
PERLND  44                     92.06      RCHRES   4        6
PERLND  16                      0.30      RCHRES   4        7
PERLND  26                      8.60      RCHRES   4        7
PERLND  34                      0.38      RCHRES   4        7
PERLND  44                      9.21      RCHRES   4        7
IMPLND  14                     18.43      RCHRES   4        2
  *** SUB-CATCHMENT 4a 70% of agwo goes to rchres 30% goes to sound
PERLND  16                      8.66      RCHRES   4        6
PERLND  26                     61.64      RCHRES   4        6
PERLND  34                     22.06      RCHRES   4        6
PERLND  44                     78.09      RCHRES   4        6
PERLND  54                     12.50      RCHRES   4        6
PERLND  16                      6.06      RCHRES   4        7
PERLND  26                     43.15      RCHRES   4        7
PERLND  34                     15.44      RCHRES   4        7
PERLND  44                     54.66      RCHRES   4        7
PERLND  54                      8.75      RCHRES   4        7
IMPLND  14                     29.14      RCHRES   4        2
  *** SUB-CATCHMENT 5
PERLND  26                     10.29      RCHRES   5        1
```

```
PERLND  44                        50.04     RCHRES   5        1
PERLND  54                        10.74     RCHRES   5        1
IMPLND  14                        16.31     RCHRES   5        2
  *** SUB-CATCHMENT 6
PERLND  16                        10.66     RCHRES  53        1
PERLND  26                        41.08     RCHRES  53        1
PERLND  34                        21.75     RCHRES  53        1
PERLND  44                        13.39     RCHRES  53        1
PERLND  54                         0.82     RCHRES  53        1
IMPLND  14                         7.14     RCHRES  53        2
  *** SUB-CATCHMENT 8
PERLND  44                        22.21     RCHRES  35        1
IMPLND  14                         6.60     RCHRES  35        2
  *** SUB-CATCHMENT 9
PERLND  16                         4.94     RCHRES  34        1
PERLND  26                        14.32     RCHRES  34        1
PERLND  34                         0.05     RCHRES  34        1
PERLND  44                        56.70     RCHRES  34        1
PERLND  54                         0.01     RCHRES  34        1
IMPLND  14                        22.46     RCHRES  34        2
  *** SUB-CATCHMENT 10
PERLND  16                         4.15     RCHRES  10        1
PERLND  26                        31.94     RCHRES  10        1
PERLND  44                        95.23     RCHRES  10        1
IMPLND  14                        71.97     RCHRES  10        2
  *** SUB-CATCHMENT 11 25% OF AGWO GOES TO 15
PERLND  16                         0.89     RCHRES  11        6
PERLND  26                       217.92     RCHRES  11        6
PERLND  34                         1.32     RCHRES  11        6
PERLND  44                        65.65     RCHRES  11        6
PERLND  16                         0.67     RCHRES  11        7
PERLND  26                       163.44     RCHRES  11        7
PERLND  34                         0.99     RCHRES  11        7
PERLND  44                        49.24     RCHRES  11        7
PERLND  16                         0.22     RCHRES  15        7
PERLND  26                        54.48     RCHRES  15        7
PERLND  34                         0.33     RCHRES  15        7
PERLND  44                        16.41     RCHRES  15        7
IMPLND  14                       230.80     RCHRES  11        2
  *** SUB-CATCHMENT 12
PERLND  16                         0.39     RCHRES  12        1
PERLND  26                       101.18     RCHRES  12        1
PERLND  34                         5.64     RCHRES  12        1
PERLND  44                        54.98     RCHRES  12        1
PERLND  54                         0.64     RCHRES  12        1
IMPLND  14                        79.83     RCHRES  12        2
  *** SUB-CATCHMENT 13
PERLND  16                         0.79     RCHRES  13        1
PERLND  26                       197.68     RCHRES  13        1
IMPLND  14                        27.66     RCHRES  13        2
  *** SUB-CATCHMENT 14 50% OF AGWO GOES TO SOUND
PERLND  16                         0.24     RCHRES  14        6
PERLND  26                       118.67     RCHRES  14        6
PERLND  34                        13.46     RCHRES  14        6
PERLND  44                        41.91     RCHRES  14        6
PERLND  16                         0.12     RCHRES  14        7
PERLND  26                        59.34     RCHRES  14        7
```

PERLND	34	6.73	RCHRES 14	7
PERLND	44	20.95	RCHRES 14	7
IMPLND	14	20.66	RCHRES 14	2
*** SUB-CATCHMENT 15				
PERLND	16	6.59	RCHRES 15	1
PERLND	26	49.55	RCHRES 15	1
PERLND	34	50.09	RCHRES 15	1
PERLND	44	86.52	RCHRES 15	1
IMPLND	14	19.47	RCHRES 15	2
*** SUB-CATCHMENT 16				
PERLND	16	10.93	RCHRES 16	1
PERLND	26	30.30	RCHRES 16	1
PERLND	34	20.03	RCHRES 16	1
PERLND	44	31.42	RCHRES 16	1
IMPLND	14	15.54	RCHRES 16	2
*** SUB-CATCHMENT 17 AGWO GOES TO SOUND				
PERLND	16	0.90	RCHRES 17	6
PERLND	26	16.31	RCHRES 17	6
PERLND	34	34.82	RCHRES 17	6
PERLND	44	82.11	RCHRES 17	6
PERLND	54	2.19	RCHRES 17	6
IMPLND	14	10.49	RCHRES 17	2
*** SUB-CATCHMENT MC-1				
PERLND	26	0.17	RCHRES 52	1
PERLND	44	8.21	RCHRES 52	1
PERLND	54	0.27	RCHRES 52	1
IMPLND	14	0.09	RCHRES 52	2
*** SUB-CATCHMENT MC-2				
PERLND	16	0.08	RCHRES 53	1
PERLND	26	0.64	RCHRES 53	1
PERLND	34	6.72	RCHRES 53	1
PERLND	44	10.43	RCHRES 53	1
PERLND	54	15.25	RCHRES 53	1
IMPLND	14	0.27	RCHRES 53	2
*** SUB-CATCHMENT MC-3				
PERLND	34	5.44	RCHRES 54	1
PERLND	44	5.03	RCHRES 54	1
PERLND	54	2.28	RCHRES 54	1
IMPLND	14	0.11	RCHRES 54	2
*** SUB-CATCHMENT MC-4				
PERLND	44	17.32	RCHRES 135	1
PERLND	54	14.41	RCHRES 135	1
IMPLND	14	1.77	RCHRES 135	2
*** SUB-CATCHMENT MC-5				
PERLND	26	13.49	RCHRES 35	1
PERLND	44	31.06	RCHRES 35	1
PERLND	54	5.95	RCHRES 35	1
IMPLND	14	2.50	RCHRES 35	2
*** SUB-CATCHMENT MC-6				
PERLND	44	17.75	RCHRES 35	1
PERLND	54	6.54	RCHRES 35	1
IMPLND	14	0.95	RCHRES 35	2
*** SUB-CATCHMENT MC-6B				
PERLND	26	34.94	RCHRES 35	1
PERLND	34	7.81	RCHRES 35	1
PERLND	44	52.91	RCHRES 35	1
PERLND	54	4.61	RCHRES 35	1

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IMPLND  14                         3.14     RCHRES  35        2
  *** SUB-CATCHMENT MC-7
PERLND  26                        12.66     RCHRES  16        1
PERLND  44                        33.53     RCHRES  16        1
PERLND  54                         4.16     RCHRES  16        1
IMPLND  14                         3.88     RCHRES  16        2
  *** SUB-CATCHMENT MC-7B
PERLND  26                        36.16     RCHRES  16        1
PERLND  44                         8.46     RCHRES  16        1
PERLND  54                         1.92     RCHRES  16        1
IMPLND  14                         2.12     RCHRES  16        2
***all sdn basin agwo goes to 35
  *** SUB-CATCHMENT SDN-1
PERLND  26                         3.23     RCHRES  52        6
PERLND  44                         2.11     RCHRES  52        6
PERLND  54                         0.20     RCHRES  52        6
PERLND  26                         3.23     RCHRES 135        7
PERLND  44                         2.11     RCHRES 135        7
PERLND  54                         0.20     RCHRES 135        7
IMPLND  14                         8.29     RCHRES  52        2

  *** SUB-CATCHMENT SDN-1-LWR
PERLND  44                         4.97     RCHRES  52        6
PERLND  54                         0.07     RCHRES  52        6
PERLND  44                         4.97     RCHRES 135        7
PERLND  54                         0.07     RCHRES 135        7
IMPLND  14                         0.38     RCHRES  52        2

  *** SUB-CATCHMENT SDN-1-OFF
PERLND  26                        29.12     RCHRES  52        6
PERLND  44                         3.62     RCHRES  52        6
PERLND  54                         1.67     RCHRES  52        6
PERLND  26                        29.12     RCHRES 135        7
PERLND  44                         3.62     RCHRES 135        7
PERLND  54                         1.67     RCHRES 135        7
IMPLND  14                        11.50     RCHRES  52        2

  *** SUB-CATCHMENT SDN-2
PERLND  26                        10.41     RCHRES  52        6
PERLND  44                         3.04     RCHRES  52        6
PERLND  26                        10.41     RCHRES 135        7
PERLND  44                         3.04     RCHRES 135        7
IMPLND  14                        33.22     RCHRES  52        2

  *** SUB-CATCHMENT SDN-2X
PERLND  26                         1.37     RCHRES  52        6
PERLND  44                         5.84     RCHRES  52        6
PERLND  26                         1.37     RCHRES 135        7
PERLND  44                         5.84     RCHRES 135        7
IMPLND  14                         0.28     RCHRES  52        2

  *** SUB-CATCHMENT SDN-3
PERLND  26                        49.79     RCHRES  54        6
PERLND  26                        49.79     RCHRES 135        7
IMPLND  14                        15.82     RCHRES  54        2

  *** SUB-CATCHMENT SDN-3X
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```
PERLND  16                        0.65    RCHRES  54          6
PERLND  26                        5.17    RCHRES  54          6
PERLND  34                       13.64    RCHRES  54          6
PERLND  44                        5.34    RCHRES  54          6
PERLND  54                        0.57    RCHRES  54          6
PERLND  16                        0.65    RCHRES 135          7
PERLND  26                        5.17    RCHRES 135          7
PERLND  34                       13.64    RCHRES 135          7
PERLND  44                        5.34    RCHRES 135          7
PERLND  54                        0.57    RCHRES 135          7

  *** SUB-CATCHMENT SDN-4
PERLND  26                       24.43    RCHRES  52          6
PERLND  44                        3.19    RCHRES  52          6
PERLND  26                       24.43    RCHRES 135          7
PERLND  44                        3.19    RCHRES 135          7
IMPLND  14                        2.61    RCHRES  52          2

  *** SUB-CATCHMENT SDN-4X
PERLND  26                        1.57    RCHRES  52          6
PERLND  34                        1.16    RCHRES  52          6
PERLND  44                       10.01    RCHRES  52          6
PERLND  26                        1.57    RCHRES 135          7
PERLND  34                        1.16    RCHRES 135          7
PERLND  44                       10.01    RCHRES 135          7

***ROUTING FOR MILLER CREEK
*** M1 TO M2 TO M3 TO STORAGE 50.  M4 TO M5 TO STORAGE 50
RCHRES   1                                RCHRES   2          4
RCHRES  23                                RCHRES  24          4
RCHRES  24                                RCHRES   3          3
RCHRES   2                                RCHRES   3          3
RCHRES   3                                RCHRES  33          3
RCHRES  33                                RCHRES  50          3
RCHRES   4                                RCHRES   5          4
RCHRES   5                                RCHRES  50          3
*** NEW STREAM REACH 52 TO LAKE REBA 53 TO RDF 54
RCHRES  52                                RCHRES  53          3
RCHRES  53                                RCHRES  54          3
RCHRES  50                                RCHRES  54          3
*** RDF 54 TO 35
RCHRES  54                                RCHRES 135          3
RCHRES  34                                RCHRES 135          4
RCHRES  34                                RCHRES 135          5
RCHRES 135                                RCHRES  35          3
RCHRES  10                                RCHRES  16          3
RCHRES  35                                RCHRES  16          3
RCHRES  11                                RCHRES  15          3
RCHRES  13                                RCHRES  12          4
RCHRES  13                                RCHRES  12          5
RCHRES  12                                RCHRES  15          3
RCHRES  16                                RCHRES  15          3
RCHRES  14                                RCHRES  17          3
RCHRES  15                                RCHRES  17          3
END SCHEMATIC

NETWORK
```

```
                                                                                        ***
***        <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>        <-MEMBER->
<NAME>   # <NAME>    TEM STRG<-FACTOR->STRG <NAME>    #    # <-GRP> <NAME> # # ***
                                                                                        ***
END NETWORK
                                                                                        ***
RCHRES
  GEN-INFO
    RCHRES         Name          Nexits   Unit Systems   Printer                        ***
    # -   #<------------------><---> User T-series  Engl Metr LKFG                     ***
                                            in   out                                    ***
    1      Arbor Lake  M 1          2     1     1    1    62     0     0
    2      Arbor Ck -03710 M 2      1     1     1    1    62     0     0
    3      Arbor Ck    M 3          1     1     1    1    62     0     0
    4      Tub Lake    M 4          2     1     1    1    62     0     0
    5      Miller Ck SR518 M5       1     1     1    1    62     0     0
   10      Trib (0371G)    M 10     1     1     1    1    62     0     0
   11      M11 Ambaum Detention     1     1     1    1    62     0     0
   12      Trib(0354)   M 12        1     1     1    1    62     0     0
   13      Burien Lake M 13         2     1     1    1    62     0     0
   14      Trib (0353) M 14         1     1     1    1    62     0     0
   15      M/S U/S OF 17            1     1     1    1    62     0     0
   16      U/S OF 15 M/S            1     1     1    1    62     0     0
   17      GAGE                     1     1     1    1    62     0     0
   23      BASIN M23                2     1     1    1    62     0     0
   24      BASIN M24                1     1     1    1    62     0     0
   33      detention m3             1     1     1    1    62     0     0
   34      LORA LAKE                2     1     1    1    62     0     0
   35      D/S OF VACA FARM         1     1     1    1    62     0     0
   38      MC basins                1     1     1    1    62     0     0
   50      sr 518                   1     1     1    1    62     0     0
   52      U/S OF LAKE REBA         1     1     1    1    62     0     0
   53      Reba outflow             1     1     1    1    62     0     0
   54      Miller RDF outflow       1     1     1    1    62     0     0
  135      VACA FARMS               1     1     1    1    62     0     0
  END GEN-INFO
  ACTIVITY
    RCHRES *************** Active Sections *****************
    # -   # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG                            ***
    1   999    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    RCHRES *************** Printout Flags ****************** PIVL  PYR
    # -   # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
    1   999    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                                 ***
    # -   #   VC A1 A2 A3  ODFVFG for each *** ODGTFG for each      FUNCT  for each
              FG FG FG FG  possible  exit  *** possible  exit       possible  exit
               *  *  *  *   *  *  *  *  *        *  *  *  *  *           ***
    1          0  1  0  0   4  5  0  0  0        0  0  0  0  0        2  2  2  2  2
    2          0  0  0  0   4  0  0  0  0        0  0  0  0  0        2  2  2  2  2
    3          0  0  0  0   4  0  0  0  0        0  0  0  0  0        2  2  2  2  2
    4          0  1  0  0   4  5  0  0  0        0  0  0  0  0        2  2  2  2  2
    5     12   0  0  0  0   4  0  0  0  0        0  0  0  0  0        2  2  2  2  2
   13          0  1  0  0   4  5  0  0  0        0  0  0  0  0        2  2  2  2  2
```

```
  14    22    0  0  0  0    4  0  0  0  0         0  0  0  0  0        2  2  2  2  2
  23          0  1  0  0    4  5  0  0  0         0  0  0  0  0        2  2  2  2  2
  24    33    0  0  0  0    4  0  0  0  0         0  0  0  0  0        2  2  2  2  2
  34          0  1  0  0    4  5  0  0  0         0  0  0  0  0        2  2  2  2  2
  35   999    0  0  0  0    4  0  0  0  0         0  0  0  0  0        2  2  2  2  2
END HYDR-PARM1
HYDR-PARM2
  RCHRES                                                                        ***
  # -  #     FTABNO        LEN      DELTH     STCOR        KS       DB50        ***
<------><--------><--------><--------><--------><--------><-------->            ***
   1              1   0.010                                0.3
   2              2   0.776                                0.3
   3              3   0.980                                0.3
   4              4   0.010                                0.3
   5              5   0.380                                0.3
  10             10   0.380                                0.3
  11             11   0.010                                0.3
  12             12   1.000                                0.3
  13             13   0.015                                0.3
  14             14   0.450                                0.3
  15             15   0.735                                0.3
  16             16   0.587                                0.3
  17             17   0.379                                0.3
  23             23   0.379               300.0            0.3
  24             24   0.379                                0.3
  33             33   0.200                                0.3
  34             34   0.852                                0.3
  35             35   0.663                                0.3
  38             38   0.010                                0.3
  50             50   0.010                                0.3
  52             52   0.010                                0.3
  53             53   0.010                                0.3
  54             54   0.010                                0.3
 135            135   0.350                                0.3
END HYDR-PARM2
HYDR-INIT
  RCHRES  Initial conditions for each HYDR section                              ***
  # -  # ***   VOL     Initial  value  of COLIND    Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
<------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
   1     2.0             4.0  5.0
   2     0.0             4.0
   3     0.0             4.0  5.0
   4     2.0             4.0
   5     0.0             4.0
  10     0.0             4.0
  11     0.0             4.0
  12     0.0             4.0
  13    10.0             4.0  5.0
  14     0.0             4.0
  15     0.0             4.0
  16     0.0             4.0
  17     0.0             4.0
  23     6.0             4.0  5.0
  24     0.0             4.0
  33     0.0             4.0
  34     9.0             4.0  5.0
```

```
   35      0.1                 4.0
   38      0.1                 4.0
   50      0.0                 4.0
   52      0.0                 4.0
   53      0.1                 4.0
   54      2.25                4.0
  135      0.00                4.0
  END HYDR-INIT
END RCHRES

FTABLES
***UPPER BASIN
***===========

  FTABLE       1
 ROWS COLS ***
   11    5
     DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
     0.00        3.00      0.00       0.00     0.00
     2.50        3.00      7.50       0.00     0.11
     3.00        3.00      9.00       1.80     0.11
     3.50        3.30     10.58       5.00     0.11
     4.00        3.60     12.30      10.90     0.11
     4.50        3.90     14.18      17.50     0.11
     5.00        4.10     16.18      26.20     0.11
     5.50        4.30     18.28      32.50     0.11
     6.00        4.50     20.48      35.90     0.11
     7.00        5.00     25.23      38.10     0.11
     8.00        5.50     30.48      46.40     0.11
  END FTABLE  1

  FTABLE       2
 ROWS COLS ***
    9    4
     DEPTH       AREA     VOLUME    OUTFLOW     ***
     0.000     0.0000     0.0000       0.00
     0.100     0.2571     0.0129       0.16
     0.500     0.3873     0.1417       6.53
     1.000     0.5501     0.3761      25.95
     1.500     0.7128     0.6918      59.86
     2.000     0.8756     1.0889     110.67
     3.000     1.2011     2.1273     272.24
     3.500     1.3639     2.7685     387.38
     4.000     1.5266     3.4912     528.19
  END FTABLE  2

  FTABLE       3
 ROWS COLS ***
   12    4
     DEPTH       AREA     VOLUME    OUTFLOW     ***
     0.000     0.0000     0.0000       0.00
     0.100     0.9669     0.0483       0.13
     0.500     1.0637     0.4545       4.92
     1.000     1.1846     1.0165      17.12
     1.500     1.3055     1.6390      34.92
     2.000     1.4264     2.3220      57.95
     2.500     1.5473     3.0654      86.14
```

3.000	1.6682	3.8693	119.53
3.500	1.7891	4.7336	158.24
4.000	1.9100	5.6584	202.41
4.500	2.0294	6.6310	251.52
5.000	2.1488	7.6624	306.28

END FTABLE 3

FTABLE 4
ROWS COLS ***
7 5

DEPTH	AREA	VOLUME	OUTFLOW	OUTFLOW2***
0.00	3.00	0.00	0.00	0.00
2.50	4.50	9.38	0.00	0.11
3.00	6.00	12.00	6.00	0.11
4.00	10.00	20.00	13.00	0.11
5.00	15.00	32.50	20.00	0.11
6.00	20.00	50.00	26.00	0.11
7.00	25.00	72.50	168.00	0.11

END FTABLE 4

FTABLE 5
ROWS COLS ***
10 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00
0.100	0.1010	0.0051	0.03
0.500	0.1754	0.0603	1.46
1.000	0.2684	0.1713	6.16
1.500	0.3614	0.3288	14.89
2.000	0.4544	0.5327	28.48
2.500	0.5474	0.7832	47.70
3.000	0.6404	1.0801	73.29
3.500	0.7334	1.4236	105.94
4.000	0.8264	1.8136	146.33

END FTABLE 5

FTABLE 10
ROWS COLS ***
9 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00
0.100	0.1010	0.0051	0.06
0.500	0.1660	0.0585	2.27
1.000	0.2472	0.1618	9.32
1.500	0.3285	0.3057	22.08
2.000	0.4097	0.4902	41.66
2.500	0.4909	0.7154	69.09
3.000	0.5722	0.9811	105.37
4.000	0.6887	1.6116	209.70

END FTABLE 10

POST AMBAUM DETENTION ***
FTABLE 11
ROWS COLS ***
11 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00

```
   1.000     0.1000     0.2300       3.90
   2.000     0.2000     0.6000       6.30
   3.000     0.3000     0.9700       8.10
   4.000     0.4000     1.3400      11.10
   5.000     0.5000     1.8200      16.00
   6.000     0.6000     2.2700      19.10
   7.000     0.7000     2.8300      21.60
   8.000     0.8000     3.3700      30.80
   9.000     0.9000     4.0000      38.10
  10.000     1.0000     4.6500      74.10
  10.500     1.1000     5.2000     133.00
  11.000     1.1500     5.3000     500.00
 END FTABLE 11

 FTABLE      12
ROWS COLS ***
   6    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.6327     0.0316       0.15
    0.500     0.7960     0.3174       5.87
    1.000     1.0002     0.7664      21.53
    1.500     1.2043     1.3176      46.43
    2.000     1.4085     1.9708      81.20
    3.000     1.8168     3.5834     183.79
    4.000     2.2251     5.6044     336.22
    5.000     2.6335     8.0337     545.30
    6.000     3.0418    10.8713     817.51
 END FTABLE 12

 FTABLE      13
ROWS COLS ***
   7    5
    DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
    0.000     40.000     0.0000       0.00     0.00
    1.000     41.400     40.000       0.00     0.11
    1.500     42.000     60.000      10.00     0.11
    2.000     42.700     80.000      16.00     0.11
    2.500     43.300     100.00      20.00     0.11
    3.000     44.000     120.00      28.00     0.11
    5.000     45.000     210.00      45.00     0.11
 END FTABLE 13

 FTABLE      14
ROWS COLS ***
   6    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.3361     0.0168       0.24
    0.500     0.3809     0.1602       9.04
    1.000     0.4370     0.3647      31.61
    1.500     0.4930     0.5972      65.00
    2.000     0.5491     0.8577     108.85
    2.500     0.6051     1.1462     163.33
    3.000     0.6612     1.4628     228.78
 END FTABLE 14
```

```
 FTABLE     15
ROWS COLS ***
   4    4
    DEPTH       AREA      VOLUME    OUTFLOW    ***
     0.00       0.10       0.00       0.00
     1.00       1.00       0.55      91.00
     2.00       1.10       1.60     268.00
     3.00       1.20       2.75     493.00
 END FTABLE 15

 FTABLE     16
ROWS COLS ***
   4    4
    DEPTH       AREA      VOLUME    OUTFLOW    ***
     0.00       0.10       0.00       0.00
     1.00       1.00       0.55      74.00
     2.00       1.10       1.60     219.00
     3.00       1.20       2.75     403.00
 END FTABLE 16

 FTABLE     17
ROWS COLS ***
   5    4
    DEPTH       AREA      VOLUME    OUTFLOW    ***
     0.00       0.10       0.00       0.00
     1.00       1.00       0.55      59.00
     2.00       1.10       1.60     173.00
     3.00       1.20       2.75     318.00
     4.00       1.30       4.00     484.00
 END FTABLE 17

 FTABLE     23
ROWS COLS ***  HERMES
   9    5
    DEPTH       AREA      VOLUME    OUTFLOW OUTFLOW   ***
     0.00       0.00       0.00       0.00    0.00          0.00
     5.00       0.50       1.91       0.00    0.00        305.00
    11.00       0.79       5.79       0.00    0.00        311.00
    15.00       1.13       9.64       0.50    0.01        315.00
    19.00       1.72      15.34       0.50    0.05        319.00
    29.00       2.86      38.25       0.50    0.10        329.00
    39.00       4.40      74.55       0.50    0.20        339.00
    50.00       6.22     132.98       0.50    0.30        350.00
    60.00      10.00    1212.98       0.50    0.40        360.00
 END FTABLE 23

 FTABLE     24
ROWS COLS ***
   9    4
    DEPTH       AREA      VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.2571     0.0129       0.16
    0.500     0.3873     0.1417       6.53
    1.000     0.5501     0.3761      25.95
    1.500     0.7128     0.6918      59.86
    2.000     0.8756     1.0889     110.67
    3.000     1.2011     2.1273     272.24
```

3.500	1.3639	2.7685	387.38
4.000	1.5266	3.4912	528.19

END FTABLE 24

FTABLE 33
ROWS COLS ***
11 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.00	1.00	0.00	0.00
0.50	1.20	0.55	2.00
1.00	1.40	1.20	6.00
1.50	1.60	1.95	9.00
2.00	1.80	2.80	13.00
2.50	2.00	3.75	16.50
3.00	2.20	4.80	20.00
3.50	2.40	5.95	23.00
4.00	2.60	7.20	26.00
5.00	2.80	9.90	104.00
6.00	3.00	12.80	246.00

END FTABLE 33

FTABLE 34
ROWS COLS *** REVISED 11/19/97 BASED ON HEC-RAS MODEL
6 5

DEPTH	AREA	VOLUME	OUTFLOW	OUTFLOW2***
0.00	3.00	0.00	0.00	0.00
3.00	3.05	9.08	0.00	0.11
4.00	3.10	12.15	0.00	0.11
5.00	3.15	15.28	0.00	0.11
6.00	3.20	18.45	72.0	0.11
7.00	3.25	21.68	225.0	0.11

END FTABLE 34

FTABLE 35
ROWS COLS *** REVISED 11/19/97 BASED ON HECRAS MODEL
5 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.00	0.10	0.00	0.00
1.00	1.10	0.60	38.00
2.00	1.20	1.75	108.00
3.00	1.30	3.00	194.00
4.00	1.40	4.35	290.00

END FTABLE 35

FTABLE 38
ROWS COLS ***
7 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00
1.000	0.4000	0.4000	2.00
1.500	0.5000	1.0000	4.00
2.000	0.9000	1.3000	11.00
2.500	1.3000	1.6000	15.00
3.000	1.6000	2.0000	18.00
3.500	1.9000	2.5000	20.80

END FTABLE 38

FTABLE 45
ROWS COLS ***
NORTH EMPLOYEE PARKING LOT VAULT (AS-BUILT)***
12 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.2200	0.0000	0.00
2.000	0.2200	0.4500	1.20
4.000	0.2200	0.9000	1.70
6.000	0.2200	1.3400	2.10
8.000	0.2200	1.7900	2.40
10.000	0.2200	2.2400	2.70
12.240	0.2200	2.7400	3.00
14.000	0.2200	3.1400	6.90
15.440	0.2200	3.4600	8.30
16.000	0.2200	3.5800	10.30
18.000	0.2200	4.0300	13.60
20.000	0.2200	4.4800	30.79

END FTABLE 45

FTABLE 50
ROWS COLS ***
10 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.00	1.00	0.00	0.00
0.50	1.10	0.53	5.00
1.00	1.20	1.10	15.00
1.50	1.30	1.73	25.00
2.00	1.40	2.40	35.00
2.50	1.50	3.13	52.00
3.00	1.60	3.90	70.00
3.50	1.70	4.73	87.00
4.00	1.80	5.60	105.00
6.00	1.90	9.30	165.00

END FTABLE 50

FTABLE 52
ROWS COLS ***
6 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00
0.100	0.3680	0.0184	0.25
0.500	0.3717	0.1664	9.39
1.000	0.3763	0.3534	31.06
2.000	0.3819	0.7325	94.37
3.000	0.3874	1.1171	174.33

END FTABLE 52

FTABLE 53
OLD LAKE REBA ***
MAX DEPTH = 4.9 FEET ***
30" CMP, 40 CFS DISCHARGE AT MAX DEPTH ***
ROWS COLS ***
7 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	2.4000	0.0000	0.00
1.000	2.5800	2.5000	18.00
2.000	2.9400	5.3000	26.00

```
   3.000    3.4100    8.4000     31.00
   4.000    3.8800    12.100     36.00
   4.900    4.3000    15.800     40.00
   6.000    4.3000    15.810    500.00
 END FTABLE 53

 FTABLE      54
EXISTING MILLER CREEK DETENTION FACILITY*** REVISED STORAGE/Q DATA
GATE SETTING: 2.0 FEET***
ROWS COLS ***
  12    4
    DEPTH       AREA    VOLUME   OUTFLOW   ***
    0.000       0.00      0.00      0.00
    1.300       0.01      0.01     10.00
    2.000       0.01      0.02     20.00
    2.900       0.70      0.40     30.00
    4.000       1.50      1.50     40.00
    5.400       3.50      4.90     50.00
    7.000       8.60     13.30     60.00
    8.800      15.60     34.80     70.00
   10.000      19.90     57.30     76.00
   10.500      21.50     68.00     92.00
   11.000      23.10     78.80    179.00
   11.500      24.70     88.60    303.00
 END FTABLE 54

 PRE AMBAUM DETENTION ***
 FTABLE     111
ROWS COLS ***
  12    4
    DEPTH       AREA    VOLUME   OUTFLOW   ***
    0.000     0.0000    0.0000      0.00
    0.500     0.2160    0.0750      5.30
    1.000     0.2730    0.1990     21.10
    1.500     0.2890    0.3410     43.90
    2.000     0.2900    0.4830     68.80
    2.500     0.2910    0.6070     89.10
    3.000     0.2950    0.6820     90.00
    3.500     0.3000    2.1000    100.00
    4.000     0.3050    2.5000    105.00
    4.500     0.3100    3.0000    110.00
    5.000     0.3200    3.5000    120.00
    5.500     0.3300    4.0000    130.00
 END FTABLE111

 FTABLE     135
ROWS COLS *** VACA FARM
   6    4
    DEPTH       AREA    VOLUME   OUTFLOW   ***
     0.00       0.10      0.00      0.00
     1.00       0.10      0.10      4.00
     2.00       0.11      0.21      8.00
     2.50       1.00      0.48     13.00
     3.50       6.50      4.23     86.00
     4.50      13.00     13.98    235.00
 END FTABLE135
```

```
                                                                                ***
END FTABLES


MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>        <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                 <Name> # #***
  MASS-LINK       1
  conversion from acre-inches to acre-ft (1/12)            ***
PERLND     PWATER PERO         0.0833333    RCHRES         INFLOW IVOL
  END MASS-LINK   1

  MASS-LINK       2
IMPLND     IWATER SURO         0.0833333    RCHRES         INFLOW IVOL
  END MASS-LINK   2

  MASS-LINK       3
RCHRES     ROFLOW                           RCHRES         INFLOW
  END MASS-LINK   3

  MASS-LINK       4
RCHRES     OFLOW  OVOL   1                  RCHRES         INFLOW IVOL
  END MASS-LINK   4

  MASS-LINK       5
RCHRES     OFLOW  OVOL   2                  RCHRES         INFLOW IVOL
  END MASS-LINK   5

  MASS-LINK       6
PERLND     PWATER SURO         0.0833333    RCHRES         INFLOW IVOL
PERLND     PWATER IFWO         0.0833333    RCHRES         INFLOW IVOL
  END MASS-LINK   6

  MASS-LINK       7
PERLND     PWATER AGWO         0.0833333    RCHRES         INFLOW IVOL
  END MASS-LINK   7

  MASS-LINK       8
PERLND     PWATER PERO         0.0833333    COPY           INPUT  MEAN
  END MASS-LINK   8
  MASS-LINK      12
PERLND     PWATER AGWO         0.0833333    COPY           INPUT  MEAN
  END MASS-LINK  12

  MASS-LINK       9
IMPLND     IWATER SURO         0.0833333    COPY           INPUT  MEAN
  END MASS-LINK   9

  MASS-LINK      10
COPY       OUTPUT MEAN                      RCHRES         INFLOW IVOL
  END MASS-LINK  10

END MASS-LINK
END RUN
```

```
RUN
GLOBAL
  ***  FILE: mill65.inp REVISED Aug 2000  Joe Brascher(atc)
  *** for parameterix
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF MILLER CREEK
  ***  - POST-MILLER CK DETENTION FACIITY 10/92-6/93
  *** m23 AND M24 new area west of m2.  Flows to rdf
  *** Calibration file run for four years using full length calibration run 1990
  *** data for initial conditions
  MILLER CREEK BASIN HSPF MODEL
  START       1990 10  1  0  0  END    1994  9 30 24  0
  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname------------------------------------------->
MESSU       24    D:\PARA\SEATAC\MILLER\lowflow\MILL.MES
WDM         25    D:\PARA\SEATAC\MILLER\lowflow\Mlowflow.wdm
            61    D:\PARA\SEATAC\MILLER\lowflow\PER.L61
            62    D:\PARA\SEATAC\MILLER\lowflow\RCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      14
      PERLND      16
      PERLND      18
      PERLND      24
      PERLND      26
      PERLND      28
      PERLND      34
      PERLND      44
      PERLND      54
      IMPLND      14
      RCHRES       1
      RCHRES      23
      RCHRES      24
      RCHRES       2
      RCHRES       3
      RCHRES      33
      RCHRES       4
      RCHRES       5
      RCHRES      50
      RCHRES      52
      RCHRES      53
      RCHRES      54
      RCHRES      34
      RCHRES     135
      RCHRES      35
      RCHRES      10
      RCHRES      16
      RCHRES      11
      RCHRES      13
      RCHRES      12
      RCHRES      15
      RCHRES      14
```

```
      RCHRES        17
    END INGRP
END OPN SEQUENCE                                                                        ***

COPY
  TIMESERIES                                                                            ***
  Copy-opn                                                                              ***
    # -  #  NPT  NMN
    1    5        1
  END TIMESERIES
END COPY

PERLND
  GEN-INFO
    <PLS >       Name             NBLKS   Unit-systems   Printer                        ***
    # -  #                              User  t-series Engl Metr                        ***
                                              in   out                                  ***
   14       TFF- TILL FOR FLT        1    1    1    1   61    0
   16       TFM- TILL FOR MOD        1    1    1    1   61    0
   18       TFS- TILL FOR STP        1    1    1    1   61    0
   24       TGF- TILL GR FLT         1    1    1    1   61    0
   26       TGM- TILL GR MOD         1    1    1    1   61    0
   28       TGS- TILL GR STP         1    1    1    1   61    0
   34       OF - OUTWASH FOR         1    1    1    1   61    0
   44       OG - OUTWASH GR          1    1    1    1   61    0
 ***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
   45       AIRPORT FILL             1    1    1    1   61    0
   54       SA - WETLANDS            1    1    1    1   61    0
   64       RES- GROUNDWATER         1    1    1    1   61    0
  END GEN-INFO
  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC                   ***
   14  200    0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    <PLS > ********************* Print-flags ************************* PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
   14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  PWAT-PARM1
    <PLS > ***************** Flags ********************
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                                 ***
   14         0    0    0    0    0    0    0    0    0
   16         0.   0    0    0    0    0    0    0    0
   18         0    0    0    0    0    0    0    0    0
   24         0    0    0    0    0    0    0    0    0
   26         0    0    0    0    0    0    0    0    0
   28         0    0    0    0    0    0    0    0    0
   34         0    0    0    0    0    0    0    0    0
   44         0    0    0    0    0    0    0    0    0
   45         0    0    0    0    0    0    0    0    0
   54         0    0    0    0    0    0    0    0    0
   64         0    0    0    0    0    0    0    0    0
  END PWAT-PARM1
  PWAT-PARM2
    <PLS > ***
```

```
  # -   # ***FOREST        LZSN     INFILT      LSUR     SLSUR     KVARY     AGWRC
 14                      9.0000     0.3200    400.00    0.0500    0.5000    0.9960
 16                      9.0000     0.3200    400.00    0.1000    0.5000    0.9960
 18                      9.0000     0.3200    200.00    0.2000    0.5000    0.9960
 24                      9.0000     0.1200    400.00    0.0500    0.5000    0.9960
 26                      9.0000     0.1200    400.00    0.1000    0.5000    0.9960
 28                      9.0000     0.1200    200.00    0.2000    0.5000    0.9960
 34                     10.0000     2.0000    400.00    0.0500    0.3000    0.9960
 44                     10.0000     0.8000    400.00    0.0500    0.3000    0.9960
 45                      7.5000     0.0200    300.00    0.0700    0.0000    0.9000
 54                      8.0000     2.0000    100.00    0.0010    0.5000    0.9960
END PWAT-PARM2
PWAT-PARM3
  <PLS >***
  # -   #*** PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
 14                              2.0000    2.0000      0.33      0.00       0.0
 16                              2.0000    2.0000      0.33      0.00       0.0
 18                              2.0000    2.0000      0.33      0.00       0.0
 24                              2.0000    2.0000      0.33      0.00        0.
 26                              2.0000    2.0000      0.33        0.        0.
 28                              2.0000    2.0000      0.33        0.        0.
 34                              2.0000    2.0000      0.33      0.00       0.0
 44                              2.0000    2.0000      0.33        0.        0.
 54                              10.000    2.0000      0.33        0.       0.7
END PWAT-PARM3
PWAT-PARM4
                                                                   ***
  <PLS >
  # -   #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
 14          0.2000    1.5000    0.3500     9.000    0.7000    0.7000
 16          0.2000    0.7500    0.3500     9.000    0.7000    0.7000
 18          0.2000    0.4500    0.3500     9.000    0.3000    0.7000
 24          0.1000    0.7500    0.2500     9.000    0.7000    0.2500
 26          0.1000    0.3750    0.2500     9.000    0.7000    0.2500
 28          0.1000    0.2250    0.2500     9.000    0.3000    0.2500
 34          0.2000    0.7500    0.3500     0.000    0.7000    0.7000
 44          0.1000    0.7500    0.2500     0.000    0.7000    0.2500
 54          0.1000    2.2500    0.5000     1.000    0.7000    0.8000
END PWAT-PARM4
PWAT-STATE1
  <PLS >  PWATER state variables***
  # -   #***   CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
 16           0.000        0.    0.0010      0.00     0.941     3.108     0.048
 26           0.000        0.    0.0010      0.00     7.672     3.341     0.071
 34           0.000        0.    0.0010      0.00     1.187     3.776     0.052
 44           0.000        0.    0.0040      0.00     9.402     4.905     0.104
 45           0.000        0.    0.0000      0.00     2.000     2.000     0.000
 54           0.000        0.    0.0960      0.00     3.211     0.000     0.000
 14           0.078        0.    0.2500      0.10     2.000     2.000     0.000
 18           0.078        0.    0.2500      0.10     2.000     2.000     0.000
 24           0.051        0.    0.2500      0.10     2.000     2.000     0.000
 28           0.051        0.    0.2500      0.10     2.000     2.000     0.000
 64           0.051        0.    0.2500      0.10     2.000     2.000     0.000
END PWAT-STATE1
END PERLND
IMPLND
  GEN-INFO
    <ILS >      Name              Unit-systems   Printer                      ***
```

```
  # -  #                        User  t-series Engl Metr                     ***
                                        in  out                              ***
 14      IMPERVIOUS               1    1    1   60    0
END GEN-INFO
ACTIVITY
  <ILS > ************* Active Sections ****
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL  ***
 14         0    0    1    0    0    0
END ACTIVITY
PRINT-INFO
  <ILS > ******** Print-flags ******** PIVL  PYR
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
 14         0    0    6    0    0    0    1    9
END PRINT-INFO
IWAT-PARM1
  <ILS >           Flags            ***                                      ***
  # -  # CSNO RTOP  VRS  VNN RTLI   ***                                      ***
 14         0    0    0    0    0
END IWAT-PARM1
IWAT-PARM2
  <ILS >                                                                     ***
  # -  #      LSUR     SLSUR      NSUR     RETSC                             ***
 14         100.00    0.0100    0.1000    0.1000
END IWAT-PARM2
IWAT-PARM3
  <ILS >                                                                     ***
  # -  #    PETMAX    PETMIN                                                 ***
 14
END IWAT-PARM3
IWAT-STATE1
  <ILS >  IWATER state variables                                             ***
  # -  #      RETS      SURS                                                 ***
 14       1.0000E-3 1.0000E-3
END IWAT-STATE1
END IMPLND
                                                                             ***
EXT SOURCES
                                                                             ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes.
                                                                             ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM   1002 PREC     ENGLZERO  1.00         PERLND  14 200 EXTNL  PREC
WDM   1002 PREC     ENGLZERO  1.00         IMPLND  14     EXTNL  PREC
WDM      1 EVAP     ENGLZERO  0.8          PERLND  14  18 EXTNL  PETINP
WDM      1 EVAP     ENGLZERO  0.8          PERLND  24  28 EXTNL  PETINP
WDM      1 EVAP     ENGLZERO  0.8          PERLND  34  54 EXTNL  PETINP
WDM      1 EVAP     ENGLZERO  0.8          PERLND  64     EXTNL  PETINP
WDM      1 EVAP     ENGLZERO  0.8          IMPLND  14     EXTNL  PETINP
*** PRECIP/EVAP TO LAKES
WDM   1002 PREC     ENGLZERO               RCHRES   1     EXTNL  PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES   1     EXTNL  POTEV
WDM   1002 PREC     ENGLZERO               RCHRES   4     EXTNL  PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES   4     EXTNL  POTEV
WDM      1 EVAP     ENGLZERO    0.8        RCHRES   1     EXTNL  POTEV
WDM   1002 PREC     ENGLZERO               RCHRES   1     EXTNL  PREC
```

```
WDM       1 EVAP      ENGLZERO     0.8        RCHRES   4      EXTNL  POTEV
WDM    1002 PREC      ENGLZERO                RCHRES   4      EXTNL  PREC
WDM    1002 PREC      ENGLZERO                RCHRES  11      EXTNL  PREC
WDM       1 EVAP      ENGLZERO     0.8        RCHRES  11      EXTNL  POTEV
WDM    1002 PREC      ENGLZERO                RCHRES  13      EXTNL  PREC
WDM       1 EVAP      ENGLZERO     0.8        RCHRES  13      EXTNL  POTEV
WDM    1002 PREC      ENGLZERO                RCHRES  23      EXTNL  PREC
WDM       1 EVAP      ENGLZERO     0.8        RCHRES  23      EXTNL  POTEV
WDM    1002 PREC      ENGLZERO                RCHRES  34      EXTNL  PREC
WDM       1 EVAP      ENGLZERO     0.8        RCHRES  34      EXTNL  POTEV
WDM    1002 PREC      ENGLZERO                RCHRES  53      EXTNL  PREC
WDM       1 EVAP      ENGLZERO     0.8        RCHRES  53      EXTNL  POTEV
WDM    1002 PREC      ENGLZERO                RCHRES  54      EXTNL  PREC
WDM       1 EVAP      ENGLZERO     0.8        RCHRES  54      EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
*** UPPER MILLER CREEK GROUNDWATER PUMPING
COPY *** 1 OUTPUT MEAN   1    12.1         WDM     18 FLOW     ENGL      REPL
*** GAUGE POINTS (17=MOUTH, 54=MILLER RDF, 50=SR 518, 18=WALKER CK)
RCHRES  35 HYDR   RO                       WDM   8035 FLOW     ENGL      REPL
RCHRES  17 HYDR   RO          ***          WDM     33 FLOW     ENGL      REPL
RCHRES  54 HYDR   RO          ***          WDM     34 FLOW     ENGL      REPL
RCHRES  50 HYDR   RO          ***          WDM     35 FLOW     ENGL      REPL
RCHRES  18 HYDR   RO          ***          WDM     36 FLOW     ENGL      REPL
*** MISC (20=WALKER WETLAND, 55=SR509, 56=1ST AVE, 1=ARBOR LAKE)
RCHRES  23 HYDR   STAGE  ***               WDM     91 STAG     ENGL      REPL
RCHRES  20 HYDR   RO     ***               WDM     37 FLOW     ENGL      REPL
RCHRES  55 HYDR   RO     ***               WDM     38 FLOW     ENGL      REPL
RCHRES  62 HYDR   RO     ***               WDM     39 FLOW     ENGL      REPL
RCHRES   1 HYDR   RO     ***               WDM     80 FLOW     ENGL      REPL
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
 ***MOUTH
RCHRES  54 HYDR   RO     1 1 0.000419   *** WDM     60 SIMQ     ENGL      REPL
RCHRES  17 HYDR   RO     1 1 0.000213   *** WDM     70 SIMQ     ENGL      REPL
END EXT TARGETS
                                                                             ***

SCHEMATIC
<-Source->                 <--Area-->     <-Target->    MBLK     ***
<Name>   #                 <-factor->     <Name>   #    Tbl#     ***
  *** SUB-CATCHMENT 1 all agwo goes to sound
PERLND  16                       3.41     RCHRES   1       6
PERLND  26                     232.36     RCHRES   1       6
PERLND  34                       3.07     RCHRES   1       6
PERLND  44                      38.03     RCHRES   1       6
PERLND  54                       3.87     RCHRES   1       6
IMPLND  14                      56.14     RCHRES   1       2
 *** SUB-CATCHMENT 2 10% of area GW goes to vaca 90% goes to sound
PERLND  16                       5.56     RCHRES   2       6
PERLND  26                     200.05     RCHRES   2       6
PERLND  34                       0.46     RCHRES   2       6
PERLND  44                      38.71     RCHRES   2       6
PERLND  16                       0.56     RCHRES 135       7
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PERLND  26                      20.01      RCHRES 135        7
PERLND  34                       0.05      RCHRES 135        7
PERLND  44                       3.87      RCHRES 135        7
IMPLND  14                      42.22      RCHRES   2        2
 *** SUB-CATCHMENT 23 New subbasin 15 % OF GW GOES TO VACCA 85% TO SOUND
PERLND  16                       3.09      RCHRES  23        6
PERLND  26                     156.15      RCHRES  23        6
PERLND  34                       2.25      RCHRES  23        6
PERLND  44                      45.84      RCHRES  23        6
PERLND  16                       0.46      RCHRES 135        7
PERLND  26                      23.42      RCHRES 135        7
PERLND  34                       0.34      RCHRES 135        7
PERLND  44                       6.88      RCHRES 135        7
IMPLND  14                      58.44      RCHRES  23        2
 *** SUB-CATCHMENT 24 New subbasin 60 % OF GW GOES TO 11 40% TO SOUND
PERLND  26                     135.43      RCHRES  24        6
PERLND  34                       2.02      RCHRES  24        6
PERLND  44                      69.29      RCHRES  24        6
PERLND  26                      81.26      RCHRES  11        7
PERLND  34                       1.21      RCHRES  11        7
PERLND  44                      41.57      RCHRES  11        7
IMPLND  14                      79.98      RCHRES  24        2
   *** SUB-CATCHMENT 3 agwo goes to vaca(135)
PERLND  16                       8.26      RCHRES   3        6
PERLND  26                     108.38      RCHRES   3        6
PERLND  34                      16.02      RCHRES   3        6
PERLND  44                     102.89      RCHRES   3        6
PERLND  54                       0.04      RCHRES   3        6
PERLND  16                       8.26      RCHRES 135        7
PERLND  26                     108.38      RCHRES 135        7
PERLND  34                      16.02      RCHRES 135        7
PERLND  44                     102.89      RCHRES 135        7
PERLND  54                       0.04      RCHRES 135        7
IMPLND  14                      27.30      RCHRES   3        2
   *** SUB-CATCHMENT 4 10% of agwo goes to rchres 90% goes to sound
PERLND  16                       2.95      RCHRES   4        6
PERLND  26                      85.95      RCHRES   4        6
PERLND  34                       3.75      RCHRES   4        6
PERLND  44                      92.06      RCHRES   4        6
PERLND  16                       0.30      RCHRES   4        7
PERLND  26                       8.60      RCHRES   4        7
PERLND  34                       0.38      RCHRES   4        7
PERLND  44                       9.21      RCHRES   4        7
IMPLND  14                      18.43      RCHRES   4        2
   *** SUB-CATCHMENT 4a 70% of agwo goes to rchres 30% goes to sound
PERLND  16                       8.66      RCHRES   4        6
PERLND  26                      61.64      RCHRES   4        6
PERLND  34                      22.06      RCHRES   4        6
PERLND  44                      78.09      RCHRES   4        6
PERLND  54                      12.50      RCHRES   4        6
PERLND  16                       6.06      RCHRES   4        7
PERLND  26                      43.15      RCHRES   4        7
PERLND  34                      15.44      RCHRES   4        7
PERLND  44                      54.66      RCHRES   4        7
PERLND  54                       8.75      RCHRES   4        7
IMPLND  14                      29.14      RCHRES   4        2
   *** SUB-CATCHMENT 5
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PERLND  26                     10.29     RCHRES   5      1
PERLND  44                     50.04     RCHRES   5      1
PERLND  54                     10.74     RCHRES   5      1
IMPLND  14                     16.31     RCHRES   5      2
  *** SUB-CATCHMENT 6
PERLND  16                     10.66     RCHRES  53      1
PERLND  26                     41.08     RCHRES  53      1
PERLND  34                     21.75     RCHRES  53      1
PERLND  44                     13.39     RCHRES  53      1
PERLND  54                      0.82     RCHRES  53      1
IMPLND  14                      7.14     RCHRES  53      2
  *** SUB-CATCHMENT 8
PERLND  44                     22.21     RCHRES  35      1
IMPLND  14                      6.60     RCHRES  35      2
  *** SUB-CATCHMENT 9
PERLND  16                      4.94     RCHRES  34      1
PERLND  26                     14.32     RCHRES  34      1
PERLND  34                      0.05     RCHRES  34      1
PERLND  44                     56.70     RCHRES  34      1
PERLND  54                      0.01     RCHRES  34      1
IMPLND  14                     22.46     RCHRES  34      2
  *** SUB-CATCHMENT 10
PERLND  16                      4.15     RCHRES  10      1
PERLND  26                     31.94     RCHRES  10      1
PERLND  44                     95.23     RCHRES  10      1
IMPLND  14                     71.97     RCHRES  10      2
  *** SUB-CATCHMENT 11 25% OF AGWO GOES TO 15
PERLND  16                      0.89     RCHRES  11      6
PERLND  26                    217.92     RCHRES  11      6
PERLND  34                      1.32     RCHRES  11      6
PERLND  44                     65.65     RCHRES  11      6
PERLND  16                      0.67     RCHRES  11      7
PERLND  26                    163.44     RCHRES  11      7
PERLND  34                      0.99     RCHRES  11      7
PERLND  44                     49.24     RCHRES  11      7
PERLND  16                      0.22     RCHRES  15      7
PERLND  26                     54.48     RCHRES  15      7
PERLND  34                      0.33     RCHRES  15      7
PERLND  44                     16.41     RCHRES  15      7
IMPLND  14                    230.80     RCHRES  11      2
  *** SUB-CATCHMENT 12
PERLND  16                      0.39     RCHRES  12      1
PERLND  26                    101.18     RCHRES  12      1
PERLND  34                      5.64     RCHRES  12      1
PERLND  44                     54.98     RCHRES  12      1
PERLND  54                      0.64     RCHRES  12      1
IMPLND  14                     79.83     RCHRES  12      2
  *** SUB-CATCHMENT 13
PERLND  16                      0.79     RCHRES  13      1
PERLND  26                    197.68     RCHRES  13      1
IMPLND  14                     27.66     RCHRES  13      2
  *** SUB-CATCHMENT 14 50% OF AGWO GOES TO SOUND
PERLND  16                      0.24     RCHRES  14      6
PERLND  26                    118.67     RCHRES  14      6
PERLND  34                     13.46     RCHRES  14      6
PERLND  44                     41.91     RCHRES  14      6
PERLND  16                      0.12     RCHRES  14      7
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PERLND  26                      59.34    RCHRES  14      7
PERLND  34                       6.73    RCHRES  14      7
PERLND  44                      20.95    RCHRES  14      7
IMPLND  14                      20.66    RCHRES  14      2
  *** SUB-CATCHMENT 15
PERLND  16                       6.59    RCHRES  15      1
PERLND  26                      49.55    RCHRES  15      1
PERLND  34                      50.09    RCHRES  15      1
PERLND  44                      86.52    RCHRES  15      1
IMPLND  14                      19.47    RCHRES  15      2
  *** SUB-CATCHMENT 16
PERLND  16                      10.93    RCHRES  16      1
PERLND  26                      30.30    RCHRES  16      1
PERLND  34                      20.03    RCHRES  16      1
PERLND  44                      31.42    RCHRES  16      1
IMPLND  14                      15.54    RCHRES  16      2
  *** SUB-CATCHMENT 17 AGWO GOES TO SOUND
PERLND  16                       0.90    RCHRES  17      6
PERLND  26                      16.31    RCHRES  17      6
PERLND  34                      34.82    RCHRES  17      6
PERLND  44                      82.11    RCHRES  17      6
PERLND  54                       2.19    RCHRES  17      6
IMPLND  14                      10.49    RCHRES  17      2
  *** SUB-CATCHMENT MC-1
PERLND  26                       0.17    RCHRES  52      1
PERLND  44                       8.21    RCHRES  52      1
PERLND  54                       0.27    RCHRES  52      1
IMPLND  14                       0.09    RCHRES  52      2
  *** SUB-CATCHMENT MC-2
PERLND  16                       0.08    RCHRES  53      1
PERLND  26                       0.64    RCHRES  53      1
PERLND  34                       6.72    RCHRES  53      1
PERLND  44                      10.43    RCHRES  53      1
PERLND  54                      15.25    RCHRES  53      1
IMPLND  14                       0.27    RCHRES  53      2
  *** SUB-CATCHMENT MC-3
PERLND  34                       5.44    RCHRES  54      1
PERLND  44                       5.03    RCHRES  54      1
PERLND  54                       2.28    RCHRES  54      1
IMPLND  14                       0.11    RCHRES  54      2
  *** SUB-CATCHMENT MC-4
PERLND  44                      17.32    RCHRES 135      1
PERLND  54                      14.41    RCHRES 135      1
IMPLND  14                       1.77    RCHRES 135      2
  *** SUB-CATCHMENT MC-5
PERLND  26                      13.49    RCHRES  35      1
PERLND  44                      31.06    RCHRES  35      1
PERLND  54                       5.95    RCHRES  35      1
IMPLND  14                       2.50    RCHRES  35      2
  *** SUB-CATCHMENT MC-6
PERLND  44                      17.75    RCHRES  35      1
PERLND  54                       6.54    RCHRES  35      1
IMPLND  14                       0.95    RCHRES  35      2
  *** SUB-CATCHMENT MC-6B
PERLND  26                      34.94    RCHRES  35      1
PERLND  34                       7.81    RCHRES  35      1
PERLND  44                      52.91    RCHRES  35      1
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PERLND  54                         4.61     RCHRES  35      1
IMPLND  14                         3.14     RCHRES  35      2
  *** SUB-CATCHMENT MC-7
PERLND  26                        12.66     RCHRES  16      1
PERLND  44                        33.53     RCHRES  16      1
PERLND  54                         4.16     RCHRES  16      1
IMPLND  14                         3.88     RCHRES  16      2
  *** SUB-CATCHMENT MC-7B
PERLND  26                        36.16     RCHRES  16      1
PERLND  44                         8.46     RCHRES  16      1
PERLND  54                         1.92     RCHRES  16      1
IMPLND  14                         2.12     RCHRES  16      2
***all sdn basin agwo goes to 35
  *** SUB-CATCHMENT SDN-1
PERLND  26                         3.23     RCHRES  52      6
PERLND  44                         2.11     RCHRES  52      6
PERLND  54                         0.20     RCHRES  52      6
PERLND  26                         3.23     RCHRES 135      7
PERLND  44                         2.11     RCHRES 135      7
PERLND  54                         0.20     RCHRES 135      7
IMPLND  14                         8.29     RCHRES  52      2

  *** SUB-CATCHMENT SDN-1-LWR
PERLND  44                         4.97     RCHRES  52      6
PERLND  54                         0.07     RCHRES  52      6
PERLND  44                         4.97     RCHRES 135      7
PERLND  54                         0.07     RCHRES 135      7
IMPLND  14                         0.38     RCHRES  52      2

  *** SUB-CATCHMENT SDN-1-OFF
PERLND  26                        29.12     RCHRES  52      6
PERLND  44                         3.62     RCHRES  52      6
PERLND  54                         1.67     RCHRES  52      6
PERLND  26                        29.12     RCHRES 135      7
PERLND  44                         3.62     RCHRES 135      7
PERLND  54                         1.67     RCHRES 135      7
IMPLND  14                        11.50     RCHRES  52      2

  *** SUB-CATCHMENT SDN-2
PERLND  26                        10.41     RCHRES  52      6
PERLND  44                         3.04     RCHRES  52      6
PERLND  26                        10.41     RCHRES 135      7
PERLND  44                         3.04     RCHRES 135      7
IMPLND  14                        33.22     RCHRES  52      2

  *** SUB-CATCHMENT SDN-2X
PERLND  26                         1.37     RCHRES  52      6
PERLND  44                         5.84     RCHRES  52      6
PERLND  26                         1.37     RCHRES 135      7
PERLND  44                         5.84     RCHRES 135      7
IMPLND  14                         0.28     RCHRES  52      2

  *** SUB-CATCHMENT SDN-3
PERLND  26                        49.79     RCHRES  54      6
PERLND  26                        49.79     RCHRES 135      7
IMPLND  14                        15.82     RCHRES  54      2
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  *** SUB-CATCHMENT SDN-3X
PERLND  16                             0.65     RCHRES  54        6
PERLND  26                             5.17     RCHRES  54        6
PERLND  34                            13.64     RCHRES  54        6
PERLND  44                             5.34     RCHRES  54        6
PERLND  54                             0.57     RCHRES  54        6
PERLND  16                             0.65     RCHRES 135        7
PERLND  26                             5.17     RCHRES 135        7
PERLND  34                            13.64     RCHRES 135        7
PERLND  44                             5.34     RCHRES 135        7
PERLND  54                             0.57     RCHRES 135        7

  *** SUB-CATCHMENT SDN-4
PERLND  26                            24.43     RCHRES  52        6
PERLND  44                             3.19     RCHRES  52        6
PERLND  26                            24.43     RCHRES 135        7
PERLND  44                             3.19     RCHRES 135        7
IMPLND  14                             2.61     RCHRES  52        2

  *** SUB-CATCHMENT SDN-4X
PERLND  26                             1.57     RCHRES  52        6
PERLND  34                             1.16     RCHRES  52        6
PERLND  44                            10.01     RCHRES  52        6
PERLND  26                             1.57     RCHRES 135        7
PERLND  34                             1.16     RCHRES 135        7
PERLND  44                            10.01     RCHRES 135        7

***ROUTING FOR MILLER CREEK
*** M1 TO M2 TO M3 TO STORAGE 50.  M4 TO M5 TO STORAGE 50
RCHRES   1                                      RCHRES   2        4
RCHRES  23                                      RCHRES  24        4
RCHRES  24                                      RCHRES   3        3
RCHRES   2                                      RCHRES   3        3
RCHRES   3                                      RCHRES  33        3
RCHRES  33                                      RCHRES  50        3
RCHRES   4                                      RCHRES   5        4
RCHRES   5                                      RCHRES  50        3
*** NEW STREAM REACH 52 TO LAKE REBA 53 TO RDF 54
RCHRES  52                                      RCHRES  53        3
RCHRES  53                                      RCHRES  54        3
RCHRES  50                                      RCHRES  54        3
*** RDF 54 TO 35
RCHRES  54                                      RCHRES 135        3
RCHRES  34                                      RCHRES 135        4
RCHRES  34                                      RCHRES 135        5
RCHRES 135                                      RCHRES  35        3
RCHRES  10                                      RCHRES  16        3
RCHRES  35                                      RCHRES  16        3
RCHRES  11                                      RCHRES  15        3
RCHRES  13                                      RCHRES  12        4
RCHRES  13                                      RCHRES  12        5
RCHRES  12                                      RCHRES  15        3
RCHRES  16                                      RCHRES  15        3
RCHRES  14                                      RCHRES  17        3
RCHRES  15                                      RCHRES  17        3
END SCHEMATIC
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NETWORK
                                                                                ***
***       <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>       <-MEMBER->
<NAME>   # <NAME>   TEM STRG<-FACTOR->STRG <NAME>   #   # <-GRP> <NAME> # # ***
                                                                                ***
END NETWORK
                                                                                ***
RCHRES
  GEN-INFO
    RCHRES        Name           Nexits   Unit Systems   Printer                ***
    # -   #<------------------><---> User T-series  Engl Metr LKFG              ***
                                             in  out                            ***
    1      Arbor Lake  M 1          2     1    1    1    62    0    0
    2      Arbor Ck -03710 M 2      1     1    1    1    62    0    0
    3      Arbor Ck    M 3          1     1    1    1    62    0    0
    4      Tub Lake    M 4          2     1    1    1    62    0    0
    5      Miller Ck SR518 M5       1     1    1    1    62    0    0
   10      Trib (0371G)    M 10     1     1    1    1    62    0    0
   11      M11 Ambaum Detention     1     1    1    1    62    0    0
   12      Trib(0354)  M 12         1     1    1    1    62    0    0
   13      Burien Lake M 13         2     1    1    1    62    0    0
   14      Trib (0353) M 14         1     1    1    1    62    0    0
   15      M/S U/S OF 17            1     1    1    1    62    0    0
   16      U/S OF 15 M/S            1     1    1    1    62    0    0
   17      GAGE                     1     1    1    1    62    0    0
   23      BASIN M23                2     1    1    1    62    0    0
   24      BASIN M24                1     1    1    1    62    0    0
   33      detention m3             1     1    1    1    62    0    0
   34      LORA LAKE                2     1    1    1    62    0    0
   35      D/S OF VACA FARM         1     1    1    1    62    0    0
   38      MC basins                1     1    1    1    62    0    0
   50      sr 518                   1     1    1    1    62    0    0
   52      U/S OF LAKE REBA         1     1    1    1    62    0    0
   53      Reba outflow             1     1    1    1    62    0    0
   54      Miller RDF outflow       1     1    1    1    62    0    0
  135      VACA FARMS               1     1    1    1    62    0    0
  END GEN-INFO
  ACTIVITY
    RCHRES *************** Active Sections *****************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG                     ***
    1  999    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    RCHRES *************** Printout Flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
    1  999    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                          ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each      FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit       possible  exit
             *  *  *  *   *  *  *  *  *       *  *  *  *  *          ***
    1        0  1  0  0   4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    2        0  0  0  0   4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
    3        0  0  0  0   4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
    4        0  1  0  0   4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    5   12   0  0  0  0   4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
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  13         0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  14    22   0  0  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  23         0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  24    33   0  0  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  34         0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  35   999   0  0  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
END HYDR-PARM1
HYDR-PARM2
  RCHRES                                                                ***
  # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50      ***
<------><--------><--------><--------><--------><--------><-------->      ***
  1               1  0.010                             0.3
  2               2  0.776                             0.3
  3               3  0.980                             0.3
  4               4  0.010                             0.3
  5               5  0.380                             0.3
 10              10  0.380                             0.3
 11              11  0.010                             0.3
 12              12  1.000                             0.3
 13              13  0.015                             0.3
 14              14  0.450                             0.3
 15              15  0.735                             0.3
 16              16  0.587                             0.3
 17              17  0.379                             0.3
 23              23  0.379               300.0         0.3
 24              24  0.379                             0.3
 33              33  0.200                             0.3
 34              34  0.852                             0.3
 35              35  0.663                             0.3
 38              38  0.010                             0.3
 50              50  0.010                             0.3
 52              52  0.010                             0.3
 53              53  0.010                             0.3
 54              54  0.010                             0.3
135             135  0.350                             0.3
END HYDR-PARM2
HYDR-INIT
  RCHRES  Initial conditions for each HYDR section                      ***
  # -  # ***   VOL     Initial  value  of COLIND   Initial  value  of OUTDGT
         *** ac-ft     for each possible exit      for each possible exit
<------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  1     2.0              4.0  5.0
  2     0.0              4.0
  3     0.0              4.0  5.0
  4     2.0              4.0
  5     0.0              4.0
 10     0.0              4.0
 11     0.0              4.0
 12     0.0              4.0
 13    10.0              4.0  5.0
 14     0.0              4.0
 15     0.0              4.0
 16     0.0              4.0
 17     0.0              4.0
 23     6.0              4.0  5.0
 24     0.0              4.0
 33     0.0              4.0
```

AR 011481

```
   34      9.0                 4.0   5.0
   35      0.1                 4.0
   38      0.1                 4.0
   50      0.0                 4.0
   52      0.0                 4.0
   53      0.1                 4.0
   54      2.25                4.0
  135      0.00                4.0
  END HYDR-INIT
END RCHRES

FTABLES
***UPPER BASIN
***===========

  FTABLE       1
 ROWS COLS ***
   11    5
     DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
     0.00        3.00      0.00       0.00     0.00
     2.50        3.00      7.50       0.00     0.11
     3.00        3.00      9.00       1.80     0.11
     3.50        3.30     10.58       5.00     0.11
     4.00        3.60     12.30      10.90     0.11
     4.50        3.90     14.18      17.50     0.11
     5.00        4.10     16.18      26.20     0.11
     5.50        4.30     18.28      32.50     0.11
     6.00        4.50     20.48      35.90     0.11
     7.00        5.00     25.23      38.10     0.11
     8.00        5.50     30.48      46.40     0.11
  END FTABLE  1

  FTABLE       2
 ROWS COLS ***
    9    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0000    0.0000       0.00
     0.100     0.2571    0.0129       0.16
     0.500     0.3873    0.1417       6.53
     1.000     0.5501    0.3761      25.95
     1.500     0.7128    0.6918      59.86
     2.000     0.8756    1.0889     110.67
     3.000     1.2011    2.1273     272.24
     3.500     1.3639    2.7685     387.38
     4.000     1.5266    3.4912     528.19
  END FTABLE  2

  FTABLE       3
 ROWS COLS ***
   12    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0000    0.0000       0.00
     0.100     0.9669    0.0483       0.13
     0.500     1.0637    0.4545       4.92
     1.000     1.1846    1.0165      17.12
     1.500     1.3055    1.6390      34.92
     2.000     1.4264    2.3220      57.95
```

```
     2.500     1.5473     3.0654      86.14
     3.000     1.6682     3.8693     119.53
     3.500     1.7891     4.7336     158.24
     4.000     1.9100     5.6584     202.41
     4.500     2.0294     6.6310     251.52
     5.000     2.1488     7.6624     306.28
  END FTABLE  3

  FTABLE      4
 ROWS COLS ***
    7    5
     DEPTH      AREA     VOLUME     OUTFLOW OUTFLOW2***
      0.00     3.00     0.00       0.00       0.00
      2.50     4.50     9.38       0.00       0.11
      3.00     6.00     12.00      6.00       0.11
      4.00     10.00    20.00      13.00      0.11
      5.00     15.00    32.50      20.00      0.11
      6.00     20.00    50.00      26.00      0.11
      7.00     25.00    72.50      168.00     0.11
  END FTABLE  4

  FTABLE      5
 ROWS COLS ***
   10    4
     DEPTH      AREA     VOLUME     OUTFLOW    ***
     0.000     0.0000     0.0000       0.00
     0.100     0.1010     0.0051       0.03
     0.500     0.1754     0.0603       1.46
     1.000     0.2684     0.1713       6.16
     1.500     0.3614     0.3288      14.89
     2.000     0.4544     0.5327      28.48
     2.500     0.5474     0.7832      47.70
     3.000     0.6404     1.0801      73.29
     3.500     0.7334     1.4236     105.94
     4.000     0.8264     1.8136     146.33
  END FTABLE  5

  FTABLE     10
 ROWS COLS ***
    9    4
     DEPTH      AREA     VOLUME     OUTFLOW    ***
     0.000     0.0000     0.0000       0.00
     0.100     0.1010     0.0051       0.06
     0.500     0.1660     0.0585       2.27
     1.000     0.2472     0.1618       9.32
     1.500     0.3285     0.3057      22.08
     2.000     0.4097     0.4902      41.66
     2.500     0.4909     0.7154      69.09
     3.000     0.5722     0.9811     105.37
     4.000     0.6887     1.6116     209.70
  END FTABLE 10

  POST AMBAUM DETENTION ***
  FTABLE     11
 ROWS COLS ***
   11    4
     DEPTH      AREA     VOLUME     OUTFLOW    ***
```

```
     0.000     0.0000     0.0000         0.00
     1.000     0.1000     0.2300         3.90
     2.000     0.2000     0.6000         6.30
     3.000     0.3000     0.9700         8.10
     4.000     0.4000     1.3400        11.10
     5.000     0.5000     1.8200        16.00
     6.000     0.6000     2.2700        19.10
     7.000     0.7000     2.8300        21.60
     8.000     0.8000     3.3700        30.80
     9.000     0.9000     4.0000        38.10
    10.000     1.0000     4.6500        74.10
    10.500     1.1000     5.2000       133.00
    11.000     1.1500     5.3000       500.00
  END FTABLE 11

  FTABLE     12
 ROWS COLS ***
    6    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0000     0.0000       0.00
     0.100     0.6327     0.0316       0.15
     0.500     0.7960     0.3174       5.87
     1.000     1.0002     0.7664      21.53
     1.500     1.2043     1.3176      46.43
     2.000     1.4085     1.9708      81.20
     3.000     1.8168     3.5834     183.79
     4.000     2.2251     5.6044     336.22
     5.000     2.6335     8.0337     545.30
     6.000     3.0418    10.8713     817.51
  END FTABLE 12

  FTABLE     13
 ROWS COLS ***
    7    5
     DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
     0.000     40.000     0.0000       0.00     0.00
     1.000     41.400     40.000       0.00     0.11
     1.500     42.000     60.000      10.00     0.11
     2.000     42.700     80.000      16.00     0.11
     2.500     43.300     100.00      20.00     0.11
     3.000     44.000     120.00      28.00     0.11
     5.000     45.000     210.00      45.00     0.11
  END FTABLE 13

  FTABLE     14
 ROWS COLS ***
    6    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0000     0.0000       0.00
     0.100     0.3361     0.0168       0.24
     0.500     0.3809     0.1602       9.04
     1.000     0.4370     0.3647      31.61
     1.500     0.4930     0.5972      65.00
     2.000     0.5491     0.8577     108.85
     2.500     0.6051     1.1462     163.33
     3.000     0.6612     1.4628     228.78
  END FTABLE 14
```

```
 FTABLE     15
ROWS COLS ***
  4    4
   DEPTH       AREA      VOLUME    OUTFLOW   ***
    0.00      0.10       0.00       0.00
    1.00      1.00       0.55      91.00
    2.00      1.10       1.60     268.00
    3.00      1.20       2.75     493.00
 END FTABLE 15

 FTABLE     16
ROWS COLS ***
  4    4
   DEPTH       AREA      VOLUME    OUTFLOW   ***
    0.00      0.10       0.00       0.00
    1.00      1.00       0.55      74.00
    2.00      1.10       1.60     219.00
    3.00      1.20       2.75     403.00
 END FTABLE 16

 FTABLE     17
ROWS COLS ***
  5    4
   DEPTH       AREA      VOLUME    OUTFLOW   ***
    0.00      0.10       0.00       0.00
    1.00      1.00       0.55      59.00
    2.00      1.10       1.60     173.00
    3.00      1.20       2.75     318.00
    4.00      1.30       4.00     484.00
 END FTABLE 17

 FTABLE     23
ROWS COLS ***   HERMES
  9    5
   DEPTH       AREA      VOLUME    OUTFLOW OUTFLOW    ***
    0.00      0.00       0.00       0.00      0.00              0.00
    5.00      0.50       1.91       0.00      0.00            305.00
   11.00      0.79       5.79       0.00      0.00            311.00
   15.00      1.13       9.64       0.50      0.01            315.00
   19.00      1.72      15.34       0.50      0.05            319.00
   29.00      2.86      38.25       0.50      0.10            329.00
   39.00      4.40      74.55       0.50      0.20            339.00
   50.00      6.22     132.98       0.50      0.30            350.00
   60.00     10.00    1212.98       0.50      0.40            360.00
 END FTABLE 23

 FTABLE     24
ROWS COLS ***
  9    4
   DEPTH       AREA      VOLUME    OUTFLOW   ***
   0.000     0.0000     0.0000       0.00
   0.100     0.2571     0.0129       0.16
   0.500     0.3873     0.1417       6.53
   1.000     0.5501     0.3761      25.95
   1.500     0.7128     0.6918      59.86
   2.000     0.8756     1.0889     110.67
```

```
   3.000    1.2011    2.1273    272.24
   3.500    1.3639    2.7685    387.38
   4.000    1.5266    3.4912    528.19
 END FTABLE 24

 FTABLE      33
ROWS COLS ***
  11    4
   DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.00      1.00      0.00       0.00
    0.50      1.20      0.55       2.00
    1.00      1.40      1.20       6.00
    1.50      1.60      1.95       9.00
    2.00      1.80      2.80      13.00
    2.50      2.00      3.75      16.50
    3.00      2.20      4.80      20.00
    3.50      2.40      5.95      23.00
    4.00      2.60      7.20      26.00
    5.00      2.80      9.90     104.00
    6.00      3.00     12.80     246.00
 END FTABLE 33

 FTABLE      34
ROWS COLS *** REVISED 11/19/97 BASED ON HEC-RAS MODEL
   6    5
   DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
    0.00       3.00      0.00       0.00     0.00
    3.00       3.05      9.08       0.00     0.11
    4.00       3.10     12.15       0.00     0.11
    5.00       3.15     15.28       0.00     0.11
    6.00       3.20     18.45       72.0     0.11
    7.00       3.25     21.68      225.0     0.11
 END FTABLE 34

 FTABLE      35
ROWS COLS *** REVISED 11/19/97 BASED ON HECRAS MODEL
   5    4
   DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.00      0.10      0.00       0.00
    1.00      1.10      0.60      38.00
    2.00      1.20      1.75     108.00
    3.00      1.30      3.00     194.00
    4.00      1.40      4.35     290.00
 END FTABLE 35

 FTABLE      38
ROWS COLS ***
   7    4
   DEPTH       AREA     VOLUME    OUTFLOW    ***
   0.000    0.0000    0.0000       0.00
   1.000    0.4000    0.4000       2.00
   1.500    0.5000    1.0000       4.00
   2.000    0.9000    1.3000      11.00
   2.500    1.3000    1.6000      15.00
   3.000    1.6000    2.0000      18.00
   3.500    1.9000    2.5000      20.80
 END FTABLE 38
```

```
 FTABLE     45
ROWS COLS ***
NORTH EMPLOYEE PARKING LOT VAULT (AS-BUILT)***
  12    4
    DEPTH       AREA     VOLUME    OUTFLOW   ***
    0.000     0.2200     0.0000       0.00
    2.000     0.2200     0.4500       1.20
    4.000     0.2200     0.9000       1.70
    6.000     0.2200     1.3400       2.10
    8.000     0.2200     1.7900       2.40
   10.000     0.2200     2.2400       2.70
   12.240     0.2200     2.7400       3.00
   14.000     0.2200     3.1400       6.90
   15.440     0.2200     3.4600       8.30
   16.000     0.2200     3.5800      10.30
   18.000     0.2200     4.0300      13.60
   20.000     0.2200     4.4800      30.79
 END FTABLE 45

 FTABLE     50
ROWS COLS ***
  10    4
    DEPTH       AREA     VOLUME    OUTFLOW   ***
     0.00       1.00       0.00       0.00
     0.50       1.10       0.53       5.00
     1.00       1.20       1.10      15.00
     1.50       1.30       1.73      25.00
     2.00       1.40       2.40      35.00
     2.50       1.50       3.13      52.00
     3.00       1.60       3.90      70.00
     3.50       1.70       4.73      87.00
     4.00       1.80       5.60     105.00
     6.00       1.90       9.30     165.00
 END FTABLE 50

 FTABLE     52
ROWS COLS ***
   6    4
    DEPTH       AREA     VOLUME    OUTFLOW   ***
    0.000     0.0000     0.0000       0.00
    0.100     0.3680     0.0184       0.25
    0.500     0.3717     0.1664       9.39
    1.000     0.3763     0.3534      31.06
    2.000     0.3819     0.7325      94.37
    3.000     0.3874     1.1171     174.33
 END FTABLE 52

 FTABLE     53
OLD LAKE REBA                                ***
MAX DEPTH = 4.9 FEET                         ***
30" CMP, 40 CFS DISCHARGE AT MAX DEPTH       ***
ROWS COLS ***
   7    4
    DEPTH       AREA     VOLUME    OUTFLOW   ***
    0.000     2.4000     0.0000       0.00
    1.000     2.5800     2.5000      18.00
```

2.000	2.9400	5.3000	26.00
3.000	3.4100	8.4000	31.00
4.000	3.8800	12.100	36.00
4.900	4.3000	15.800	40.00
6.000	4.3000	15.810	500.00

END FTABLE 53

FTABLE 54
EXISTING MILLER CREEK DETENTION FACILITY*** REVISED STORAGE/Q DATA
GATE SETTING: 2.0 FEET***
ROWS COLS ***
12 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.00	0.00	0.00
1.300	0.01	0.01	10.00
2.000	0.01	0.02	20.00
2.900	0.70	0.40	30.00
4.000	1.50	1.50	40.00
5.400	3.50	4.90	50.00
7.000	8.60	13.30	60.00
8.800	15.60	34.80	70.00
10.000	19.90	57.30	76.00
10.500	21.50	68.00	92.00
11.000	23.10	78.80	179.00
11.500	24.70	88.60	303.00

END FTABLE 54

PRE AMBAUM DETENTION ***
FTABLE 111
ROWS COLS ***
12 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00
0.500	0.2160	0.0750	5.30
1.000	0.2730	0.1990	21.10
1.500	0.2890	0.3410	43.90
2.000	0.2900	0.4830	68.80
2.500	0.2910	0.6070	89.10
3.000	0.2950	0.6820	90.00
3.500	0.3000	2.1000	100.00
4.000	0.3050	2.5000	105.00
4.500	0.3100	3.0000	110.00
5.000	0.3200	3.5000	120.00
5.500	0.3300	4.0000	130.00

END FTABLE111

FTABLE 135
ROWS COLS *** VACA FARM
6 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.00	0.10	0.00	0.00
1.00	0.10	0.10	4.00
2.00	0.11	0.21	8.00
2.50	1.00	0.48	13.00
3.50	6.50	4.23	86.00
4.50	13.00	13.98	235.00

END FTABLE135

```
                                                                                ***
END FTABLES

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>        <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                 <Name> # #***
  MASS-LINK       1
  conversion from acre-inches to acre-ft (1/12)             ***
PERLND     PWATER PERO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK   1

  MASS-LINK       2
IMPLND     IWATER SURO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK   2

  MASS-LINK       3
RCHRES     ROFLOW                          RCHRES          INFLOW
  END MASS-LINK   3

  MASS-LINK       4
RCHRES     OFLOW  OVOL   1                 RCHRES          INFLOW IVOL
  END MASS-LINK   4

  MASS-LINK       5
RCHRES     OFLOW  OVOL   2                 RCHRES          INFLOW IVOL
  END MASS-LINK   5

  MASS-LINK       6
PERLND     PWATER SURO       0.0833333     RCHRES          INFLOW IVOL
PERLND     PWATER IFWO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK   6

  MASS-LINK       7
PERLND     PWATER AGWO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK   7

  MASS-LINK       8
PERLND     PWATER PERO       0.0833333     COPY            INPUT  MEAN
  END MASS-LINK   8
  MASS-LINK       12
PERLND     PWATER AGWO       0.0833333     COPY            INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       9
IMPLND     IWATER SURO       0.0833333     COPY            INPUT  MEAN
  END MASS-LINK   9

  MASS-LINK       10
COPY       OUTPUT MEAN                     RCHRES          INFLOW IVOL
  END MASS-LINK   10

END MASS-LINK
END RUN
```

```
RUN
GLOBAL
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF MILLER CREEK
  ***  FILE: MLOWFLOW2.INP - 2006 future condition
  ***  LOW FLOW ANALYSIS
  ***  BASED ON MILL65.INP FILE FROM AQUA TERRA
  ***  REMOVED FILL AREAS
  ***  PERLND 80 is the groundwater PERLND for the Fill area.
  ***  FOLLOWING STATEMENTS MAY NOT APPLY
  ***  ADDED PERLND 47,57,
  ***  ADDED GROUND WATER INFILTRATION TO WDM FOR USE WITH MCAGWO.INP
  ***  FK revised SDW1A and SDW1B with flow splitters, storages at SDN3/3X,
SDN2X/4X;
  ***  FK revised MC-1 and SDN-2X land uses, added POC at Lake Reba, removed
run-of-river tables
  ***  FOUR YEAR RUN USING CALIBRATION INITIAL CONDITIONS
MILLER CREEK BASIN HSPF MODEL
***  START       1994  1  1  0  0  END     1996  8 30 24  0
  START       1990 10  1  0  0  END     1994  9 30 24  0
  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname------------------------------------------->
MESSU      24    D:\PARA\SEATAC\MILLER\LOWFLOW\MLOWFLOW2.MES
WDM        25    D:\PARA\SEATAC\MILLER\LOWFLOW\MLOWFLOW.WDM
           61    D:\PARA\SEATAC\MILLER\LOWFLOW\PER.L61
           62    D:\PARA\SEATAC\MILLER\LOWFLOW\RCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      16
      PERLND      26
      PERLND      34
      PERLND      44
      PERLND      45
  *** special PERLND for infiltration SDW1A
      PERLND      47
      PERLND      54
  *** special PERLND for infiltration SDW1B
      PERLND      57
  *** PERLNDS FOR INFLOW OF LOW FLOW FROM FILL PGG
      PERLND      80
      IMPLND      14
      RCHRES       1
      RCHRES      23
      RCHRES      24
      RCHRES       2
      RCHRES       3
      RCHRES      33
      RCHRES       4
      RCHRES       5
      RCHRES      50
      RCHRES     242
      RCHRES     240
```

```
      COPY         61
      COPY         44
      RCHRES       51
      RCHRES       43
      RCHRES      451
      RCHRES      452
      COPY         45
      COPY        645
      RCHRES       46
      RCHRES      552
      RCHRES       52
      RCHRES       53
      COPY         53
      RCHRES       54
      RCHRES       37
      RCHRES      237
      COPY         37
      RCHRES      147
      RCHRES      247
      COPY         66
      COPY         69
      RCHRES       47
      COPY         62
      COPY         63
      COPY         67
      COPY         68
  *** output special PERLND outflow to check
      COPY         47
      COPY         70
      RCHRES       34
      RCHRES      135
      RCHRES      570
      RCHRES       57
      RCHRES      257
      COPY         64
      COPY         65
      COPY        357
      COPY         56
  *** output special PERLND outflow to check
      COPY         57
      COPY         71
      RCHRES       35
      COPY         55
      RCHRES       10
      RCHRES       16
      RCHRES       11
      RCHRES       13
      RCHRES       12
      RCHRES       15
      RCHRES       14
      RCHRES       17
    END INGRP
END OPN SEQUENCE
                                                                          ***
PERLND
  GEN-INFO
    <PLS >      Name            NBLKS   Unit-systems   Printer            ***
```

```
  # -  #                          User  t-series Engl Metr                     ***
                                        in  out                                ***
 16      TFM- TILL FOR MOD       1    1    1    1   61    0
 26      TGM- TILL GR MOD        1    1    1    1   61    0
 34      OF - OUTWASH FOR        1    1    1    1   61    0
 44      OG - OUTWASH GR         1    1    1    1   61    0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
 45      AIRPORT FILL            1    1    1    1   61    0
 47      OG - INFILTRATION 1     1    1    1    1   61    0
 54      SA - WETLANDS           1    1    1    1   61    0
 57      OG - INFILTRATION 3     1    1    1    1   61    0
 80      LOW FLOW                1    1    1    1   61    0
END GEN-INFO
ACTIVITY
  <PLS > ************* Active Sections ****************************
  # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC          ***
 14  200    0    0    1    0    0    0    0    0    0    0    0    0
END ACTIVITY
PRINT-INFO
  <PLS > ******************** Print-flags *********************** PIVL  PYR
  # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
 14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
END PRINT-INFO
PWAT-PARM1
  <PLS > **************** Flags ******************
  # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                         ***
 14  200    0    0    0    0    0    0    0    0    0
END PWAT-PARM1
PWAT-PARM2
  <PLS > ***
  # -  # ***FOREST    LZSN    INFILT     LSUR    SLSUR     KVARY     AGWRC
 16                9.0000    0.3200   400.00   0.1000    0.5000    0.9960
 26                9.0000    0.1200   400.00   0.1000    0.5000    0.9960
 34               10.0000    2.0000   400.00   0.0500    0.3000    0.9960
 44               10.0000    0.8000   400.00   0.0500    0.3000    0.9960
 45                7.5000    0.0200   300.00   0.0700    0.0000    0.9960
 47               10.0000    0.8000   400.00   0.0500    0.3000    0.9960
 54                8.0000    2.0000   100.00   0.0010    0.5000    0.9960
 57               10.0000    0.8000   400.00   0.0500    0.3000    0.9960
 80                9.0000    0.1200   400.00   0.1000    0.5000    0.9960
END PWAT-PARM2
PWAT-PARM3
  <PLS >***
  # -  #*** PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
 16                           2.0000    2.0000      0.33      0.00       0.0
 26                           2.0000    2.0000      0.33        0.         0.
 34                           2.0000    2.0000      0.33      0.00       0.0
 44                           2.0000    2.0000      0.33        0.         0.
 47                           2.0000    2.0000      0.33        0.         0.
 45                           2.0000    2.0000      0.33        0.         0.
 54                           10.000    2.0000      0.33        0.        0.7
 57                           2.0000    2.0000      0.33        0.         0.
 80                           2.0000    2.0000      0.33        0.         0.
END PWAT-PARM3
PWAT-PARM4
  <PLS >                                                          ***
  # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP***
```

```
  16          0.2000     0.7500     0.3500      9.000     0.7000     0.7000
  26          0.1000     0.3750     0.2500      9.000     0.7000     0.2500
  34          0.2000     0.7500     0.3500      0.000     0.7000     0.7000
  44          0.1000     0.7500     0.2500      0.000     0.7000     0.2500
  47          0.1000     0.7500     0.2500      0.000     0.7000     0.2500
  45          0.1000     0.2800     0.2500      6.000     0.1500     0.6000
  54          0.1000     2.2500     0.5000      1.000     0.7000     0.8000
  57          0.1000     0.7500     0.2500      0.000     0.7000     0.2500
  80          0.1000     0.3750     0.2500      9.000     0.7000     0.2500

  END PWAT-PARM4
  PWAT-STATE1
    <PLS >  PWATER state variables***
    # -   #***    CEPS       SURS        UZS       IFWS       LZS       AGWS       GWVS
   16            0.078         0.     0.2500       0.10     2.000      2.000      0.000
   26            0.051         0.     0.2500       0.10     2.000      2.000      0.000
   34            0.078         0.     0.2500       0.10     2.000      2.000      0.000
   44            0.051         0.     0.2500       0.10     2.000      2.000      0.000
   47            0.051         0.     0.2500       0.10     2.000      2.000      0.000
   45            0.051         0.     0.2500       0.10     2.000      2.000      0.000
   54            0.051         0.     0.2500       0.10     2.000      2.000      0.000
   57            0.051         0.     0.2500       0.10     2.000      2.000      0.000
   80            0.051         0.     0.2500       0.10     2.000      2.000      0.000
  END PWAT-STATE1
END PERLND

IMPLND
  GEN-INFO
    <ILS >      Name              Unit-systems   Printer                      ***
    # -  #                      User  t-series Engl Metr                      ***
                                        in  out                               ***
   14      IMPERVIOUS              1    1    1   60    0
  END GEN-INFO
  ACTIVITY
    <ILS > ************* Active Sections ****
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL  ***
   14         0    0    1    0    0    0
  END ACTIVITY
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
   14         0    0    6    0    0    0    1    9
  END PRINT-INFO
  IWAT-PARM1
    <ILS >           Flags          ***                                       ***
    # -  # CSNO RTOP  VRS  VNN RTLI  ***                                      ***
   14         0    0    0    0    0
  END IWAT-PARM1
  IWAT-PARM2
    <ILS >                                                                    ***
    # -  #      LSUR     SLSUR      NSUR     RETSC                            ***
   14         100.00    0.0100    0.1000    0.1000
  END IWAT-PARM2
  IWAT-PARM3
    <ILS >                                                                    ***
    # -  #    PETMAX    PETMIN                                                ***
   14
```

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```
  END IWAT-PARM3
  IWAT-STATE1
    <ILS >  IWATER state variables                                               ***
    # -  #       RETS      SURS                                                  ***
   14       1.0000E-3 1.0000E-3
  END IWAT-STATE1
END IMPLND
                                                                                 ***
EXT SOURCES
                                                                                 ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes and ponds
*** FOLLOWING RCHRES ARE PONDS: 57, 247, 237
                                                                                 ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->    ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #    ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM   1002 PREC     ENGLZERO  1.00         PERLND  14  65 EXTNL   PREC
WDM   1002 PREC     ENGLZERO  0.0          PERLND  80     EXTNL   PREC
WDM   1002 PREC     ENGLZERO  1.00         IMPLND  14     EXTNL   PREC
WDM      1 EVAP     ENGLZERO  0.8          PERLND  14  65 EXTNL   PETINP
WDM      1 EVAP     ENGLZERO  0.0          PERLND  80     EXTNL   PETINP
WDM      1 EVAP     ENGLZERO  0.8          IMPLND  14     EXTNL   PETINP
  ***  --> lateral inflow from reinfiltration chamber for SDW1A
*** WDM      5 FLOW     ENGLZERO  1.0          PERLND  47     EXTNL   AGWLI
  ***  --> lateral inflow from reinfiltration chamber for SDW1B
*** WDM      6 FLOW     ENGLZERO  1.0          PERLND  57     EXTNL   AGWLI
*** PRECIP/EVAP TO LAKES
WDM   1002 PREC     ENGLZERO               RCHRES   1     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES   1     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES   4     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES   4     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES  11     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  11     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES  13     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  13     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES  23     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  23     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES  34     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  34     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES  53     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  53     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES  54     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  54     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES 237     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES 237     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES 247     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES 247     EXTNL   POTEV
WDM   1002 PREC     ENGLZERO               RCHRES  57     EXTNL   PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  57     EXTNL   POTEV
*** till seapage groundwater flow from Fill area.  PGG time series
WDM   7001 FLOW     ENGLZERO.000000099     PERLND  80     EXTNL   AGWLI
*** Fill flow directly to stream
WDM   7000 FLOW     ENGL     .000000957    RCHRES  35     INFLOW IVOL

END EXT SOURCES

EXT TARGETS
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
***PROJECT CONDITION FLOWS
*** RCHRES=LOCATION:
*** 54=MCDF      47=SDW1A INFILTRATION TANK     43=SDN3X     247=SDW1A POND G
*** 17=MOUTH     49=SDW2        44=SDN4X        52=SDN1      451= EXISTING NEPL
*** 61=SDN2X     57=SDW1B       51=SDN2X+SDN4X  53=Lake Reba 452=NEW NEPL
*** 45=NEPL POC  55=SR509       39=SDN3A/SDW1A POC
*** 46=CARGO     37=SDN3AI VAULT 237=SDN3AO POND
*** GAUGE POINTS (17=MOUTH, 54=MILLER RDF, 55=SR509)
RCHRES  17 HYDR   RO      1 1                WDM   7017 FLOW     ENGL      REPL
RCHRES  35 HYDR   RO      1 1                WDM   7036 FLOW     ENGL      REPL
***COPY    55 OUTPUT MEAN   1 1 12.1           WDM    118 FLOW     ENGL      REPL
RCHRES  54 HYDR   RO      1 1                WDM   7054 FLOW     ENGL      REPL
*** DETENTION POND FLOWS
***COPY    61 OUTPUT MEAN   1 1 12.1           WDM    101 FLOW     ENGL      REPL
***RCHRES 552 HYDR   RO     1 1                WDM    102 FLOW     ENGL      REPL
***RCHRES 451 HYDR   RO     1 1                WDM    105 FLOW     ENGL      REPL
***RCHRES 452 HYDR   RO     1 1                WDM    119 FLOW     ENGL      REPL
***RCHRES  46 HYDR   RO     1 1                WDM    106 FLOW     ENGL      REPL
*** write RCHRES 47 (Inf. Area # 1)outlet 1 and 2 to WDM 107 and 108 like so:
***COPY    62 OUTPUT MEAN   1 1 12.1           WDM    107 FLOW     ENGL      REPL
***COPY    63 OUTPUT MEAN   1 1 12.1           WDM    108 FLOW     ENGL      REPL
***COPY    66 OUTPUT MEAN   1 1 12.1           WDM    112 FLOW     ENGL      REPL
***COPY    69 OUTPUT MEAN   1 1 12.1           WDM   1120 FLOW     ENGL      REPL
*** write SDW1a vault flows to WDM:
***COPY    67 OUTPUT MEAN   1 1 12.1           WDM    109 FLOW     ENGL      REPL
***COPY    68 OUTPUT MEAN   1 1 12.1           WDM   1090 FLOW     ENGL      REPL
*** write RCHRES 570 outlet 1 and 2 to WDM 110 and 115 like so:
***RCHRES 570 HYDR   RO     1 1                WDM    210 FLOW     ENGL      REPL
***COPY    64 OUTPUT MEAN   1 1 12.1           WDM    110 FLOW     ENGL      REPL
***COPY    65 OUTPUT MEAN   1 1 12.1           WDM    115 FLOW     ENGL      REPL
***COPY   357 OUTPUT MEAN   1 1 12.1           WDM    211 FLOW     ENGL      REPL
***COPY    56 OUTPUT MEAN   1 1 12.1           WDM    121 FLOW     ENGL      REPL
*** write RCHRES 37 vault to WDM 111
***RCHRES  37 HYDR   RO     1 1                WDM    111 FLOW     ENGL      REPL
***RCHRES 237 HYDR   RO     1 1                WDM    122 FLOW     ENGL      REPL
***RCHRES  43 HYDR   RO     1 1                WDM    103 FLOW     ENGL      REPL
***COPY    44 OUTPUT MEAN   1 1 12.1           WDM    104 FLOW     ENGL      REPL
***RCHRES  51 HYDR   RO     1 1                WDM    139 FLOW     ENGL      REPL
*** DETENTION STAGES
***RCHRES  47 HYDR   STAGE                     WDM    652 STAG     ENGL      REPL
***RCHRES 147 HYDR   STAGE                     WDM    657 STAG     ENGL      REPL
***RCHRES 247 HYDR   STAGE                     WDM    654 STAG     ENGL      REPL
***RCHRES 552 HYDR   STAGE                     WDM    601 STAG     ENGL      REPL
***RCHRES  57 HYDR   STAGE                     WDM    651 STAG     ENGL      REPL
***RCHRES 257 HYDR   STAGE                     WDM    655 STAG     ENGL      REPL
***RCHRES 237 HYDR   STAGE                     WDM    656 STAG     ENGL      REPL
***RCHRES  37 HYDR   STAGE                     WDM    650 STAG     ENGL      REPL
***RCHRES  54 HYDR   STAGE                     WDM     61 STAG     ENGL      REPL
***RCHRES 451 HYDR   STAGE                     WDM    662 STAG     ENGL      REPL
***RCHRES 452 HYDR   STAGE                     WDM    667 STAG     ENGL      REPL
***RCHRES  46 HYDR   STAGE                     WDM    663 STAG     ENGL      REPL
***RCHRES  43 HYDR   STAGE                     WDM    664 STAG     ENGL      REPL
***RCHRES  44 HYDR   STAGE                     WDM    665 STAG     ENGL      REPL
***RCHRES  51 HYDR   STAGE                     WDM    666 STAG     ENGL      REPL
*** DETENTION VOLUMES
```

```
***RCHRES  47 HYDR    VOL                              WDM     752 VOL       ENGL        REPL
***RCHRES 147 HYDR    VOL                              WDM     757 VOL       ENGL        REPL
***RCHRES 247 HYDR    VOL                              WDM     754 VOL       ENGL        REPL
***RCHRES 552 HYDR    VOL                              WDM     602 VOL       ENGL        REPL
***RCHRES  57 HYDR    VOL                              WDM     751 VOL       ENGL        REPL
***RCHRES 257 HYDR    VOL                              WDM     755 VOL       ENGL        REPL
***RCHRES 237 HYDR    VOL                              WDM     756 VOL       ENGL        REPL
***RCHRES  37 HYDR    VOL                              WDM     750 VOL       ENGL        REPL
***RCHRES  54 HYDR    VOL                              WDM      62 VOL       ENGL        REPL
***RCHRES 451 HYDR    VOL                              WDM     762 VOL       ENGL        REPL
***RCHRES 452 HYDR    VOL                              WDM     767 VOL       ENGL        REPL
***RCHRES  46 HYDR    VOL                              WDM     763 VOL       ENGL        REPL
***RCHRES  43 HYDR    VOL                              WDM     764 VOL       ENGL        REPL
***RCHRES  44 HYDR    VOL                              WDM     765 VOL       ENGL        REPL
***RCHRES  51 HYDR    VOL                              WDM     766 VOL       ENGL        REPL
*** POINT OF COMPLIANCE (POC)FLOWS
***COPY     37 OUTPUT MEAN   1 1 12.1                  WDM     125 FLOW      ENGL        REPL
***COPY     45 OUTPUT MEAN   1 1 12.1                  WDM     199 FLOW      ENGL        REPL
***COPY     53 OUTPUT MEAN   1 1 12.1                  WDM     399 FLOW      ENGL        REPL
***COPY     70 OUTPUT MEAN   1 1 12.1                  WDM    7000 FLOW      ENGL        REPL
***COPY     71 OUTPUT MEAN   1 1 12.1                  WDM    7001 FLOW      ENGL        REPL
*** SPECIAL PERLND REINFILTRATION RESULTS
  ***  --> output special PERLND parameters to check operations:
  ***  --> PERLND 47 active ground water storage depth (in)
*** PERLND  47 PWATER AGWS                              WDM     471 AGWS      ENGL
REPL
  ***  --> PERLND 47 active ground water outflow (acft/2ac -> in/acre)
***COPY     47 OUTPUT MEAN   1 1 12                    WDM     472 FLOW      ENGL        REPL
  ***  --> PERLND 57 active ground water storage depth (in)
***PERLND  57 PWATER AGWS                              WDM     571 AGWS      ENGL        REPL
  ***  --> PERLND 57 active ground water outflow (acft/2ac -> in/acre)
***COPY     57 OUTPUT MEAN   1 1 12                    WDM     572 FLOW      ENGL        REPL

END EXT TARGETS

SCHEMATIC
<-Source->                    <--Area-->    <-Target->   MBLK    ***
<Name>   #                    <-factor->    <Name>   #   Tbl#    ***
  *** SUB-CATCHMENT 1 all agwo goes to sound
PERLND  16                          3.41    RCHRES   1      6
PERLND  26                        232.36    RCHRES   1      6
PERLND  34                          3.07    RCHRES   1      6
PERLND  44                         38.03    RCHRES   1      6
PERLND  54                          3.87    RCHRES   1      6
IMPLND  14                         56.14    RCHRES   1      2
 *** SUB-CATCHMENT 2 10% of area GW goes to vaca 90% goes to sound
PERLND  16                          5.56    RCHRES   2      6
PERLND  26                        200.05    RCHRES   2      6
PERLND  34                          0.46    RCHRES   2      6
PERLND  44                         38.71    RCHRES   2      6
PERLND  16                          0.56    RCHRES 135      7
PERLND  26                         20.00    RCHRES 135      7
PERLND  34                          0.05    RCHRES 135      7
PERLND  44                          3.87    RCHRES 135      7
IMPLND  14                         42.22    RCHRES   2      2
 *** SUB-CATCHMENT 23 New subbasin 15 % OF GW GOES TO VACCA 85% TO SOUND
PERLND  16                          3.09    RCHRES  23      6
```

```
PERLND  26                    156.15     RCHRES  23        6
PERLND  34                      2.25     RCHRES  23        6
PERLND  44                     45.84     RCHRES  23        6
PERLND  16                      0.46     RCHRES 135        7
PERLND  26                     23.42     RCHRES 135        7
PERLND  34                      0.34     RCHRES 135        7
PERLND  44                      6.88     RCHRES 135        7
IMPLND  14                     58.44     RCHRES  23        2
 *** SUB-CATCHMENT 24 New subbasin 60 % OF GW GOES TO 11 40% TO SOUND
PERLND  26                    135.43     RCHRES  24        6
PERLND  34                      2.02     RCHRES  24        6
PERLND  44                     69.29     RCHRES  24        6
PERLND  26                     81.26     RCHRES  11        7
PERLND  34                      1.21     RCHRES  11        7
PERLND  44                     41.57     RCHRES  11        7
IMPLND  14                     79.98     RCHRES  24        2
  *** SUB-CATCHMENT 3 agwo goes to vaca(135)
PERLND  16                      8.26     RCHRES   3        6
PERLND  26                    108.38     RCHRES   3        6
PERLND  34                     16.02     RCHRES   3        6
PERLND  44                    102.89     RCHRES   3        6
PERLND  54                      0.04     RCHRES   3        6
PERLND  16                      8.26     RCHRES 135        7
PERLND  26                    108.38     RCHRES 135        7
PERLND  34                     16.02     RCHRES 135        7
PERLND  44                    102.89     RCHRES 135        7
PERLND  54                      0.04     RCHRES 135        7
IMPLND  14                     27.30     RCHRES   3        2
  *** SUB-CATCHMENT 4 10% of agwo goes to rchres 90% goes to sound
PERLND  16                      2.95     RCHRES   4        6
PERLND  26                     85.95     RCHRES   4        6
PERLND  34                      3.75     RCHRES   4        6
PERLND  44                     92.06     RCHRES   4        6
PERLND  16                      0.30     RCHRES   4        7
PERLND  26                      8.59     RCHRES   4        7
PERLND  34                      0.38     RCHRES   4        7
PERLND  44                      9.21     RCHRES   4        7
IMPLND  14                     18.43     RCHRES   4        2
  *** SUB-CATCHMENT 4a 70% of agwo goes to rchres 30% goes to sound
PERLND  16                      8.66     RCHRES   4        6
PERLND  26                     61.64     RCHRES   4        6
PERLND  34                     22.06     RCHRES   4        6
PERLND  44                     78.09     RCHRES   4        6
PERLND  54                     12.50     RCHRES   4        6
PERLND  16                      6.06     RCHRES   4        7
PERLND  26                     43.15     RCHRES   4        7
PERLND  34                     15.44     RCHRES   4        7
PERLND  44                     54.66     RCHRES   4        7
PERLND  54                      8.75     RCHRES   4        7
IMPLND  14                     29.14     RCHRES   4        2
  *** SUB-CATCHMENT 5
PERLND  26                     10.29     RCHRES   5        1
PERLND  44                     50.05     RCHRES   5        1
PERLND  54                     10.74     RCHRES   5        1
IMPLND  14                     16.31     RCHRES   5        2
  *** SUB-CATCHMENT 6
PERLND  16                      1.42     COPY   645       26
```

```
PERLND  26                  20.38     COPY   645      26
PERLND  34                  13.44     COPY   645      26
PERLND  44                  11.79     COPY   645      26
PERLND  54                   0.82     COPY   645      26
PERLND  16                   1.42     RCHRES  53       7
PERLND  26                  20.38     RCHRES  53       7
PERLND  34                  13.44     RCHRES  53       7
PERLND  44                  11.79     RCHRES  53       7
PERLND  54                   0.82     RCHRES  53       7
IMPLND  14                   6.23     COPY   645      22
 *** SUB-CATCHMENT 8
PERLND  44                  22.21     RCHRES  35       1
IMPLND  14                   6.60     RCHRES  35       2
 *** SUB-CATCHMENT 9
PERLND  16                   4.98     RCHRES  34       1
PERLND  26                  14.38     RCHRES  34       1
PERLND  34                   0.05     RCHRES  34       1
PERLND  44                  56.71     RCHRES  34       1
PERLND  54                   0.01     RCHRES  34       1
IMPLND  14                  22.47     RCHRES  34       2
 *** SUB-CATCHMENT 10
PERLND  16                   4.15     RCHRES  10       1
PERLND  26                  31.94     RCHRES  10       1
PERLND  44                  95.22     RCHRES  10       1
IMPLND  14                  71.98     RCHRES  10       2
 *** SUB-CATCHMENT 11 25% OF AGWO GOES TO 15
PERLND  16                   0.89     RCHRES  11       6
PERLND  26                 217.92     RCHRES  11       6
PERLND  34                   1.32     RCHRES  11       6
PERLND  44                  65.65     RCHRES  11       6
PERLND  16                   0.67     RCHRES  11       7
PERLND  26                 163.44     RCHRES  11       7
PERLND  34                   0.99     RCHRES  11       7
PERLND  44                  49.24     RCHRES  11       7
PERLND  16                   0.22     RCHRES  15       7
PERLND  26                  54.48     RCHRES  15       7
PERLND  34                   0.33     RCHRES  15       7
PERLND  44                  16.41     RCHRES  15       7
IMPLND  14                 230.80     RCHRES  11       2
 *** SUB-CATCHMENT 12
PERLND  16                   0.39     RCHRES  12       1
PERLND  26                 101.18     RCHRES  12       1
PERLND  34                   5.64     RCHRES  12       1
PERLND  44                  54.98     RCHRES  12       1
PERLND  54                   0.64     RCHRES  12       1
IMPLND  14                  79.83     RCHRES  12       2
 *** SUB-CATCHMENT 13
PERLND  16                   0.79     RCHRES  13       1
PERLND  26                 197.68     RCHRES  13       1
IMPLND  14                  27.66     RCHRES  13       2
 *** SUB-CATCHMENT 14 50% OF AGWO GOES TO SOUND
PERLND  16                   0.24     RCHRES  14       6
PERLND  26                 118.67     RCHRES  14       6
PERLND  34                  13.46     RCHRES  14       6
PERLND  44                  41.91     RCHRES  14       6
PERLND  16                   0.12     RCHRES  14       7
PERLND  26                  59.34     RCHRES  14       7
```

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PERLND  34                         6.73     RCHRES  14         7
PERLND  44                        20.95     RCHRES  14         7
IMPLND  14                        20.66     RCHRES  14         2
  *** SUB-CATCHMENT 15
PERLND  16                         6.59     RCHRES  15         1
PERLND  26                        49.55     RCHRES  15         1
PERLND  34                        50.09     RCHRES  15         1
PERLND  44                        86.52     RCHRES  15         1
IMPLND  14                        19.47     RCHRES  15         2
  *** SUB-CATCHMENT 16
PERLND  16                        10.93     RCHRES  16         1
PERLND  26                        29.93     RCHRES  16         1
PERLND  34                        20.03     RCHRES  16         1
PERLND  44                        31.83     RCHRES  16         1
IMPLND  14                        15.58     RCHRES  16         2
  *** SUB-CATCHMENT 17 AGWO GOES TO SOUND
PERLND  16                         0.90     RCHRES  17         6
PERLND  26                        16.31     RCHRES  17         6
PERLND  34                        34.82     RCHRES  17         6
PERLND  44                        82.11     RCHRES  17         6
PERLND  54                         2.19     RCHRES  17         6
IMPLND  14                        10.49     RCHRES  17         2
  *** SUB-CATCHMENT MC-1
PERLND  26                         0.14     RCHRES  52         1
PERLND  44                         9.44     RCHRES  52         1
PERLND  45                         0.14     RCHRES  52         1
PERLND  54                         0.27     RCHRES  52         1
IMPLND  14                         1.98     RCHRES  52         2
  *** SUB-CATCHMENT MC-2
PERLND  16                         0.08     RCHRES  53         1
PERLND  26                         0.53     RCHRES  53         1
PERLND  34                         3.60     RCHRES  53         1
PERLND  44                         9.20     RCHRES  53         1
PERLND  45                         2.22     RCHRES  53         1
PERLND  54                        15.14     RCHRES  53         1
IMPLND  14                         2.54     RCHRES  53         2
  *** SUB-CATCHMENT MC-3
PERLND  34                         3.70     RCHRES  54         1
PERLND  44                         4.91     RCHRES  54         1
PERLND  45                         1.07     RCHRES  54         1
PERLND  54                         1.84     RCHRES  54         1
IMPLND  14                         1.42     RCHRES  54         2
  *** SUB-CATCHMENT MC-4
PERLND  34                         0.27     RCHRES 135         1
PERLND  44                        16.51     RCHRES 135         1
PERLND  45                         4.23     RCHRES 135         1
PERLND  54                        11.98     RCHRES 135         1
IMPLND  14                         3.31     RCHRES 135         2
  *** SUB-CATCHMENT MC-5
PERLND  26                        13.43     RCHRES  35         1
PERLND  44                        33.84     RCHRES  35         1
PERLND  54                         7.44     RCHRES  35         1
IMPLND  14                         0.02     RCHRES  35         2
  *** SUB-CATCHMENT MC-6
  ***  --> reduce by 2 acres to make special PERLND 47 for SDW1A
***PERLND  44                        14.10     RCHRES  35         1
PERLND  44                        12.10     RCHRES  35         1
```

```
PERLND  45                           0.09     RCHRES  35       1
PERLND  54                           0.90     RCHRES  35       1
IMPLND  14                           0.26     RCHRES  35       2
  ***  --> add 2 acres from special PERLND 47 for SDW1A
PERLND  47                           2.00     RCHRES  35       1
  ***  --> output outflow from special PERLND 47 (acft/ac)
PERLND  47                           1.00     COPY    47      21

  *** SUB-CATCHMENT MC-7
  ***  --> reduce by 2 acres to make special PERLND 57 for SDW1B
PERLND  26                          11.26     COPY    55      21
  ***  --> reduce by 2 acres to make special PERLND 57 for SDW1B
***PERLND  44                          31.80     COPY    55      21
  ***  --> add 2 acres from special PERLND 57 for SDW1B
PERLND  57                           2.00     COPY    55      21
  ***  --> output outflow from special PERLND 57 (acft/ac)
PERLND  57                           1.00     COPY    57      21
PERLND  44                          29.80     COPY    55      21
PERLND  54                           3.20     COPY    55      21
IMPLND  14                           0.03     COPY    55      22

***note: SDN AGWO TO VACCA FARMS (135)NOT TO PONDS

  *** SUB-CATCHMENT SDN-1
PERLND  26                           1.97     RCHRES 552       6
PERLND  44                           1.29     RCHRES 552       6
PERLND  54                           0.20     RCHRES 552       6
PERLND  26                           1.97     RCHRES 135       7
PERLND  44                           1.29     RCHRES 135       7
PERLND  54                           0.20     RCHRES 135       7
IMPLND  14                          12.68     RCHRES 552       2

  *** SUB-CATCHMENT SDN-1-LWR
PERLND  44                           4.79     RCHRES 552       6
PERLND  54                           0.07     RCHRES 552       6
PERLND  44                           4.79     RCHRES 135       7
PERLND  54                           0.07     RCHRES 135       7
IMPLND  14                           0.56     RCHRES 552       2

  *** SUB-CATCHMENT SDN-1-OFF
PERLND  26                          23.01     RCHRES  52       6
PERLND  44                           3.58     RCHRES  52       6
PERLND  54                           1.67     RCHRES  52       6
PERLND  26                          23.01     RCHRES 135       7
PERLND  44                           3.58     RCHRES 135       7
PERLND  54                           1.67     RCHRES 135       7
IMPLND  14                           8.00     RCHRES  52       2

  *** SUB-CATCHMENT SDN-2X (TO POND)
PERLND  26                           0.63     COPY    61      26
PERLND  44                           2.40     COPY    61      26
PERLND  45                           0.86     COPY    61      26
PERLND  26                           0.63     RCHRES 135       7
PERLND  44                           2.40     RCHRES 135       7
PERLND  45                           0.86     RCHRES 135       7
IMPLND  14                           0.36     COPY    61      22
```

```
  *** SUB-CATCHMENT SDN-3 (TO POND)
PERLND  26                        23.56      RCHRES  43        6
PERLND  26                        23.56      RCHRES 135        7
IMPLND  14                        24.30      RCHRES  43        2

  *** SUB-CATCHMENT SDN-3X (TO POND)
PERLND  26                         1.61      RCHRES  43        6
***original PERLND area
***PERLND  45                        23.77      RCHRES  43        6
***PERLND AREA TO BE REMOVED = 0.29 AC
PERLND  45                        23.48      RCHRES  43        6
PERLND  80                         0.29      RCHRES 135        7
PERLND  26                         1.61      RCHRES 135        7
PERLND  45                        23.48      RCHRES 135        7

  *** SUB-CATCHMENT SDN-4 (TO POND)
PERLND  26                        15.75      COPY    44       26
PERLND  44                         1.31      COPY    44       26
PERLND  45                         0.99      COPY    44       26
PERLND  26                        15.75      RCHRES 135        7
PERLND  44                         1.31      RCHRES 135        7
PERLND  45                         0.99      RCHRES 135        7
IMPLND  14                        12.26      COPY    44       22

  *** SUB-CATCHMENT SDN-4X (TO POND)
PERLND  26                         1.92      COPY    44       26
PERLND  44                         0.75      COPY    44       26
PERLND  45                         8.31      COPY    44       26
PERLND  26                         1.92      RCHRES 135        7
PERLND  44                         0.75      RCHRES 135        7
PERLND  45                         8.31      RCHRES 135        7
IMPLND  14                         4.21      COPY    44       22

  *** SUB-CATCHMENT IWS-NCPS (TO POND)
PERLND  26                         4.78      RCHRES 242        6
PERLND  26                         4.78      RCHRES 135        7
IMPLND  14                        30.93      RCHRES 242        2

  *** SUB-CATCHMENT IWS-NSMPS (TO POND)
PERLND  26                         2.69      RCHRES 240        6
PERLND  44                         1.97      RCHRES 240        6
PERLND  45                         0.01      RCHRES 240        6
PERLND  26                         2.69      RCHRES 135        7
PERLND  44                         1.97      RCHRES 135        7
PERLND  45                         0.01      RCHRES 135        7
IMPLND  14                         1.95      RCHRES 240        2

  *** SUB-CATCHMENT NEPL (TO POND)
PERLND  26                        10.00      RCHRES 452        6
PERLND  26                        10.00      RCHRES 135        7
IMPLND  14                         6.00      RCHRES 451        2
IMPLND  14                        26.29      RCHRES 452        2

  *** SUB-CATCHMENT CARGO (TO POND)
IMPLND  14                         8.12      RCHRES  46        2

  *** SUB-CATCHMENT SDN3AI (TO VAULT)
```

```
***original IMPLND area
***IMPLND  14                    5.87     RCHRES  37       2
***IMPLND AREA TO BE REMOVED = 5.69 AC
IMPLND  14                    0.18     RCHRES  37       2
PERLND  80                    5.69     RCHRES 135       7

  *** SUB-CATCHMENT SDN3AO (TO POND)
PERLND  26                    0.08     RCHRES 237       6
PERLND  44                    0.03     RCHRES 237       6
***original PERLND area
***PERLND  45                   22.12     RCHRES 237       6
***PERLND AREA TO BE REMOVED = 11.16 AC
***PERLND AREA TO BE REMOVED = 4.56 AC
PERLND  45                    6.40     RCHRES 237       6
PERLND  80                   11.16     RCHRES 135       7
PERLND  80                    4.56     RCHRES 135       7
PERLND  26                    0.08     RCHRES 135       7
PERLND  44                    0.03     RCHRES 135       7
PERLND  45                    6.40     RCHRES 135       7
***original IMPLND area
***IMPLND  14                    2.35     RCHRES 237       2
***IMPLND AREA TO BE REMOVED = 2.19 AC
IMPLND  14                    0.16     RCHRES 237       2
PERLND  80                    2.19     RCHRES 135       7

  *** SUB-CATCHMENT SDW1AO (TO POND)
***original PERLND area
***PERLND  26                    4.28     RCHRES 247       6
***PERLND AREA TO BE REMOVED = 0.67 AC
PERLND  26                    3.61     RCHRES 247       6
PERLND  80                    0.67     RCHRES 135       7
PERLND  44                    0.69     RCHRES 247       6
***original PERLND area
***PERLND  45                   32.44     RCHRES 247       6
***PERLND AREA TO BE REMOVED = 18.06 AC
***PERLND AREA TO BE REMOVED = 0.60 AC
PERLND  45                   13.78     RCHRES 247       6
PERLND  80                   18.06     RCHRES 135       7
PERLND  80                    0.60     RCHRES 135       7
PERLND  26                    3.61     RCHRES 135       7
PERLND  44                    0.69     RCHRES 135       7
PERLND  45                   13.78     RCHRES 135       7
***original IMPLND area
***IMPLND  14                    1.64     RCHRES 247       2
***IMPLND AREA TO BE REMOVED = 0.93 AC
IMPLND  14                    0.71     RCHRES 247       2
PERLND  80                    0.93     RCHRES 135       7
  *** PERVIOUS AREA FOR 1AI IS IN 1AO
  *** SUB-CATCHMENT SDN1AI (TO VAULT)
***original IMPLND area
***IMPLND  14                   13.78     RCHRES 147       2
***IMPLND AREA TO BE REMOVED = 13.07 AC
IMPLND  14                    0.71     RCHRES 147       2
PERLND  80                   13.07     RCHRES  35       7
  *** CONTAINS BOTH I AND O
  *** SUB-CATCHMENT SDW1B (TO POND)
  *** AGWO TO 35, AS 57 IS D/S OF VACCA FARMS (135)
```

```
***original PERLND area
***PERLND  26                          21.25     RCHRES 570       6
***PERLND AREA TO BE REMOVED = 0.54 AC
PERLND  26                          20.71     RCHRES 570     6
PERLND  80                           0.54     RCHRES  35     7
PERLND  44                           2.39     RCHRES 570     6
***original PERLND area
***PERLND  45                          46.26     RCHRES 570       6
***PERLND AREA TO BE REMOVED = 34.71 AC
***PERLND AREA TO BE REMOVED =  1.34 AC
PERLND  45                          10.21     RCHRES 570     6
PERLND  80                          34.71     RCHRES  35     7
PERLND  80                           1.34     RCHRES  35     7
PERLND  26                          20.71     RCHRES  35     7
PERLND  44                           2.39     RCHRES  35     7
PERLND  45                          10.21     RCHRES  35     7
***original IMPLND area
***IMPLND  14                          26.95     RCHRES 570       2
***IMPLND AREA TO BE REMOVED = 20.79 AC
***IMPLND AREA TO BE REMOVED =  1.62 AC
IMPLND  14                           4.54     RCHRES 570     2
PERLND  80                          20.79     RCHRES  35     7
PERLND  80                           1.62     RCHRES  35     7

  *** ADD SUB-CATCHMENT IWS-PRIMARY TO PREDEVELOPEMENT ONLY

***ROUTING FOR MILLER CREEK
 *** M1 TO M2 TO M3 TO STORAGE 50.  M4 TO M5 TO STORAGE 50
RCHRES   1                                    RCHRES   2     4
RCHRES  23                                    RCHRES  24     4
RCHRES  24                                    RCHRES   3     3
RCHRES   2                                    RCHRES   3     3
RCHRES   3                                    RCHRES  33     3
RCHRES  33                                    RCHRES  50     3
RCHRES   4                                    RCHRES   5     4
RCHRES   5                                    RCHRES  50     3
 *** PONDS TO 52, 53 & 54
RCHRES 242                                    RCHRES 240     5
 *** OVERFLOW ONLY TO 61
RCHRES 240                                    RCHRES  51     5
COPY    61                                    RCHRES  51    12
COPY    44                                    RCHRES  51    12
RCHRES  51                                    RCHRES  52     3
RCHRES  43                                    RCHRES  54     3
 *** 2 NEPL VAULTS* (FK-Changed to eliminate run-of-river tables)
RCHRES 451                                    COPY    45    11
RCHRES 452                                    COPY    45    11
COPY    45                                    COPY   645    10
COPY   645                                    RCHRES  53    12
RCHRES  46                                    RCHRES  53     3
 *** NEW STREAM REACH 52 TO LAKE REBA 53 TO RDF 54 (FK-changed to insert new POC
at Lake Reba)
RCHRES 552                                    RCHRES  52     3
RCHRES  52                                    RCHRES  53     3
RCHRES  53                                    COPY    53    11
COPY    53                                    RCHRES  54    12
RCHRES  50                                    RCHRES  54     3
```

```
 *** RDF 54 TO 35
RCHRES  54                                RCHRES 135      3
<-Source->              <--Area-->        <-Target->   MBLK    ***
<Name>   #              <-factor->        <Name>   #   Tbl#    ***
 *** PONDS TO 34
RCHRES  37                                COPY     37     11
RCHRES 237                                COPY     37     11
COPY    37                                RCHRES 135      12
 *** SDW1A flow to bypass added (FK, June 2001)
SDW1AI VAULT FLOW TO INFILTRATION 1                                ***
RCHRES 147                                RCHRES   47      4
SDW1AI VAULT FLOW TO BYPASS                                        ***
RCHRES 147                                COPY     70     15
STORMWATER Q 1ST EXIT AT POND G (Bypass)                           ***
RCHRES 247                                COPY     70     14
RCHRES 247                                COPY     66     14
RCHRES 247                                COPY     69     15
2ND EXIT TO INFILTRATION TANK-MILLER CREEK                         ***
RCHRES 247                                RCHRES   47      5
STORMWATER Q 1ST EXIT TO BYPASS                                    ***
RCHRES  47                                COPY     70     14
*** 2ND EXIT TO SOIL AND MILLER CREEK (2nd exit intr. as AGWLI)***
*** RCHRES  47                                COPY    70     15
COPY BLOCK FOR OUTPUT PURPOSES                                     ***
RCHRES  47                                COPY     62     14
RCHRES  47                                COPY     63     15
RCHRES 147                                COPY     67     14
RCHRES 147                                COPY     68     15
COPY    70                                RCHRES 135      12
RCHRES  34                                RCHRES 135       4
RCHRES  34                                RCHRES 135       5
RCHRES 135                                RCHRES  35       3
RCHRES  10                                RCHRES  16       3
 *** PONDS TO 35
 *** Configuration changed to flow splitter to Pond D and Infiltration Basin 3
(FK, June 2001)
STORM Q - 1ST EXIT OF FLOW SPLITTER TO POND D                      ***
RCHRES 570                                RCHRES  57       4
***INFILTRATION Q - 2ND EXIT OF FLOW SPLITTER TO SOIL              ***
*** RCHRES 570                                RCHRES 257       5
STORM Q EXIT OF POND D TO MILLER CREEK                         ***
RCHRES  57                                COPY     71     11
COPY BLOCK FOR OUTPUT PURPOSES                                     ***
RCHRES 570                                COPY     64     14
RCHRES 570                                COPY     65     15
RCHRES  57                                COPY    357     11
RCHRES 257                                COPY     56     14
RCHRES 257                                COPY     71     14
RCHRES 257                                COPY     71     15
COPY    71                                RCHRES  35      12
RCHRES  35                                COPY     55     11
COPY    55                                RCHRES  16      12
RCHRES  11                                RCHRES  15       3
RCHRES  13                                RCHRES  12       4
RCHRES  13                                RCHRES  12       5
RCHRES  12                                RCHRES  15       3
RCHRES  16                                RCHRES  15       3
```

```
RCHRES  14                                   RCHRES  17      3
RCHRES  15                                   RCHRES  17      3
END SCHEMATIC

NETWORK
***         <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>           <-MEMBER->
<NAME>   # <NAME>   TEM STRG<-FACTOR->STRG <NAME>    #    # <-GRP> <NAME> # # ***
END NETWORK
                                                                                ***
RCHRES
  GEN-INFO
    RCHRES       Name          Nexits   Unit Systems   Printer                  ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG               ***
                                             in  out                            ***
    1      Arbor Lake  M 1         2     1    1    1    62    0    0
    2      Arbor Ck -03710 M 2     1     1    1    1    62    0    0
    3      Arbor Ck    M 3         1     1    1    1    62    0    0
    4      Tub Lake    M 4         2     1    1    1    62    0    0
    5      Miller Ck SR518 M5      1     1    1    1    62    0    0
   10      Trib (0371G)    M 10    1     1    1    1    62    0    0
   11      M11 Ambaum Detention    1     1    1    1    62    0    0
   12      Trib(0354)   M 12       1     1    1    1    62    0    0
   13      Burien Lake M 13        2     1    1    1    62    0    0
   14      Trib (0353) M 14        1     1    1    1    62    0    0
   15      M/S U/S OF 17           1     1    1    1    62    0    0
   16      U/S OF 15 M/S           1     1    1    1    62    0    0
   17      GAGE                    1     1    1    1    62    0    0
   23      BASIN M23               2     1    1    1    62    0    0
   24      BASIN M24               1     1    1    1    62    0    0
   33      detention m3            1     1    1    1    62    0    0
   34      LORA LAKE               2     1    1    1    62    0    0
   35      D/S OF VACA FARM        1     1    1    1    62    0    0
   37      sdn3ai vault            1     1    1    1    62    0    0
   38      MC basins               1     1    1    1    62    0    0
***   39      SDN3A/SDW1A POC         1     1    1    1    62    0    0
   43      sdn3 pond               1     1    1    1    62    0    0
***   44      sdn4 pond               1     1    1    1    62    0    0
***   45      nepl poc                1     1    1    1    62    0    0
   46      cargo pond              1     1    1    1    62    0    0
   47      sdw1a infiltration      2     1    1    1    62    0    0
   50      sr 518                  1     1    1    1    62    0    0
   51      SDN2X+SDN4X             1     1    1    1    62    0    0
   52      U/S OF LAKE REBA        1     1    1    1    62    0    0
   53      Reba outflow            1     1    1    1    62    0    0
   54      Miller RDF outflow      1     1    1    1    62    0    0
   57      sdw1b pond              1     1    1    1    62    0    0
  135      VACA FARMS              1     1    1    1    62    0    0
  147      sdw1a vault             2     1    1    1    62    0    0
  237      sdn3ao-pond c           1     1    1    1    62    0    0
  240      iws-ncps                2     1    1    1    62    0    0
  242      iws-nsmps               2     1    1    1    62    0    0
  247      sdw1a pond g            2     1    1    1    62    0    0
  257      sdw1b infiltration      2     1    1    1    62    0    0
  451      nepl VAULT              1     1    1    1    62    0    0
  452      nepl VAULT              1     1    1    1    62    0    0
  552      SDN1 POC                1     1    1    1    62    0    0
  570      SDW1B flow splitter     2     1    1    1    62    0    0
```

```
*** 645     nepl POC                    1    1    1    1   62    0    0
  END GEN-INFO

  ACTIVITY
    RCHRES *************** Active Sections *****************                   ***
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG
    1  999    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    RCHRES *************** Printout Flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
    1  999    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1                                                                ***
    RCHRES  Flags for each HYDR Section
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each       FUNCT  for each
            FG FG FG FG  possible   exit *** possible  exit        possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *           ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
    2        0  0  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
    3        0  0  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
    4        0  1  0  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
    5    12  0  0  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
   13        0  1  0  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
   14    22  0  0  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
   23        0  1  0  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
   24    33  0  0  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
   34        0  1  0  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
   35    46  0  1  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
   47        0  1  0  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
   48   146  0  1  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
  147        0  1  1  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
  148   239  0  1  1  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
  240   257  0  1  1  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
  258   552  0  1  0  0    4  0  0  0  0       0  0  0  0  0         2  2  2  2  2
  553   570  0  1  1  0    4  5  0  0  0       0  0  0  0  0         2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    RCHRES                                                                  ***
    # -  #     FTABNO       LEN     DELTH     STCOR        KS      DB50     ***
  <------><--------><--------><--------><--------><--------><-------->      ***
    1              1     0.010                              0.3
    2              2     0.776                              0.3
    3              3     0.980                              0.3
    4              4     0.010                              0.3
    5              5     0.380                              0.3
   10             10     0.380                              0.3
   11             11     0.010                              0.3
   12             12     1.000                              0.3
   13             13     0.015                              0.3
   14             14     0.450                              0.3
   15             15     0.735                              0.3
   16             16     0.587                              0.3
   17             17     0.379                              0.3
```

```
 23                  23   0.379                           0.0            0.3
 24                  24   0.379                                          0.3
 33                  33   0.200                                          0.3
 34                  34   0.852                                          0.3
 35                  35   0.663                                          0.3
 37                  37   0.010                           0.0            0.3
 38                  38   0.010                                          0.3
 43                  43   0.010                                          0.3
 46                  46   0.010                                          0.3
 47                  47   0.010                           0.0            0.3
 50                  50   0.010                                          0.3
 51                  51   0.010                                          0.3
 52                  52   0.010                                          0.3
 53                  53   0.010                                          0.3
 54                  54   0.010                           0.0            0.3
 57                  57   0.010                           0.0            0.3
135                 135   0.350                                          0.3
147                 147   0.010                                          0.3
237                 237   0.010                           0.0            0.3
240                 240   0.010                                          0.3
242                 242   0.010                                          0.3
247                 247   0.010                           0.0            0.3
257                 257   0.010                           0.0            0.3
451                 451   0.010                           0.0            0.3
452                 452   0.010                           0.0            0.3
552                 552   0.010                           0.0            0.3
570                 570   0.010                           0.0            0.3
END HYDR-PARM2

HYDR-INIT
  RCHRES  Initial conditions for each HYDR section                                ***
  # -  # ***    VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
        *** ac-ft     for each possible exit        for each possible exit
<------><-------->    <---><---><---><---><---> *** <---><---><---><---><--->
  1     2.0             4.0  5.0
  2     0.0             4.0
  3     0.0             4.0
  4     2.0             4.0  5.0
  5     0.0             4.0
 10     0.0             4.0
 11     0.0             4.0
 12     0.0             4.0
 13     10.0            4.0  5.0
 14     0.0             4.0
 15     0.0             4.0
 16     0.0             4.0
 17     0.0             4.0
 23     6.0             4.0  5.0
 24     0.0             4.0
 33     0.0             4.0
 34     9.0             4.0  5.0
 35     0.1             4.0
 37     0.0             4.0
 38     0.1             4.0
 43     0.0             4.0
 46     0.0             4.0
 47     0.0             4.0  5.0
```

```
   50       0.0                 4.0
   51       0.0                 4.0
   52       0.0                 4.0
   53       0.1                 4.0
   54       2.25                4.0
   57       0.0                 4.0
  237       0.00                4.0
  147       0.00                4.0  5.0
  135       0.00                4.0
  240       0.0                 4.0  5.0
  242       0.0                 4.0  5.0
  247       0.0                 4.0  5.0
  257       0.0                 4.0  5.0
  451       0.0                 4.0
  452       0.0                 4.0
  552       0.0                 4.0
  570       0.0                 4.0  5.0
  END HYDR-INIT
END RCHRES

FTABLES
***UPPER BASIN
***===========

  FTABLE       1
           *** REVISED 8/16/00 ADDED 2ND OUTFLOW
 ROWS COLS ***
   11    5
     DEPTH       AREA     VOLUME     OUTFLOW  OUTFLOW2***
     0.00        3.00      0.00        0.00     0.00
     2.50        3.00      7.50        0.00     0.11
     3.00        3.00      9.00        1.80     0.11
     3.50        3.30     10.58        5.00     0.11
     4.00        3.60     12.30       10.90     0.11
     4.50        3.90     14.18       17.50     0.11
     5.00        4.10     16.18       26.20     0.11
     5.50        4.30     18.28       32.50     0.11
     6.00        4.50     20.48       35.90     0.11
     7.00        5.00     25.23       38.10     0.11
     8.00        5.50     30.48       46.40     0.11
  END FTABLE   1

  FTABLE       2
 ROWS COLS ***
    9    4
     DEPTH       AREA     VOLUME     OUTFLOW     ***
     0.000     0.0000     0.0000        0.00
     0.100     0.2571     0.0129        0.16
     0.500     0.3873     0.1417        6.53
     1.000     0.5501     0.3761       25.95
     1.500     0.7128     0.6918       59.86
     2.000     0.8756     1.0889      110.67
     3.000     1.2011     2.1273      272.24
     3.500     1.3639     2.7685      387.38
     4.000     1.5266     3.4912      528.19
  END FTABLE   2
```

```
 FTABLE       3
ROWS COLS ***
  12    4
    DEPTH       AREA     VOLUME   OUTFLOW   ***
    0.000     0.0000     0.0000      0.00
    0.100     0.9669     0.0483      0.13
    0.500     1.0637     0.4545      4.92
    1.000     1.1846     1.0165     17.12
    1.500     1.3055     1.6390     34.92
    2.000     1.4264     2.3220     57.95
    2.500     1.5473     3.0654     86.14
    3.000     1.6682     3.8693    119.53
    3.500     1.7891     4.7336    158.24
    4.000     1.9100     5.6584    202.41
    4.500     2.0294     6.6310    251.52
    5.000     2.1488     7.6624    306.28
 END FTABLE  3

 FTABLE       4
         *** REVISED 8/16/00 ADDED 2ND OUTFLOW
ROWS COLS ***
   7    5
    DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
     0.00     3.00     0.00       0.00       0.00
     2.50     4.50     9.38       0.00       0.11
     3.00     6.00     12.00      6.00       0.11
     4.00     10.00    20.00      13.00      0.11
     5.00     15.00    32.50      20.00      0.11
     6.00     20.00    50.00      26.00      0.11
     7.00     25.00    72.50      168.00     0.11
 END FTABLE  4

 FTABLE       5
ROWS COLS ***
  10    4
    DEPTH       AREA     VOLUME   OUTFLOW   ***
    0.000     0.0000     0.0000      0.00
    0.100     0.1010     0.0051      0.03
    0.500     0.1754     0.0603      1.46
    1.000     0.2684     0.1713      6.16
    1.500     0.3614     0.3288     14.89
    2.000     0.4544     0.5327     28.48
    2.500     0.5474     0.7832     47.70
    3.000     0.6404     1.0801     73.29
    3.500     0.7334     1.4236    105.94
    4.000     0.8264     1.8136    146.33
 END FTABLE  5

 FTABLE      10
ROWS COLS ***
   9    4
    DEPTH       AREA     VOLUME   OUTFLOW   ***
    0.000     0.0000     0.0000      0.00
    0.100     0.1010     0.0051      0.06
    0.500     0.1660     0.0585      2.27
    1.000     0.2472     0.1618      9.32
    1.500     0.3285     0.3057     22.08
```

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    2.000     0.4097     0.4902      41.66
    2.500     0.4909     0.7154      69.09
    3.000     0.5722     0.9811     105.37
    4.000     0.6887     1.6116     209.70
 END FTABLE 10

 POST AMBAUM DETENTION ***
 FTABLE     11
ROWS COLS ***
  12    4
    DEPTH       AREA     VOLUME    OUTFLOW   ***
    0.000     0.0000     0.0000       0.00
    1.000     0.1000     0.2300       3.90
    2.000     0.2000     0.6000       6.30
    3.000     0.3000     0.9700       8.10
    4.000     0.4000     1.3400      11.10
    5.000     0.5000     1.8200      16.00
    6.000     0.6000     2.2700      19.10
    7.000     0.7000     2.8300      21.60
    8.000     0.8000     3.3700      30.80
    9.000     0.9000     4.0000      38.10
   10.000     1.0000     4.6500      74.10
   10.500     1.1000     5.2000     133.00
   11.000     1.1500     6.0000     500.00
   11.500     1.3000     11.000    1300.00
 END FTABLE 11

 FTABLE     12
ROWS COLS ***
   6    4
    DEPTH       AREA     VOLUME    OUTFLOW   ***
    0.000     0.0000     0.0000       0.00
    0.100     0.6327     0.0316       0.15
    0.500     0.7960     0.3174       5.87
    1.000     1.0002     0.7664      21.53
    1.500     1.2043     1.3176      46.43
    2.000     1.4085     1.9708      81.20
    3.000     1.8168     3.5834     183.79
    4.000     2.2251     5.6044     336.22
    5.000     2.6335     8.0337     545.30
    6.000     3.0418    10.8713     817.51
 END FTABLE 12

 FTABLE     13
          *** REVISED 8/16/00 ADDED 2ND OUTFLOW
ROWS COLS ***
   7    5
    DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
    0.000     40.000     0.0000       0.00      0.00
    1.000     41.400     40.000       0.00      0.11
    1.500     42.000     60.000      10.00      0.11
    2.000     42.700     80.000      16.00      0.11
    2.500     43.300     100.00      20.00      0.11
    3.000     44.000     120.00      28.00      0.11
    5.000     45.000     210.00      45.00      0.11
 END FTABLE 13
```

FTABLE 14
ROWS COLS ***
6 4

DEPTH	AREA	VOLUME	OUTFLOW	***
0.000	0.0000	0.0000	0.00	
0.100	0.3361	0.0168	0.24	
0.500	0.3809	0.1602	9.04	
1.000	0.4370	0.3647	31.61	
1.500	0.4930	0.5972	65.00	
2.000	0.5491	0.8577	108.85	
2.500	0.6051	1.1462	163.33	
3.000	0.6612	1.4628	228.78	

END FTABLE 14

FTABLE 15
ROWS COLS ***
4 4

DEPTH	AREA	VOLUME	OUTFLOW	***
0.00	0.10	0.00	0.00	
1.00	1.00	0.55	91.00	
2.00	1.10	1.60	268.00	
3.00	1.20	2.75	493.00	

END FTABLE 15

FTABLE 16
ROWS COLS ***
4 4

DEPTH	AREA	VOLUME	OUTFLOW	***
0.00	0.10	0.00	0.00	
1.00	1.00	0.55	74.00	
2.00	1.10	1.60	219.00	
3.00	1.20	2.75	403.00	

END FTABLE 16

FTABLE 17
ROWS COLS ***
5 4

DEPTH	AREA	VOLUME	OUTFLOW	***
0.00	0.10	0.00	0.00	
1.00	1.00	0.55	59.00	
2.00	1.10	1.60	173.00	
3.00	1.20	2.75	318.00	
4.00	1.30	4.00	484.00	

END FTABLE 17

FTABLE 23
ROWS COLS *** HERMES
9 5

DEPTH	AREA	VOLUME	OUTFLOW	OUTFLOW	***	
0.00	0.00	0.00	0.00	0.00		0.00
5.00	0.50	1.91	0.00	0.00		305.00
11.00	0.79	5.79	0.00	0.00		311.00
15.00	1.13	9.64	0.50	0.01		315.00
19.00	1.72	15.34	0.50	0.05		319.00
29.00	2.86	38.25	0.50	0.10		329.00
39.00	4.40	74.55	0.50	0.20		339.00
50.00	6.22	132.98	0.50	0.30		350.00

```
   60.00    10.00   1212.98       0.50     0.40       360.00
 END FTABLE 23

 FTABLE     24
ROWS COLS ***
   9    4
   DEPTH      AREA     VOLUME    OUTFLOW    ***
   0.000     0.0000    0.0000       0.00
   0.100     0.2571    0.0129       0.16
   0.500     0.3873    0.1417       6.53
   1.000     0.5501    0.3761      25.95
   1.500     0.7128    0.6918      59.86
   2.000     0.8756    1.0889     110.67
   3.000     1.2011    2.1273     272.24
   3.500     1.3639    2.7685     387.38
   4.000     1.5266    3.4912     528.19
 END FTABLE 24

 FTABLE     33
ROWS COLS ***
  11    4
   DEPTH      AREA     VOLUME    OUTFLOW    ***
     0.00     1.00      0.00       0.00
     0.50     1.20      0.55       2.00
     1.00     1.40      1.20       6.00
     1.50     1.60      1.95       9.00
     2.00     1.80      2.80      13.00
     2.50     2.00      3.75      16.50
     3.00     2.20      4.80      20.00
     3.50     2.40      5.95      23.00
     4.00     2.60      7.20      26.00
     5.00     2.80      9.90     104.00
     6.00     3.00     12.80     246.00
 END FTABLE 33

 FTABLE     34
ROWS COLS *** REVISED 11/19/97 BASED ON HEC-RAS MODEL
          *** REVISED 8/16/00 ADDED 2ND OUTFLOW
   6    5
   DEPTH       AREA     VOLUME    OUTFLOW OUTFLOW2***
    0.00       3.00     0.00       0.00    0.00
    3.00       3.05     9.08       0.00    0.11
    4.00       3.10     12.15      0.00    0.11
    5.00       3.15     15.28      0.00    0.11
    6.00       3.20     18.45      72.0    0.11
    7.00       3.25     21.68     225.0    0.11
 END FTABLE 34

 FTABLE     35
ROWS COLS *** REVISED 11/19/97 BASED ON HECRAS MODEL
   5    4
   DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.00     0.10      0.00       0.00
    1.00     1.10      0.60      38.00
    2.00     1.20      1.75     108.00
    3.00     1.30      3.00     194.00
    4.00     1.40      4.35     290.00
```

```
 END FTABLE 35

 FTABLE     38
ROWS COLS ***
   7    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0000     0.0000       0.00
     1.000     0.4000     0.4000       2.00
     1.500     0.5000     1.0000       4.00
     2.000     0.9000     1.3000      11.00
     2.500     1.3000     1.6000      15.00
     3.000     1.6000     2.0000      18.00
     3.500     1.9000     2.5000      20.80
 END FTABLE 38

 FTABLE     45
ROWS COLS ***
   4    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0010     0.0000       0.00
     0.000     0.0100     0.0100      10.00
     0.100     0.1000     0.1000     100.00
     1.000     1.0000     1.0000    1000.00
    10.000    10.0000    10.0000   10000.00
 END FTABLE 45

 FTABLE    645
ROWS COLS ***
   4    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0010     0.0000       0.00
     0.000     0.0100     0.0100      10.00
     0.100     0.1000     0.1000     100.00
     1.000     1.0000     1.0000    1000.00
    10.000    10.0000    10.0000   10000.00
 END FTABLE645

 FTABLE     50
ROWS COLS ***
  10    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
      0.00       1.00       0.00       0.00
      0.50       1.10       0.53       5.00
      1.00       1.20       1.10      15.00
      1.50       1.30       1.73      25.00
      2.00       1.40       2.40      35.00
      2.50       1.50       3.13      52.00
      3.00       1.60       3.90      70.00
      3.50       1.70       4.73      87.00
      4.00       1.80       5.60     105.00
      6.00       1.90       9.30     165.00
 END FTABLE 50

 FTABLE     52
ROWS COLS ***
   6    4
```

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00
0.100	0.3680	0.0184	0.25
0.500	0.3717	0.1664	9.39
1.000	0.3763	0.3534	31.06
2.000	0.3819	0.7325	94.37
3.000	0.3874	1.1171	174.33

END FTABLE 52

FTABLE 552
ROWS COLS *** SDN1 VAULT EFFECTIVE DEPTH=12 FT RISER=24 INCHES
15 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.4308	0.0000	0.00
1.290	0.4308	0.6520	0.111
2.130	0.4308	1.0760	0.143
3.530	0.4308	1.7830	0.184
4.640	0.4308	2.3430	0.211
5.200	0.4308	2.6260	0.223
6.320	0.4308	3.1920	0.246
7.430	0.4308	3.7530	0.267
8.200	0.4308	4.1410	0.280
9.220	0.4308	4.6570	0.407
10.190	0.4308	5.1460	0.567
11.250	0.4308	5.6820	0.954
12.100	0.4308	6.1110	2.130
12.300	0.4308	6.2120	4.730
13.700	0.4308	6.9190	21.360

END FTABLE552

FTABLE 53
OLD LAKE REBA ***
MAX DEPTH = 4.9 FEET ***
30" CMP, 40 CFS DISCHARGE AT MAX DEPTH ***
ROWS COLS ***
7 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	2.4000	0.0000	0.00
1.000	2.5800	2.5000	18.00
2.000	2.9400	5.3000	26.00
3.000	3.4100	8.4000	31.00
4.000	3.8800	12.100	36.00
4.900	4.3000	15.800	40.00
6.000	4.3000	15.810	500.00

END FTABLE 53

FTABLE 54
EXISTING MILLER CREEK DETENTION FACILITY*** REVISED STORAGE/Q DATA
GATE SETTING: 2.0 FEET*** BASED ON CALIBRATION FILE
ROWS COLS ***
12 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.00	0.00	0.00
1.300	0.01	0.01	10.00
2.000	0.01	0.02	20.00
2.900	0.70	0.40	30.00
4.000	1.50	1.50	40.00

5.400	3.50	4.90	50.00
7.000	8.60	13.30	60.00
8.800	15.60	34.80	70.00
10.000	19.90	57.30	76.00
10.500	21.50	68.00	92.00
11.000	23.10	78.80	179.00
11.500	24.70	88.60	303.00

END FTABLE 54

FTABLE 104
MILLER CREEK DETENTION FACILITY*** WITH ADD'L AREA 1+AREA 2 55.5 ACFT @ 10FT
GATE SETTING: 2.0 FEET*** EXISTING OUTLET NO LOW FLOW CONTROL
ROWS COLS ***
17 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00
0.500	0.0100	0.0100	2.50
1.500	0.0300	0.2800	14.29
2.500	1.1100	1.3900	24.88
3.500	2.6100	4.0000	34.51
4.500	4.6100	9.1400	43.20
5.500	7.1200	19.600	50.98
6.000	8.3600	21.180	54.53
6.500	11.870	30.060	57.87
7.000	15.370	38.930	61.00
7.500	18.870	47.800	63.91
8.000	21.860	59.160	66.62
8.500	24.850	70.510	69.12
9.000	27.340	84.160	71.42
9.500	29.820	97.820	73.53
10.000	32.050	112.83	75.44
10.500	34.275	127.84	90.74
11.500	38.220	161.54	320.00

END FTABLE104

FTABLE 69
PRE-MILLER CREEK DETENTION FACILITY***
ROWS COLS ***
12 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.0000	0.0000	0.00
0.100	0.1860	0.0093	0.12
0.500	0.2552	0.0975	4.84
1.000	0.3417	0.2467	18.49
1.500	0.4282	0.4392	41.30
2.000	0.5148	0.6750	74.40
2.500	0.6013	0.9540	119.01
3.000	0.6878	1.2763	176.30
3.500	0.7744	1.6418	247.41
4.000	0.8609	2.0506	333.43
4.500	0.9470	2.4992	434.59
5.000	1.0331	2.9905	552.33

END FTABLE 69

*** PROJECT CONDITION PONDS/VAULTS
FTABLE 452
ROWS COLS ***

```
*** NEW NORTH EMPLOYEE PARKING LOT VAULT (NEPL)
*** PARALLEL VAULT BASED ON KCRTS EFFECTIVE DEPTH=20 FT
  20    4
    DEPTH       AREA      VOLUME    OUTFLOW ***
     0.00      3.214      0.000      0.000
     1.11      3.214      0.826      0.129
     1.57      3.214      1.168      0.154
     3.43      3.214      2.551      0.227
     4.83      3.214      3.593      0.269
     8.08      3.214      6.010      0.348
    10.41      3.214      7.743      0.395
    12.74      3.214      9.476      0.437
    14.00      3.214     10.413      0.458
    14.65      3.214     10.897      0.557
    16.09      3.214     11.968      0.665
    16.23      3.214     12.072      0.754
    17.92      3.214     13.329      1.140
    18.22      3.214     13.552      1.310
    18.81      3.214     13.991      1.860
    19.11      3.214     14.214      2.190
    20.00      3.214     14.876      3.350
    20.20      3.214     15.025      5.110
    20.70      32.14     15.397     14.820
    21.00      32.14     15.620     18.560
  END FTABLE452

  FTABLE    451
 ROWS COLS ***
 *** NORTH EMPLOYEE PARKING LOT VAULT (NEPL)
 *** EXISTING VAULT W/MODIFIED OUTLET   EFFECTIVE DEPTH= 18.0 FT
   14    4
    DEPTH       AREA      VOLUME    OUTFLOW    ***
    0.000     0.2240     0.0000       0.00
    2.170     0.2240     0.4860      0.031
    4.260     0.2240     0.9550      0.043
    5.930     0.2240     1.3290      0.051
    8.030     0.2240     1.8000      0.059
   10.120     0.2240     2.2680      0.066
   12.210     0.2240     2.7360      0.073
   14.040     0.2240     3.1460      0.109
   15.510     0.2240     3.4760      0.166
   16.220     0.2240     3.6350      0.295
   18.000     0.2240     4.0340      1.080
   18.400     0.2240     4.1240      5.400
   19.000     0.2240     4.2580     12.680
   19.900     0.2240     4.4600     17.080
  END FTABLE451


  FTABLE     46
 ROWS COLS ***
 SDN-6: 24TH STREET CARGO VAULT ***  EFFECTIVE DEPTH=14 FT RISER DIA=12 IN
   20    4
    DEPTH       AREA      VOLUME    OUTFLOW    ***
     0.00       0.35      0.000      0.000
     0.37       0.35      0.131      0.021
     1.19       0.35      0.421      0.037
```

3.39	0.35	1.198	0.063
5.03	0.35	1.778	0.077
7.23	0.35	2.556	0.092
9.15	0.35	3.235	0.104
10.25	0.35	3.624	0.110
10.53	0.35	3.723	0.111
10.92	0.35	3.861	0.128
12.00	0.35	4.242	0.165
12.13	0.35	4.288	0.190
12.95	0.35	4.578	0.245
13.77	0.35	4.868	0.282
14.00	0.35	4.949	0.291
14.10	0.35	4.985	0.910
14.20	0.35	5.020	2.040
14.30	0.35	5.056	3.500
14.50	0.35	5.126	7.200
14.70	0.35	5.197	11.720

END FTABLE 46

*** SDW-1A: 3RD RUNWAY POND G TO MILLER CREEK (LEVEL 2): ***
FTABLE 47
*** PROJECT SDW1A EFFECTIVE DIAMETER=3.0 FT
ROWS COLS *** INFILTRATION TANK TO OBTAIN 0.3 CFS
14 5

DEPTH	AREA	VOLUME	STORMQ	INFILTRQ ***
0.000	0.000	0.000	0.000	0.000
0.250	0.002	0.002	0.000	0.027
0.500	0.004	0.004	0.000	0.054
1.000	0.012	0.012	0.000	0.109
1.500	0.020	0.020	0.000	0.164
2.000	0.029	0.029	0.000	0.218
2.500	0.036	0.036	0.000	0.272
3.000	0.041	0.0406	0.000	0.327
3.100	0.041	0.0419	0.596	0.338
3.200	0.041	0.0420	1.685	0.349
3.300	0.041	0.0421	3.096	0.360
3.400	0.041	0.0422	4.766	0.371
3.500	0.041	0.0423	6.661	0.382
3.750	0.041	0.0424	12.237	0.409

END FTABLE 47

*** SDW-1A: 3RD RUNWAY NORTH POND G TO MILLER CREEK (LEVEL 2): ***
FTABLE 147
*** PROJECT SDW1A EFFECTIVE DEPTH=14.0 FT RISER DIA 24 INCHES
ROWS COLS *** VAULT BASED ON INFILTRATION=0.15CFS
17 5

DEPTH	AREA	VOLUME	INFILTRQ	BYPASS Q***
0.000	0.689	0.000	0.0000	0.0000
0.010	0.689	0.007	0.1400	0.0000
1.000	0.689	0.689	0.1408	0.0000
2.000	0.689	1.377	0.1417	0.0000
4.000	0.689	2.755	0.1432	0.0000
6.000	0.689	4.132	0.1446	0.0000
8.000	0.689	5.510	0.1461	0.0000
10.000	0.689	6.887	0.1475	0.0000
12.000	0.689	8.264	0.1489	0.0000

14.000	0.689	9.642	0.1503	0.0000
16.000	0.689	11.019	0.1517	0.0000
16.750	0.689	11.536	0.1517	10.7600
16.900	0.689	11.639	0.1517	13.9600
17.000	0.689	11.708	0.1517	16.1000
17.100	0.689	11.777	0.1517	18.5700
17.300	0.689	11.915	0.1517	23.8600
18.000	0.689	12.397	0.1517	45.5400

END FTABLE147

*** SDW-1A: 3RD RUNWAY NORTH POND G TO MILLER CREEK (LEVEL 2): ***

FTABLE 247

*** PROJECT SDW1A EFFECTIVE DEPTH=12.0 FT RISER DIA 12 INCHES

ROWS COLS *** POND BASED ON INFILTRATION=0.15CFS

17 5

DEPTH	AREA	VOLUME	STORMQ	INFILTRQ ***
0.000	1.300	0.000	0.00	0.00
0.010	1.310	0.010	0.001	0.15
1.000	1.320	1.320	0.007	0.15
2.000	1.342	2.650	0.010	0.15
3.000	1.363	4.000	0.012	0.15
4.000	1.385	5.370	0.013	0.15
5.000	2.672	8.000	0.015	0.15
6.000	2.739	10.700	0.017	0.15
7.000	2.807	13.470	0.018	0.15
8.000	2.876	16.300	0.019	0.15
8.300	2.896	17.176	0.031	0.15
9.000	2.945	19.210	0.041	0.15
10.000	3.014	22.180	0.051	0.15
11.000	3.084	25.228	0.058	0.15
11.100	3.092	25.540	0.675	0.15
11.300	3.106	26.162	3.260	0.15
12.000	3.155	28.340	15.190	0.15

END FTABLE247

*** SDN3A: 3RD RUNWAY VAULT TO MILLER CREEK (LEVEL 2): ***

FTABLE 37

*** PROJECT C SDN3A EFFECTIVE DEPTH=11.0FT RISER DIA=24 INCHES

ROWS COLS *** VAULT BASED ON IMPERVIOUS TOP SURO

14 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.644	0.000	0.000
0.010	0.644	0.006	0.001
1.000	0.644	0.643	0.016
3.980	0.644	2.558	0.033
6.030	0.644	3.876	0.041
9.010	0.644	5.792	0.050
10.00	0.644	6.428	0.052
10.46	0.644	6.724	0.072
11.00	0.644	7.071	0.082
11.10	0.644	7.135	0.699
11.20	0.644	7.199	1.830
11.30	0.644	7.264	3.290
11.40	0.644	7.328	5.020
11.60	0.644	7.456	9.140

END FTABLE 37

*** SDN3A: 3RD RUNWAY POND C TO MILLER CREEK (LEVEL 2): ***
FTABLE 237
*** PROJECT C SDN3A EFFECTIVE DEPTH= 9.0FT RISER DIA=24 INCHES
ROWS COLS *** POND BASED ON INTERFLOW AND PERVIOUS TOP SURO
19 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	1.3090	0.000	0.00
0.020	1.3120	0.026	0.009
1.020	1.3550	1.358	0.070
2.070	1.4030	2.806	0.100
3.130	1.4530	4.320	0.123
4.020	1.4980	5.632	0.139
5.070	1.5460	7.229	0.156
7.750	1.6720	11.549	0.193
7.800	1.6800	11.633	0.199
7.850	1.6840	11.718	0.213
8.250	1.7050	12.395	0.249
8.340	1.7090	12.549	0.270
8.570	1.7210	12.944	0.313
8.950	1.7410	13.601	0.354
9.500	1.7690	14.567	0.399
9.600	1.7740	14.744	0.714
9.800	1.7850	15.100	2.020
10.300	1.8110	15.999	3.840
10.900	1.8430	17.095	4.960

END FTABLE237

*** SDN-3X: 3RD RUNWAY NORTH VAULT (LEVEL 2): ***
FTABLE 43
ROWS COLS *** EFFECTIVE DEPTH=20 FT RISER DIA=24 INCHES
21 4

DEPTH (FT)	AREA (ACRES)	VOLUME (ACRE-FT)	FLOW (FT3/S) ***
0.00	1.288	0.00	0.00
0.14	1.288	0.180	0.067
1.39	1.288	1.790	0.216
3.35	1.288	4.314	0.336
5.31	1.288	6.839	0.423
8.06	1.288	10.380	0.521
8.84	1.288	11.385	0.545
10.02	1.288	12.905	0.580
11.98	1.288	15.429	0.635
12.37	1.288	15.931	0.645
14.00	1.288	18.030	0.686
14.10	1.288	18.159	0.705
14.91	1.288	19.202	0.757
16.09	1.288	20.722	0.810
18.00	1.288	23.182	0.881
18.32	1.288	23.594	1.150
18.76	1.288	24.161	1.360
20.00	1.288	25.758	1.680
20.10	1.288	25.886	2.320
20.50	1.288	26.402	8.620
20.80	1.288	26.788	15.370

END FTABLE 43

*** SDN-4X/2X: 3RD RUNWAY NORTH VAULT (COMBINED FACILITY)

```
 FTABLE      51
ROWS COLS ***        EFFECTIVE DEPTH=19FT RISER DIA=24 INCHES
  20    4
    DEPTH      AREA     VOLUME     OUTFLOW                           ***
     (FT)    (ACRES)  (ACRE-FT)    (FT3/S)                           ***
     0.00     0.789      0.000      0.000
     0.16     0.789      0.126      0.056
     1.51     0.789      1.192      0.169
     3.28     0.789      2.588      0.249
     5.49     0.789      4.332      0.322
     7.26     0.789      5.729      0.370
    10.35     0.789      8.168      0.442
    12.12     0.789      9.564      0.478
    13.44     0.789     10.606      0.503
    14.33     0.789     11.308      0.520
    15.57     0.789     12.287      0.654
    16.72     0.789     13.194      0.828
    17.19     0.789     13.565      0.950
    17.63     0.789     13.913      1.030
    18.00     0.789     14.205      1.080
    19.00     0.789     14.994      1.960
    19.10     0.789     15.073      2.580
    19.40     0.789     15.309      6.930
    19.60     0.789     15.467     11.080
    20.00     0.789     15.783     17.190
  END FTABLE 51

*** SDW-1B:3RD RUNWAY CENTRAL SOUTH POND D TO MILLER CREEK (LEVEL 2): ***
  FTABLE      57
 ROWS COLS ***      EFFECTIVE DEPTH = 14.0 FT
   17    4
    DEPTH      AREA     VOLUME     STORMQ     ***
     (FT)    (ACRES)  (ACRE-FT)    (FT3/S)    ***
     0.00     2.430      0.000      0.000
     0.01     2.430      0.041      0.010
     1.00     2.680      2.411      0.183
     2.00     2.760      4.860      0.257
     3.00     2.818      7.370      0.319
     4.00     3.079      9.945      0.366
     5.00     5.832     15.320      0.411
     6.00     5.927     20.742      0.450
     7.00     6.022     26.264      0.481
     8.00     6.118     31.888      0.518
     9.00     6.210     37.613      0.550
    10.00     6.311     43.441      0.583
    11.00     6.408     49.372      0.609
    12.00     6.607     55.406      0.634
    13.00     6.405     61.543      0.764
    14.00     6.504     67.786      1.320
    15.00     7.000     70.000     16.600
  END FTABLE 57

*** SDW-1B:3RD RUNWAY CENTRAL SOUTH POND D TO MILLER CREEK (LEVEL 2): ***
  FTABLE     257
  *** PROJECT  SDW1B   EFFECTIVE DIAMETER=3.0 FT
 ROWS COLS ***         INFILTRATION TANK TO OBTAIN 0.2 CFS
   15    5
```

DEPTH	AREA	VOLUME	STORMQ	INFILTRQ ***
0.000	0.001	0.000	0.000	0.000
0.010	0.001	0.001	0.000	0.002
0.250	0.002	0.002	0.000	0.017
0.500	0.004	0.004	0.000	0.035
1.000	0.012	0.012	0.000	0.071
1.500	0.020	0.020	0.000	0.106
2.000	0.029	0.029	0.000	0.142
2.500	0.036	0.036	0.000	0.178
3.000	0.041	0.0406	0.000	0.213
3.100	0.041	0.0420	0.596	0.220
3.200	0.041	0.0421	1.685	0.227
3.300	0.041	0.0422	3.096	0.233
3.400	0.041	0.0423	4.766	0.241
3.500	0.041	0.0424	6.661	0.248
3.750	0.041	0.0425	12.237	0.266

END FTABLE257

FTABLE 570
*** PROJECT SDW1B FLOW SPLITTER (to 257 and 57)
ROWS COLS ***
15 5

DEPTH	AREA	VOLUME	STORMQ	INFILTRQ ***
0.000	0.00	0.000	0.000	0.000
0.100	0.01	0.0002	0.000	0.050
0.400	0.01	0.0009	0.000	0.110
0.600	0.01	0.0014	0.000	0.130
0.750	0.01	0.0017	0.000	0.150
0.800	0.01	0.0018	0.720	0.150
1.000	0.01	0.0023	8.050	0.170
1.100	0.01	0.0025	13.330	0.180
1.200	0.01	0.0027	19.440	0.190
1.300	0.01	0.0030	26.270	0.190
1.400	0.01	0.0032	33.750	0.200
1.420	0.01	0.0033	35.320	0.200
1.440	0.01	0.0033	36.910	0.200
1.450	0.01	0.0034	37.920	0.200
1.460	0.01	0.0035	38.530	0.200

END FTABLE570

FTABLE 61
ROWS COLS ***
*** SDN-2X: DETAIN OVERFLOW FROM NCPS AND NSMPS-
17 4

DEPTH	AREA	VOLUME	OUTFLOW ***
0.000	0.5740	0.0000	0.00
1.200	0.5740	0.7710	0.151
2.220	0.5740	1.4270	0.205
3.240	0.5740	2.0830	0.247
3.650	0.5740	2.3460	0.262
4.260	0.5740	2.7380	0.283
4.660	0.5740	2.9950	0.296
5.680	0.5740	3.6510	0.327
6.640	0.5740	4.2680	0.517
7.650	0.5740	4.9170	0.644
8.670	0.5740	5.9710	0.739
9.810	0.5740	6.3570	0.836

```
  10.700     0.5740     6.8780      0.894
  12.000     0.5740     7.7130      0.978
  12.100     0.5740     7.7780      1.600
  12.300     0.5740     7.9060      4.200
  12.800     0.5740     8.2280     14.560
 END FTABLE 61

 PRE AMBAUM DETENTION ***
 FTABLE     111
ROWS COLS ***
  15    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.500     0.2160     0.0750       5.30
    1.000     0.2730     0.1990      21.10
    1.500     0.2890     0.3410      43.90
    2.000     0.2900     0.4830      68.80
    2.500     0.2910     0.6070      89.10
    3.000     0.2950     0.6820      90.00
    3.500     0.3000     2.1000     100.00
    4.000     0.3050     2.5000     105.00
    4.500     0.3100     3.0000     110.00
    5.000     0.3200     3.5000     120.00
    5.500     0.3300     4.0000     130.00
    6.000     0.3800     5.0530     166.48
    6.500     0.3980     5.9430     225.31
    7.000     0.4150     6.9040     320.10
 END FTABLE111

 FTABLE     135
ROWS COLS *** VACA FARM
   6    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.00       0.10       0.00       0.00
     1.00       0.10       0.10       4.00
     2.00       0.11       0.21       8.00
     2.50       1.00       0.48      13.00
     3.50       6.50       4.23      86.00
     4.50      13.00      13.98     235.00
 END FTABLE135

 FTABLE     240
*** NORTH SNOWMELT PUMP STATION (SDN-2) (INSTALLED IN LATE 1997/1998)
ROWS COLS                                                              ***
  14    5
    DEPTH      AREA     VOLUME       (IWS)       (SDS)                 ***
     (FT)   (ACRES)  (ACRE-FT)       (CFS)       (CFS)                 ***
      0.0     0.002       0.00        0.00        0.00
     1.00     0.002     0.0023        0.00        0.00
     2.00     0.002     0.0046        1.67        0.00
     3.00     0.002     0.0069        1.67        0.00
     4.00     0.002     0.0092        1.67        0.00
     5.00     0.002     0.0115        1.67        0.00
     5.25     0.002     0.0121        1.67        1.53
     5.50     0.002     0.0126        1.67        6.06
     5.75     0.002     0.0132        1.67       12.65
     6.00     0.002     0.0138        1.67       19.83
```

```
     6.25      0.002     0.0144       1.67      25.66
     6.50      0.002     0.0149       1.67      25.70
     6.75      0.002     0.0155       1.67      26.70
     7.00      0.002     0.0161       1.67      50.00
 END FTABLE240

 FTABLE    242
*** NORTH CARGO PUMP STATION (SDN-2) (INSTALLED IN OCTOBER 1997)
 ROWS COLS                                                                ***
   14    5
    DEPTH      AREA    VOLUME       (IWS)      (SDS)                      ***
     (FT)   (ACRES) (ACRE-FT)       (CFS)      (CFS)                      ***
      0.0     0.002      0.00        0.00       0.00
     1.00     0.002    0.0023        0.00       0.00
     2.00     0.002    0.0046        6.13       0.00
     3.00     0.002    0.0069        6.13       0.00
     4.00     0.002    0.0092        6.13       0.00
     5.00     0.002    0.0115        6.13       0.00
     5.25     0.002    0.0121        6.13       0.28
     5.50     0.002    0.0126        6.13       1.16
     5.75     0.002    0.0132        6.13       2.53
     6.00     0.002    0.0138        6.13       4.23
     6.25     0.002    0.0144        6.13       6.05
     6.50     0.002    0.0149        6.13       7.72
     6.75     0.002    0.0155        6.13       8.50
     7.00     0.002    0.0161        6.13       20.0
 END FTABLE242

END FTABLES

MASS-LINK
<Volume>    <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        1
  conversion from acre-inches to acre-ft (1/12)              ***
PERLND      PWATER PERO        0.0833333    RCHRES         INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
IMPLND      IWATER SURO        0.0833333    RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
RCHRES      ROFLOW                          RCHRES         INFLOW
  END MASS-LINK    3

  MASS-LINK        4
RCHRES      OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK    4

  MASS-LINK        5
RCHRES      OFLOW  OVOL   2                 RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        6
PERLND      PWATER SURO        0.0833333    RCHRES         INFLOW IVOL
PERLND      PWATER IFWO        0.0833333    RCHRES         INFLOW IVOL
```

```
  END MASS-LINK    6

  MASS-LINK        7
PERLND     PWATER AGWO         0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        10
COPY       OUTPUT MEAN                       COPY            INPUT  MEAN
  END MASS-LINK    10

  MASS-LINK        11
RCHRES     ROFLOW                            COPY            INPUT  MEAN
  END MASS-LINK    11

  MASS-LINK        12
COPY       OUTPUT MEAN                       RCHRES          INFLOW IVOL
  END MASS-LINK    12

  MASS-LINK        14
RCHRES     OFLOW  OVOL   1                   COPY            INPUT  MEAN
  END MASS-LINK    14

  MASS-LINK        15
RCHRES     OFLOW  OVOL   2                   COPY            INPUT  MEAN
  END MASS-LINK    15

  MASS-LINK        21
PERLND     PWATER PERO         0.0833333     COPY            INPUT  MEAN
  END MASS-LINK    21

  MASS-LINK        22
IMPLND     IWATER SURO         0.0833333     COPY            INPUT  MEAN
  END MASS-LINK    22

  MASS-LINK        26
PERLND     PWATER SURO         0.0833333     COPY            INPUT  MEAN
PERLND     PWATER IFWO         0.0833333     COPY            INPUT  MEAN
  END MASS-LINK    26

  MASS-LINK        27
PERLND     PWATER AGWO         0.0833333     COPY            INPUT  MEAN
  END MASS-LINK    27

END MASS-LINK

COPY
  TIMESERIES
  Copy-opn                                                              ***
    # -  #  NPT  NMN                                                    ***
   37   71        1
  240  242        1
  357  357        1
  645  645        1
  END TIMESERIES
END COPY

END RUN
```

```
RUN
GLOBAL
  ***  FILE: WClowflo.inp REVISED July 2001. ATC
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF WALKER CREEK
  ***  2006 FUTURE PROJECT CONDITION SIZING BASED
  ***  CHANGED PREC DSN 2 TO NEW PREC DSN 1002
  ***  WALKER CREEK FOUR YEAR RUN USING CALIBRATION INITIAL CONDITIONS
  WALKER CREEK BASIN HSPF MODEL
  START       1990 10  1  0  0  END    1994  9 30 24  0

  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname------------------------------------------>
MESSU      24   D:\PARA\SEATAC\MILLER\LOWFLOW\WALKER.MES
WDM        25   D:\PARA\SEATAC\MILLER\LOWFLOW\mlowflow.WDM
           61   D:\PARA\SEATAC\MILLER\LOWFLOW\wPER.L61
           62   D:\PARA\SEATAC\MILLER\LOWFLOW\wRCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      14
      PERLND      16
      PERLND      18
      PERLND      24
      PERLND      26
      PERLND      28
      PERLND      34
      PERLND      44
      PERLND      45
      PERLND      54
      PERLND      64
      PERLND      65
      PERLND      80
      IMPLND      14
      RCHRES      49
      RCHRES      20
      RCHRES      19
      RCHRES      18
    END INGRP
END OPN SEQUENCE
                                                                        ***
COPY
  TIMESERIES
  Copy-opn                                                              ***
    # -  #  NPT  NMN                                                    ***
    1    5        1
  END TIMESERIES
END COPY

PERLND
  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer            ***
    # -  #                          User  t-series Engl Metr            ***
```

```
                                                   in  out                           ***
  14       TFF- TILL FOR FLT      1    1     1    1   61     0
  16       TFM- TILL FOR MOD      1    1     1    1   61     0
  18       TFS- TILL FOR STP      1    1     1    1   61     0
  24       TGF- TILL GR FLT       1    1     1    1   61     0
  26       TGM- TILL GR MOD       1    1     1    1   61     0
  28       TGS- TILL GR STP       1    1     1    1   61     0
  34       OF - OUTWASH FOR       1    1     1    1   61     0
  44       OG - OUTWASH GR        1    1     1    1   61     0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
  45       AIRPORT FILL           1    1     1    1   61     0
  54       SA - WETLANDS          1    1     1    1   61     0
  64       TGM DES MOINES         1    1     1    1   61     0
  65       OG  DES MOINES         1    1     1    1   61     0
  80       Fill AGWO              1    1     1    1   61     0
 END GEN-INFO
 ACTIVITY
   <PLS > ************* Active Sections *****************************
   # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC          ***
  14  200    0    0    1    0    0    0    0    0    0    0    0    0
 END ACTIVITY
 PRINT-INFO
   <PLS > ********************* Print-flags ************************* PIVL  PYR
   # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
  14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
 END PRINT-INFO
 PWAT-PARM1
   <PLS > ***************** Flags *******************
   # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                          ***
  14         0    0    0    0    0    0    0    0    0
  16         0    0    0    0    0    0    0    0    0
  18         0    0    0    0    0    0    0    0    0
  24         0    0    0    0    0    0    0    0    0
  26         0    0    0    0    0    0    0    0    0
  28         0    0    0    0    0    0    0    0    0
  34         0    0    0    0    0    0    0    0    0
  44         0    0    0    0    0    0    0    0    0
  45         0    0    0    0    0    0    0    0    0
  54         0    0    0    0    0    0    0    0    0
  64         0    0    0    0    0    0    0    0    0
  80         0    0    0    0    0    0    0    0    0
 END PWAT-PARM1
 PWAT-PARM2
   <PLS > ***
   # -  # ***FOREST       LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  14                    4.5000    0.0800    400.00    0.0500    0.5000    0.9960
  16                    4.5000    0.0800    400.00    0.1000    0.5000    0.9960
  18                    4.5000    0.0800    200.00    0.2000    0.5000    0.9960
  24                    4.5000    0.0300    400.00    0.0500    0.5000    0.9960
  26                    4.5000    0.0300    400.00    0.1000    0.5000    0.9960
  28                    4.5000    0.0300    200.00    0.2000    0.5000    0.9960
  34                    5.0000    2.0000    400.00    0.0500    0.3000    0.9960
  44                    5.0000    0.8000    400.00    0.0500    0.3000    0.9960
  45                    7.5000    0.0200    300.00    0.0700    0.0000    0.9960
  54                    4.0000    2.0000    100.00    0.0010    0.5000    0.9960
  64                    4.5000    0.1200    400.00    0.1000    0.5000    0.9990
  65                    5.0000    0.8000    400.00    0.0500    0.5000    0.9960
```

```
WDM   7100 FLOW     ENGL     .000000957     RCHRES  20      INFLOW IVOL
END EXT SOURCES
                                                                            ***

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES  18 HYDR   RO                       WDM   7196 FLOW     ENGL      REPL
RCHRES  20 HYDR   RO                       WDM   7197 FLOW     ENGL      REPL
 ***PROJECT CONDITION FLOWS
RCHRES  49 HYDR   RO      1 1      ***     WDM    109 FLOW     ENGL      REPL
*** DETENTION STAGES
RCHRES  49 HYDR   STAGE            ***     WDM    649 STAG     ENGL      REPL
*** DETENTION VOLUME
RCHRES  49 HYDR   VOL              ***     WDM    749 VOL      ENGL      REPL
*** 39=SR509     37=SDW2
END EXT TARGETS
                                                                            ***

SCHEMATIC
<-Source->                 <--Area-->      <-Target->   MBLK    ***
<Name>    #                <--factor->     <Name>    #  Tbl#    ***

***WALKER CREEK
*** SUB-CATCHMENT  MC 8
PERLND  26                      3.93       RCHRES  20       1
PERLND  44                     18.73       RCHRES  20       1
PERLND  54                      2.70       RCHRES  20       1
IMPLND  14                      0.01       RCHRES  20       2
***   *** SUB-CATCHMENT  SDW-2
***PERLND  26                     26.82      RCHRES  49       6
***PERLND  44                      1.42      RCHRES  49       6
***PERLND  45                      6.70      RCHRES  49       6
***PERLND  26                     26.82      RCHRES  20       7
***PERLND  44                      1.42      RCHRES  20       7
***PERLND  45                      6.70      RCHRES  20       7
***IMPLND  14                      9.51      RCHRES  49       2
***REPLACE SUBCATCHMENT SDW-2   WITH NEW SDW-2 SUBBASIN
***SUBBASIN SDW-2 ROUTING AS OF 4/19/01
*** old fill area
***PERLND  26                     26.88      RCHRES  49       6
*** area removed = 0.04 ac
PERLND  26                     26.84       RCHRES  49       6
PERLND  44                      1.51       RCHRES  49       6
*** old fill area
***PERLND  45                      6.700     RCHRES  49       6
*** area removed = 4.66 ac
PERLND  45                      2.040      RCHRES  49       6
PERLND  26                     26.84       RCHRES  20       7
PERLND  44                      1.51       RCHRES  20       7
PERLND  45                      2.040      RCHRES  20       7
*** old fill area
***IMPLND  14                      9.51      RCHRES  49       2
*** area removed = 3.35 ac
IMPLND  14                      6.16       RCHRES  49       2
*** FILL AGWO PERLND 80 ALL TO GROUNDWATER RCHRES 20
PERLND  80                      8.05       RCHRES  20       7
*** SUB-CATCHMENT  MC 9
PERLND  26                      9.28       RCHRES  20       1
```

```
PERLND  44                        0.76      RCHRES  20        1
IMPLND  14                        0.40      RCHRES  20        2
  *** SUB-CATCHMENT 18
PERLND  16                        0.76      RCHRES  18        1
PERLND  26                       16.08      RCHRES  18        1
PERLND  34                       20.95      RCHRES  18        1
PERLND  44                       49.22      RCHRES  18        1
IMPLND  14                        3.30      RCHRES  18        2
  *** SUB-CATCHMENT 19
PERLND  16                       12.72      RCHRES  19        1
PERLND  26                       92.07      RCHRES  19        1
PERLND  34                        8.39      RCHRES  19        1
PERLND  44                       95.55      RCHRES  19        1
IMPLND  14                       30.53      RCHRES  19        2
  *** SUB-CATCHMENT 20
PERLND  26                       12.54      RCHRES  20        1
PERLND  44                       53.42      RCHRES  20        1
PERLND  54                       33.43      RCHRES  20        1
IMPLND  14                       52.83      RCHRES  20        2
*** DOWN STREAM OF WALKER CREEK GAGE
  *** SUB-CATCHMENT 21 33% OF GW GOES TO GAGE REST GOES TO SOUND
PERLND  16                        2.54      RCHRES  18        7
PERLND  26                       44.30      RCHRES  18        7
PERLND  34                        2.03      RCHRES  18        7
PERLND  44                       41.13      RCHRES  18        7
PERLND  16                        2.54      RCHRES  21        6
PERLND  26                       44.30      RCHRES  21        6
PERLND  34                        2.03      RCHRES  21        6
PERLND  44                       41.13      RCHRES  21        6
IMPLND  14                       16.54      RCHRES  21        2
PERLND  16                        5.07      RCHRES  21        1
PERLND  26                       88.61      RCHRES  21        1
PERLND  34                        4.06      RCHRES  21        1
PERLND  44                       82.26      RCHRES  21        1
IMPLND  14                       33.09      RCHRES  21        2
  *** SUB-CATCHMENT 22
PERLND  34                        4.30      RCHRES  22        1
PERLND  44                       19.49      RCHRES  22        1
PERLND  54                        3.21      RCHRES  22        1
IMPLND  14                        3.95      RCHRES  22        2

***GROUNDWATER FROM OUTSIDE OF WALKER CREEK

PERLND  64        ***            630.00     RCHRES  20        7
*** reduced area because of new impervious
PERLND  64                       570.66     RCHRES  20        7
PERLND  65                ***    130.00     RCHRES  20        7


***STREAM ROUTING
RCHRES  49                                  RCHRES  20        3
RCHRES  20                                  RCHRES  19        3
RCHRES  19                                  RCHRES  18        3

END SCHEMATIC
```

```
  80                  4.5000    0.0300    400.00    0.1000    0.5000    0.9960
END PWAT-PARM2
PWAT-PARM3
  <PLS >***
  # -  #*** PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  14                            2.0000    2.0000      0.00      0.00       0.0
  16                            2.0000    2.0000      0.00      0.00       0.0
  18                            2.0000    2.0000      0.00      0.00       0.0
  24                            2.0000    2.0000      0.00      0.00        0.
  26                            2.0000    2.0000      0.00        0.        0.
  28                            2.0000    2.0000      0.00        0.        0.
  34                            2.0000    2.0000      0.00      0.00       0.0
  44                            2.0000    2.0000      0.00        0.        0.
  45                            2.0000    2.0000      0.00        0.        0.
  54                            10.000    2.0000      0.00        0.       0.7
  64                            2.0000    2.0000      0.00        0.       0.0
  80                            2.0000    2.0000      0.00        0.        0.
END PWAT-PARM3
PWAT-PARM4
  <PLS >                                                          ***
  # -  #     CEPSC      UZSN      NSUR     INTFW       IRC    LZETP***
  14        0.2000    1.0000    0.3500     2.000    0.1500    0.7000
  16        0.2000    0.5000    0.3500     2.000    0.1500    0.7000
  18        0.2000    0.3000    0.3500     2.000    0.1500    0.7000
  24        0.1000    0.5000    0.2500     2.000    0.1500    0.2500
  26        0.1000    0.2500    0.2500     2.000    0.1500    0.2500
  28        0.1000    0.1500    0.2500     2.000    0.1500    0.2500
  34        0.2000    0.5000    0.3500     0.000    0.5000    0.7000
  44        0.1000    0.5000    0.2500     0.000    0.5000    0.2500
  45        0.1000    0.2800    0.2500     6.000    0.1500    0.6000
  54        0.1000    3.0000    0.5000     1.000    0.7000    0.8000
  64        0.1000    0.2500    0.2500     3.000    0.5000    0.2500
  65        0.1000    0.5000    0.2500     0.000    0.5000    0.2500
  80        0.1000    0.2500    0.2500     2.000    0.1500    0.2500
END PWAT-PARM4
PWAT-STATE1
  <PLS >  PWATER state variables***
  # -  #***   CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
  14         0.078        0.    0.2500      0.10     2.500      2.00     0.000
  16         0.078        0.    0.2500      0.10     2.500      2.00     0.000
  18         0.078        0.    0.2500      0.10     2.500      2.00     0.000
  24         0.051        0.    0.2500      0.10     2.500      2.00     0.000
  26         0.051        0.    0.2500      0.10     2.500      2.00     0.000
  28         0.051        0.    0.2500      0.10     2.500      2.00     0.000
  34         0.078        0.    0.2500      0.10     0.000      2.00     0.000
  44         0.051        0.    0.2500      0.10     0.000      2.00     0.000
  45         0.051        0.    0.2500      0.10     0.000      2.00     0.000
  54         0.051        0.    0.2500      0.10     2.000      2.00     0.000
  64         0.051        0.    0.2500      0.10     2.000     20.00     0.000
  65         0.051        0.    0.2500      0.10     0.000     20.00     0.000
  80         0.051        0.    0.2500      0.10     2.500      2.00     0.000
END PWAT-STATE1
END PERLND
IMPLND
GEN-INFO
  <ILS >      Name              Unit-systems   Printer                    ***
  # -  #                      User  t-series Engl Metr                    ***
```

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```
                                              in  out                                       ***
  14      IMPERVIOUS               1    1    1   60     0
 END GEN-INFO
 ACTIVITY
   <ILS > ************* Active Sections ****
   # -  # ATMP SNOW IWAT  SLD  IWG IQAL  ***
  14        0    0    1    0    0    0
 END ACTIVITY
 PRINT-INFO
   <ILS > ******** Print-flags ******** PIVL  PYR
   # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
  14        0    0    6    0    0    0    1    9
 END PRINT-INFO
 IWAT-PARM1
   <ILS >          Flags          ***                                                       ***
   # -  # CSNO RTOP  VRS  VNN RTLI    ***                                                   ***
  14        0    0    0    0    0
 END IWAT-PARM1
 IWAT-PARM2
   <ILS >                                                                                   ***
   # -  #      LSUR     SLSUR      NSUR     RETSC                                          ***
  14         100.00    0.0100    0.1000    0.1000
 END IWAT-PARM2
 IWAT-PARM3
   <ILS >                                                                                   ***
   # -  #    PETMAX    PETMIN                                                               ***
  14
 END IWAT-PARM3
 IWAT-STATE1
   <ILS >  IWATER state variables                                                           ***
   # -  #      RETS      SURS                                                               ***
  14       1.0000E-3 1.0000E-3
 END IWAT-STATE1
END IMPLND
                                                                                           ***
EXT SOURCES
                                                                                           ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes.
                                                                                           ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM   1002 PREC      ENGLZERO  1.00         PERLND  14  65 EXTNL  PREC
WDM   1002 PREC      ENGLZERO  0.00         PERLND  80     EXTNL  PREC
WDM   1002 PREC      ENGLZERO  1.00         IMPLND  14     EXTNL  PREC
WDM      1 EVAP      ENGLZERO  0.8          PERLND  14  65 EXTNL  PETINP
WDM      1 EVAP      ENGLZERO  0.0          PERLND  80     EXTNL  PETINP
WDM      1 EVAP      ENGLZERO  0.8          IMPLND  14     EXTNL  PETINP
*** PRECIP/EVAP TO LAKES
WDM   1002 PREC      ENGLZERO               RCHRES  20     EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8        RCHRES  20     EXTNL  POTEV
WDM   1002 PREC      ENGLZERO               RCHRES  49     EXTNL  PREC
WDM      1 EVAP      ENGLZERO    0.8        RCHRES  49     EXTNL  POTEV

*** till seapage groundwater flow from Fill area.  PGG time series
WDM   7101 FLOW      ENGLZERO.000001426     PERLND  80     EXTNL  AGWLI
*** Fill flow directly to stream
```

```
NETWORK
                                                                              ***
***        <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>        <-MEMBER->
<NAME>   # <NAME>    TEM STRG<-FACTOR->STRG <NAME>   #    # <-GRP> <NAME> # # ***
                                                                              ***
END NETWORK
                                                                              ***
RCHRES
  GEN-INFO
    RCHRES        Name          Nexits   Unit Systems   Printer               ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG             ***
                                            in  out                           ***
   18     Trib (0371A) M 18       1     1    1    1   62    0    0
   19     Trib (0371A) M 19       1     1    1    1   62    0    0
   20     Trib   M 20             1     1    1    1   62    0    1
   21     Trib (0371H) M 21       1     1    1    1   62    0    0
   22     Trib (0371A) M 22       1     1    1    1   62    0    0
   39     SR509                   1     1    1    1   62    0    0
   49     SDW2 POND               1     1    1    1   62    0    0

  END GEN-INFO
  ACTIVITY
    RCHRES *************** Active Sections *****************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG                  ***
    1   63    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    RCHRES *************** Printout Flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
    1   63    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                       ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible   exit *** possible  exit      possible  exit
             *  *  *  *     *  *  *  *  *        *  *  *  *  *       ***
    1   99   0  1  0  0     4  0  0  0  0        0  0  0  0  0     2  2  2  2  2
  END HYDR-PARM1
  HYDR-PARM2
    RCHRES                                                                    ***
    # -  #     FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->        ***
   18             18   0.800                               0.3
   19             19   0.568                               0.3
   20             20   0.379                               0.3
   21             21   0.450                               0.3
   22             22   0.300                               0.3
   49             49   0.010                    0.0        0.3

  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***    VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
   18     0.1             4.0
   19     0.1             4.0
```

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```
  20     10.0               4.0
  21     0.1                4.0
  22     0.1                4.0
  49     0.0                4.0

  END HYDR-INIT
END RCHRES

FTABLES

  FTABLE      18
 ROWS COLS ***
    3    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
      0.00       1.30      0.00       0.00
      1.00       1.30      1.30     166.00
      2.00       1.40      2.65     490.00
  END FTABLE 18

  FTABLE      19
 ROWS COLS ***
    3    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
      0.00       1.10      0.00       0.00
      1.00       1.10      1.10      65.00
      2.00       1.20      2.25     223.00
  END FTABLE 19

  FTABLE      49
  *** PROJECT POND F SDW2
 ROWS COLS ***
   12    4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.8880     0.0000    0.00
     1.000     0.9270     1.0823    0.25
     2.000     0.9690     2.2096    0.35
     3.000     1.0450     3.3828    0.42
     4.000     1.0450     4.6027    0.49
     5.000     1.0860     5.8726    0.55
     6.000     1.1260     7.1935    0.60
     7.000     1.1670     8.5645    1.20
     8.000     1.2130     9.9861    2.69
     8.300     1.2560     10.454    3.09
     9.000     1.2560     11.459    7.57
    10.000     1.3000     12.987    16.88
  END FTABLE 49

  FTABLE      20
*** WALKER CREEK WETLAND
 ROWS COLS ***
   10    4
     DEPTH       AREA     VOLUME    OUTFLOW    OUTFLOW ***
      0.00       0.00      0.00       0.00
      1.00       2.50      1.25       7.04
      2.00       5.00      5.00      17.84
      3.00      12.00     13.50      32.17
      4.00      19.00     29.00      45.13
```

```
     5.00      22.00      49.50      54.95
     6.00      23.00      72.00      61.62
     6.10      23.00      74.30      62.15
     7.00      23.50      95.25      67.00
     7.24      24.10     101.10     100.00
 END FTABLE 20

 FTABLE     21
ROWS COLS ***
  8    4
    DEPTH      AREA     VOLUME   OUTFLOW    ***
    0.000    0.0000    0.0000       0.00
    0.100    0.2259    0.0113       0.11
    0.500    0.2707    0.1106       4.27
    1.000    0.3268    0.2600      15.13
    1.500    0.3828    0.4374      31.67
    2.000    0.4389    0.6428      54.02
    2.500    0.4949    0.8763      82.52
    3.000    0.5510    1.1377     117.55
 END FTABLE 21

 FTABLE     22
ROWS COLS ***
  9    4
    DEPTH      AREA     VOLUME   OUTFLOW    ***
    0.000    0.0000    0.0000       0.00
    0.100    0.3680    0.0184       0.25
    0.500    0.3717    0.1664       9.39
    1.000    0.3763    0.3534      31.06
    2.000    0.3819    0.7325      94.37
    3.000    0.3874    1.1171     174.33
    4.000    0.3930    1.5073     265.38
    5.000    0.3985    1.9030     364.68
    6.000    0.4040    2.3043     470.60
 END FTABLE 22
END FTABLES
MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       1
  conversion from acre-inches to acre-ft (1/12)               ***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK     1

  MASS-LINK       2
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK     2

  MASS-LINK       3
RCHRES     ROFLOW                          RCHRES         INFLOW
  END MASS-LINK     3

  MASS-LINK       4
RCHRES     OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK     4

  MASS-LINK       5
```

```
RCHRES      OFLOW   OVOL    2                    RCHRES        INFLOW IVOL
  END MASS-LINK     5

  MASS-LINK         6
PERLND      PWATER SURO         0.0833333        RCHRES        INFLOW IVOL
PERLND      PWATER IFWO         0.0833333        RCHRES        INFLOW IVOL
  END MASS-LINK     6

  MASS-LINK         7
PERLND      PWATER AGWO         0.0833333        RCHRES        INFLOW IVOL
  END MASS-LINK     7

  MASS-LINK         8
PERLND      PWATER PERO         0.0833333        COPY          INPUT  MEAN
  END MASS-LINK     8
  MASS-LINK         12
PERLND      PWATER AGWO         0.0833333        COPY          INPUT  MEAN
  END MASS-LINK     12

  MASS-LINK         9
IMPLND      IWATER SURO         0.0833333        COPY          INPUT  MEAN
  END MASS-LINK     9

  MASS-LINK         10
COPY        OUTPUT MEAN                          RCHRES        INFLOW IVOL
  END MASS-LINK     10

END MASS-LINK
END RUN
```

```
RUN
GLOBAL
  ***  FILE: WClowfT.inp REVISED July 2001. ATC
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF WALKER CREEK
  ***  2006 FUTURE PROJECT CONDITION SIZING BASED
  ***  CHANGED PREC DSN 2 TO NEW PREC DSN 1002
  ***  WALKER CREEK FOUR YEAR RUN USING FULL LENGTH 1990 DATA FOR
  ***  INITIAL CONDITIONS
  WALKER CREEK BASIN HSPF MODEL
  START       1990 10  1  0  0  END    1994  9 30 24  0

  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname--------------------------------------->
MESSU      24    D:\PARA\SEATAC\MILLER\LOWFLOW\WALKER.MES
WDM        25    D:\PARA\SEATAC\MILLER\LOWFLOW\mlowflow.WDM
           61    D:\PARA\SEATAC\MILLER\LOWFLOW\wPER.L61
           62    D:\PARA\SEATAC\MILLER\LOWFLOW\wRCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND     14
      PERLND     16
      PERLND     18
      PERLND     24
      PERLND     26
      PERLND     28
      PERLND     34
      PERLND     44
      PERLND     45
      PERLND     54
      PERLND     64
      PERLND     65
      PERLND     80
      IMPLND     14
      RCHRES     49
      RCHRES     20
      RCHRES     19
      RCHRES     18
    END INGRP
END OPN SEQUENCE
                                                                       ***
COPY
  TIMESERIES
  Copy-opn                                                             ***
    # -  #  NPT  NMN                                                   ***
    1    5         1
  END TIMESERIES
END COPY

PERLND
  GEN-INFO
    <PLS >     Name          NBLKS  Unit-systems   Printer             ***
```

```
  # -  #                              User  t-series Engl Metr                   ***
                                              in  out                            ***
 14      TFF- TILL FOR FLT       1    1    1    1   61     0
 16      TFM- TILL FOR MOD       1    1    1    1   61     0
 18      TFS- TILL FOR STP       1    1    1    1   61     0
 24      TGF- TILL GR FLT        1    1    1    1   61     0
 26      TGM- TILL GR MOD        1    1    1    1   61     0
 28      TGS- TILL GR STP        1    1    1    1   61     0
 34      OF - OUTWASH FOR        1    1    1    1   61     0
 44      OG - OUTWASH GR         1    1    1    1   61     0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
 45      AIRPORT FILL            1    1    1    1   61     0
 54      SA - WETLANDS           1    1    1    1   61     0
 64      TGM DES MOINES          1    1    1    1   61     0
 65      OG  DES MOINES          1    1    1    1   61     0
 80      Fill AGWO               1    1    1    1   61     0
END GEN-INFO
ACTIVITY
  <PLS > ************* Active Sections *****************************
  # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC         ***
 14  200    0    0    1    0    0    0    0    0    0    0    0    0
END ACTIVITY
PRINT-INFO
  <PLS > ********************* Print-flags ************************* PIVL  PYR
  # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
 14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
END PRINT-INFO
PWAT-PARM1
  <PLS > ***************** Flags ********************
  # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                          ***
 14         0    0    0    0    0    0    0    0    0
 16         0    0    0    0    0    0    0    0    0
 18         0    0    0    0    0    0    0    0    0
 24         0    0    0    0    0    0    0    0    0
 26         0    0    0    0    0    0    0    0    0
 28         0    0    0    0    0    0    0    0    0
 34         0    0    0    0    0    0    0    0    0
 44         0    0    0    0    0    0    0    0    0
 45         0    0    0    0    0    0    0    0    0
 54         0    0    0    0    0    0    0    0    0
 64         0    0    0    0    0    0    0    0    0
 80         0    0    0    0    0    0    0    0    0
END PWAT-PARM1
PWAT-PARM2
  <PLS > ***
  # -  # ***FOREST        LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
 14                     4.5000    0.0800    400.00    0.0500    0.5000    0.9960
 16                     4.5000    0.0800    400.00    0.1000    0.5000    0.9960
 18                     4.5000    0.0800    200.00    0.2000    0.5000    0.9960
 24                     4.5000    0.0300    400.00    0.0500    0.5000    0.9960
 26                     4.5000    0.0300    400.00    0.1000    0.5000    0.9960
 28                     4.5000    0.0300    200.00    0.2000    0.5000    0.9960
 34                     5.0000    2.0000    400.00    0.0500    0.3000    0.9960
 44                     5.0000    0.8000    400.00    0.0500    0.3000    0.9960
 45                     7.5000    0.0200    300.00    0.0700    0.0000    0.9960
 54                     4.0000    2.0000    100.00    0.0010    0.5000    0.9960
 64                     4.5000    0.1200    400.00    0.1000    0.5000    0.9990
```

```
 65                  5.0000    0.8000    400.00    0.0500    0.5000    0.9960
 80                  4.5000    0.0300    400.00    0.1000    0.5000    0.9960
END PWAT-PARM2
PWAT-PARM3
  <PLS >***
  # -  #*** PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
 14                            2.0000    2.0000      0.00      0.00       0.0
 16                            2.0000    2.0000      0.00      0.00       0.0
 18                            2.0000    2.0000      0.00      0.00       0.0
 24                            2.0000    2.0000      0.00      0.00        0.
 26                            2.0000    2.0000      0.00        0.        0.
 28                            2.0000    2.0000      0.00        0.        0.
 34                            2.0000    2.0000      0.00      0.00       0.0
 44                            2.0000    2.0000      0.00        0.        0.
 45                            2.0000    2.0000      0.00        0.        0.
 54                            10.000    2.0000      0.00        0.       0.7
 64                            2.0000    2.0000      0.00        0.       0.0
 80                            2.0000    2.0000      0.00        0.        0.
END PWAT-PARM3
PWAT-PARM4
  <PLS >                                                      ***
  # -  #     CEPSC      UZSN      NSUR     INTFW       IRC    LZETP***
 14         0.2000    1.0000    0.3500     2.000    0.1500    0.7000
 16         0.2000    0.5000    0.3500     2.000    0.1500    0.7000
 18         0.2000    0.3000    0.3500     2.000    0.1500    0.7000
 24         0.1000    0.5000    0.2500     2.000    0.1500    0.2500
 26         0.1000    0.2500    0.2500     2.000    0.1500    0.2500
 28         0.1000    0.1500    0.2500     2.000    0.1500    0.2500
 34         0.2000    0.5000    0.3500     0.000    0.5000    0.7000
 44         0.1000    0.5000    0.2500     0.000    0.5000    0.2500
 45         0.1000    0.2800    0.2500     6.000    0.1500    0.6000
 54         0.1000    3.0000    0.5000     1.000    0.7000    0.8000
 64         0.1000    0.2500    0.2500     3.000    0.5000    0.2500
 65         0.1000    0.5000    0.2500     0.000    0.5000    0.2500
 80         0.1000    0.2500    0.2500     2.000    0.1500    0.2500
END PWAT-PARM4
PWAT-STATE1
  <PLS >  PWATER state variables***
  # -  #***     CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
 14            0.000        0.    0.0000      0.00     2.500      2.00     0.000
 16            0.000        0.    0.0010      0.00     0.020      3.51     0.047
 18            0.000        0.    0.0000      0.00     2.500      2.00     0.000
 24            0.000        0.    0.0000      0.00     2.500      2.00     0.000
 26            0.000        0.    0.0000      0.00     1.598      2.81     0.041
 28            0.000        0.    0.0000      0.00     2.500      2.00     0.000
 34            0.000        0.    0.0000      0.00     0.023      5.66     0.084
 44            0.000        0.    0.0000      0.00     2.756      6.25     0.134
 45            0.000        0.    0.0000      0.00     0.373      3.01     0.000
 54            0.000        0.    0.3650      0.00     0.561      0.00     0.000
 64            0.000        0.    0.0000      0.00     1.978     22.28     0.000
 65            0.000        0.    0.0000      0.00     0.000     20.00     0.000
 80            0.000        0.    0.0000      0.00     1.598      2.81     0.041
END PWAT-STATE1
END PERLND
IMPLND
 GEN-INFO
  <ILS >      Name             Unit-systems   Printer                        ***
```

```
  # -  #                          User  t-series Engl Metr                                ***
                                         in  out                                          ***
 14     IMPERVIOUS                  1    1    1   60    0
END GEN-INFO
ACTIVITY
  <ILS > ************* Active Sections ****
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL  ***
 14         0    0    1    0    0    0
END ACTIVITY
PRINT-INFO
  <ILS > ******** Print-flags ******** PIVL  PYR
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
 14         0    0    6    0    0    0    1    9
END PRINT-INFO
IWAT-PARM1
  <ILS >          Flags          ***                                                      ***
  # -  # CSNO RTOP  VRS  VNN RTLI   ***                                                   ***
 14         0    0    0    0    0
END IWAT-PARM1
IWAT-PARM2
  <ILS >                                                                                  ***
  # -  #       LSUR     SLSUR      NSUR     RETSC                                         ***
 14          100.00    0.0100    0.1000    0.1000
END IWAT-PARM2
IWAT-PARM3
  <ILS >                                                                                  ***
  # -  #     PETMAX    PETMIN                                                             ***
 14
END IWAT-PARM3
IWAT-STATE1
  <ILS >  IWATER state variables                                                          ***
  # -  #       RETS      SURS                                                             ***
 14       1.0000E-3 1.0000E-3
END IWAT-STATE1
END IMPLND
                                                                                          ***
EXT SOURCES
                                                                                          ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes.
                                                                                          ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->             ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #             ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM   1002 PREC     ENGLZERO  1.00         PERLND  14  65 EXTNL  PREC
WDM   1002 PREC     ENGLZERO  0.00         PERLND  80     EXTNL  PREC
WDM   1002 PREC     ENGLZERO  1.00         IMPLND  14     EXTNL  PREC
WDM      1 EVAP     ENGLZERO  0.8          PERLND  14  65 EXTNL  PETINP
WDM      1 EVAP     ENGLZERO  0.0          PERLND  80     EXTNL  PETINP
WDM      1 EVAP     ENGLZERO  0.8          IMPLND  14     EXTNL  PETINP
*** PRECIP/EVAP TO LAKES
WDM   1002 PREC     ENGLZERO               RCHRES  20     EXTNL  PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  20     EXTNL  POTEV
WDM   1002 PREC     ENGLZERO               RCHRES  49     EXTNL  PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  49     EXTNL  POTEV

*** till seapage groundwater flow from Fill area.  PGG time series
WDM   7101 FLOW     ENGLZERO.000001426     PERLND  80     EXTNL  AGWLI
```

```
*** Fill flow directly to stream
WDM    7100 FLOW      ENGL     .000000957     RCHRES  20      INFLOW IVOL
END EXT SOURCES
                                                                        ***

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>    #        <Name> # #<-factor->strg <Name>    # <Name>    tem strg strg***
RCHRES  18 HYDR   RO                        WDM   7196 FLOW     ENGL      REPL
RCHRES  20 HYDR   RO                        WDM   7197 FLOW     ENGL      REPL
 ***PROJECT CONDITION FLOWS
RCHRES  49 HYDR   RO      1 1      ***      WDM    109 FLOW     ENGL      REPL
*** DETENTION STAGES
RCHRES  49 HYDR   STAGE            ***      WDM    649 STAG     ENGL      REPL
*** DETENTION VOLUME
RCHRES  49 HYDR   VOL              ***      WDM    749 VOL      ENGL      REPL
*** 39=SR509     37=SDW2
END EXT TARGETS
                                                                        ***

SCHEMATIC
<-Source->                   <--Area-->     <-Target->   MBLK    ***
<Name>    #                  <-factor->     <Name>    #  Tbl#    ***

***WALKER CREEK
*** SUB-CATCHMENT  MC 8
PERLND  26                       3.93      RCHRES  20       1
PERLND  44                      18.73      RCHRES  20       1
PERLND  54                       2.70      RCHRES  20       1
IMPLND  14                       0.01      RCHRES  20       2
***   *** SUB-CATCHMENT  SDW-2
***PERLND  26                      26.82      RCHRES  49       6
***PERLND  44                       1.42      RCHRES  49       6
***PERLND  45                       6.70      RCHRES  49       6
***PERLND  26                      26.82      RCHRES  20       7
***PERLND  44                       1.42      RCHRES  20       7
***PERLND  45                       6.70      RCHRES  20       7
***IMPLND  14                       9.51      RCHRES  49       2
***REPLACE SUBCATCHMENT SDW-2    WITH NEW SDW-2 SUBBASIN
***SUBBASIN SDW-2 ROUTING AS OF 4/19/01
*** old fill area
***PERLND  26                      26.88      RCHRES  49       6
*** area removed = 0.04 ac
PERLND  26                      26.84      RCHRES  49       6
PERLND  44                       1.51      RCHRES  49       6
*** old fill area
***PERLND  45                      6.700      RCHRES  49       6
*** area removed = 4.66 ac
PERLND  45                      2.040      RCHRES  49       6
PERLND  26                      26.84      RCHRES  20       7
PERLND  44                       1.51      RCHRES  20       7
PERLND  45                      2.040      RCHRES  20       7
*** old fill area
***IMPLND  14                       9.51      RCHRES  49       2
*** area removed = 3.35 ac
IMPLND  14                       6.16      RCHRES  49       2
*** FILL AGWO PERLND 80 ALL TO GROUNDWATER RCHRES 20
PERLND  80                       8.05      RCHRES  20       7
*** SUB-CATCHMENT  MC 9
```

```
PERLND  26                          9.28     RCHRES  20      1
PERLND  44                          0.76     RCHRES  20      1
IMPLND  14                          0.40     RCHRES  20      2
  *** SUB-CATCHMENT 18
PERLND  16                          0.76     RCHRES  18      1
PERLND  26                         16.08     RCHRES  18      1
PERLND  34                         20.95     RCHRES  18      1
PERLND  44                         49.22     RCHRES  18      1
IMPLND  14                          3.30     RCHRES  18      2
  *** SUB-CATCHMENT 19
PERLND  16                         12.72     RCHRES  19      1
PERLND  26                         92.07     RCHRES  19      1
PERLND  34                          8.39     RCHRES  19      1
PERLND  44                         95.55     RCHRES  19      1
IMPLND  14                         30.53     RCHRES  19      2
  *** SUB-CATCHMENT 20
PERLND  26                         12.54     RCHRES  20      1
PERLND  44                         53.42     RCHRES  20      1
PERLND  54                         33.43     RCHRES  20      1
IMPLND  14                         52.83     RCHRES  20      2
*** DOWN STREAM OF WALKER CREEK GAGE
  *** SUB-CATCHMENT 21 33% OF GW GOES TO GAGE REST GOES TO SOUND
PERLND  16                          2.54     RCHRES  18      7
PERLND  26                         44.30     RCHRES  18      7
PERLND  34                          2.03     RCHRES  18      7
PERLND  44                         41.13     RCHRES  18      7
PERLND  16                          2.54     RCHRES  21      6
PERLND  26                         44.30     RCHRES  21      6
PERLND  34                          2.03     RCHRES  21      6
PERLND  44                         41.13     RCHRES  21      6
IMPLND  14                         16.54     RCHRES  21      2
PERLND  16                          5.07     RCHRES  21      1
PERLND  26                         88.61     RCHRES  21      1
PERLND  34                          4.06     RCHRES  21      1
PERLND  44                         82.26     RCHRES  21      1
IMPLND  14                         33.09     RCHRES  21      2
  *** SUB-CATCHMENT 22
PERLND  34                          4.30     RCHRES  22      1
PERLND  44                         19.49     RCHRES  22      1
PERLND  54                          3.21     RCHRES  22      1
IMPLND  14                          3.95     RCHRES  22      2

***GROUNDWATER FROM OUTSIDE OF WALKER CREEK

PERLND  64        ***             630.00     RCHRES  20      7
*** reduced area because of new impervious
PERLND  64                        570.66     RCHRES  20      7
PERLND  65                ***     130.00     RCHRES  20      7


***STREAM ROUTING
RCHRES  49                                   RCHRES  20      3
RCHRES  20                                   RCHRES  19      3
RCHRES  19                                   RCHRES  18      3

END SCHEMATIC
```

AR 011540

```
NETWORK
                                                                                        ***
***          <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>         <-MEMBER->
<NAME>   # <NAME>    TEM STRG<-FACTOR->STRG <NAME>    #    # <-GRP> <NAME> # # ***
                                                                                        ***
END NETWORK
                                                                                        ***
RCHRES
  GEN-INFO
    RCHRES        Name         Nexits   Unit Systems   Printer                          ***
    # -   #<------------------><---> User T-series  Engl Metr LKFG                      ***
                                             in   out                                   ***
   18     Trib (0371A) M 18         1     1     1     1    62     0     0
   19     Trib (0371A) M 19         1     1     1     1    62     0     0
   20     Trib   M 20               1     1     1     1    62     0     1
   21     Trib (0371H) M 21         1     1     1     1    62     0     0
   22     Trib (0371A) M 22         1     1     1     1    62     0     0
   39     SR509                     1     1     1     1    62     0     0
   49     SDW2 POND                 1     1     1     1    62     0     0

  END GEN-INFO
  ACTIVITY
    RCHRES *************** Active Sections *****************
    # -   # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG                            ***
    1   63    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
  PRINT-INFO
    RCHRES *************** Printout Flags ****************** PIVL  PYR
    # -   # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
    1   63    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                                 ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
              *  *  *  *    *  *  *  *  *       *  *  *  *  *           ***
    1   99   0  1  0  0    4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
  END HYDR-PARM1
  HYDR-PARM2
    RCHRES                                                                              ***
    # -  #     FTABNO        LEN      DELTH      STCOR        KS       DB50             ***
  <------><--------><--------><--------><--------><--------><-------->                  ***
   18              18   0.800                                 0.3
   19              19   0.568                                 0.3
   20              20   0.379                                 0.3
   21              21   0.450                                 0.3
   22              22   0.300                                 0.3
   49              49   0.010                      0.0        0.3

  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                                    ***
    # -  # ***    VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft      for each possible exit        for each possible exit
  <------><-------->      <---><---><---><---><---> *** <---><---><---><---><--->
   18     0.1               4.0
```

```
    19       0.1                 4.0
    20       10.0                4.0
    21       0.1                 4.0
    22       0.1                 4.0
    49       0.0                 4.0

  END HYDR-INIT
END RCHRES

FTABLES

  FTABLE     18
 ROWS COLS ***
    3    4
     DEPTH        AREA     VOLUME    OUTFLOW    ***
      0.00        1.30       0.00       0.00
      1.00        1.30       1.30     166.00
      2.00        1.40       2.65     490.00
  END FTABLE 18

  FTABLE     19
 ROWS COLS ***
    3    4
     DEPTH        AREA     VOLUME    OUTFLOW    ***
      0.00        1.10       0.00       0.00
      1.00        1.10       1.10      65.00
      2.00        1.20       2.25     223.00
  END FTABLE 19

  FTABLE     49
  *** PROJECT POND F SDW2
 ROWS COLS ***
   12    4
     DEPTH        AREA     VOLUME    OUTFLOW    ***
     0.000      0.8880     0.0000    0.00
     1.000      0.9270     1.0823    0.25
     2.000      0.9690     2.2096    0.35
     3.000      1.0450     3.3828    0.42
     4.000      1.0450     4.6027    0.49
     5.000      1.0860     5.8726    0.55
     6.000      1.1260     7.1935    0.60
     7.000      1.1670     8.5645    1.20
     8.000      1.2130     9.9861    2.69
     8.300      1.2560     10.454    3.09
     9.000      1.2560     11.459    7.57
    10.000      1.3000     12.987    16.88
  END FTABLE 49

  FTABLE     20
*** WALKER CREEK WETLAND
 ROWS COLS ***
   10    4
     DEPTH        AREA     VOLUME    OUTFLOW   OUTFLOW ***
      0.00        0.00       0.00       0.00
      1.00        2.50       1.25       7.04
      2.00        5.00       5.00      17.84
      3.00       12.00      13.50      32.17
```

```
     4.00      19.00      29.00      45.13
     5.00      22.00      49.50      54.95
     6.00      23.00      72.00      61.62
     6.10      23.00      74.30      62.15
     7.00      23.50      95.25      67.00
     7.24      24.10     101.10     100.00
 END FTABLE 20

 FTABLE     21
ROWS COLS ***
   8    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.2259     0.0113       0.11
    0.500     0.2707     0.1106       4.27
    1.000     0.3268     0.2600      15.13
    1.500     0.3828     0.4374      31.67
    2.000     0.4389     0.6428      54.02
    2.500     0.4949     0.8763      82.52
    3.000     0.5510     1.1377     117.55
 END FTABLE 21

 FTABLE     22
ROWS COLS ***
   9    4
    DEPTH       AREA     VOLUME    OUTFLOW    ***
    0.000     0.0000     0.0000       0.00
    0.100     0.3680     0.0184       0.25
    0.500     0.3717     0.1664       9.39
    1.000     0.3763     0.3534      31.06
    2.000     0.3819     0.7325      94.37
    3.000     0.3874     1.1171     174.33
    4.000     0.3930     1.5073     265.38
    5.000     0.3985     1.9030     364.68
    6.000     0.4040     2.3043     470.60
 END FTABLE 22
END FTABLES
MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>        <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                 <Name> # #***
  MASS-LINK        1
  conversion from acre-inches to acre-ft (1/12)             ***
PERLND     PWATER PERO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK    1

  MASS-LINK        2
IMPLND     IWATER SURO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
RCHRES     ROFLOW                          RCHRES          INFLOW
  END MASS-LINK    3

  MASS-LINK        4
RCHRES     OFLOW  OVOL   1                 RCHRES          INFLOW IVOL
  END MASS-LINK    4
```

```
  MASS-LINK        5
RCHRES     OFLOW  OVOL   2                         RCHRES          INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        6
PERLND     PWATER SURO        0.0833333            RCHRES          INFLOW IVOL
PERLND     PWATER IFWO        0.0833333            RCHRES          INFLOW IVOL
  END MASS-LINK    6

  MASS-LINK        7
PERLND     PWATER AGWO        0.0833333            RCHRES          INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        8
PERLND     PWATER PERO        0.0833333            COPY            INPUT  MEAN
  END MASS-LINK    8
  MASS-LINK        12
PERLND     PWATER AGWO        0.0833333            COPY            INPUT  MEAN
  END MASS-LINK    12

  MASS-LINK        9
IMPLND     IWATER SURO        0.0833333            COPY            INPUT  MEAN
  END MASS-LINK    9

  MASS-LINK        10
COPY       OUTPUT MEAN                             RCHRES          INFLOW IVOL
  END MASS-LINK    10

END MASS-LINK
END RUN
```

```
RUN
GLOBAL
  ***  COPY COMMAND ADDED
  ***  FILE: WCPREDF.inp REVISED OCTOBER 2000
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF WALKER CREEK
  ***  CALIBRATION FILE RUN FOR FULL LENGTH OF RECORD
  WALKER CREEK BASIN HSPF MODEL
  START       1948 10  1  0  0  END    1996  9 30 24  0
  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname---------------------------------------------->
MESSU      24    D:\PARA\SEATAC\MILLER\LOWFLOW\WALKER.MES
WDM        25    D:\PARA\SEATAC\MILLER\LOWFLOW\mlowflow.WDM
           61    D:\PARA\SEATAC\MILLER\LOWFLOW\wPER.L61
           62    D:\PARA\SEATAC\MILLER\LOWFLOW\wRCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      14
      PERLND      16
      PERLND      18
      PERLND      24
      PERLND      26
      PERLND      28
      PERLND      34
      PERLND      44
      PERLND      45
      PERLND      54
      PERLND      64
      PERLND      65
      IMPLND      14
      COPY         2
      COPY         1
      COPY         3
      RCHRES      20
      RCHRES      19
      RCHRES      18
    END INGRP
END OPN SEQUENCE
                                                                              ***
COPY
  TIMESERIES
  Copy-opn                                                                    ***
    # -  #  NPT  NMN                                                          ***
    1    5       1
  END TIMESERIES
END COPY

PERLND
  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer                  ***
    # -  #                           User  t-series Engl Metr                 ***
                                           in   out                           ***
```

```
  14      TFF- TILL FOR FLT       1    1    1    1   61     0
  16      TFM- TILL FOR MOD       1    1    1    1   61     0
  18      TFS- TILL FOR STP       1    1    1    1   61     0
  24      TGF- TILL GR FLT        1    1    1    1   61     0
  26      TGM- TILL GR MOD        1    1    1    1   61     0
  28      TGS- TILL GR STP        1    1    1    1   61     0
  34      OF - OUTWASH FOR        1    1    1    1   61     0
  44      OG - OUTWASH GR         1    1    1    1   61     0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
  45      AIRPORT FILL            1    1    1    1   61     0
  54      SA - WETLANDS           1    1    1    1   61     0
  64      TGM DES MOINES          1    1    1    1   61     0
  65      OG  DES MOINES          1    1    1    1   61     0
 END GEN-INFO
 ACTIVITY
   <PLS > ************* Active Sections *****************************
   # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC          ***
  14  200    0    0    1    0    0    0    0    0    0    0    0    0
 END ACTIVITY
 PRINT-INFO
   <PLS > ********************* Print-flags ************************* PIVL  PYR
   # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
  14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
 END PRINT-INFO
 PWAT-PARM1
   <PLS > ***************** Flags ********************
   # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                        ***
  14         0    0    0    0    0    0    0    0    0
  16         0    0    0    0    0    0    0    0    0
  18         0    0    0    0    0    0    0    0    0
  24         0    0    0    0    0    0    0    0    0
  26         0    0    0    0    0    0    0    0    0
  28         0    0    0    0    0    0    0    0    0
  34         0    0    0    0    0    0    0    0    0
  44         0    0    0    0    0    0    0    0    0
  45         0    0    0    0    0    0    0    0    0
  54         0    0    0    0    0    0    0    0    0
  64         0    0    0    0    0    0    0    0    0
 END PWAT-PARM1
 PWAT-PARM2
   <PLS > ***
   # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  14                   4.5000    0.0800    400.00    0.0500    0.5000    0.9960
  16                   4.5000    0.0800    400.00    0.1000    0.5000    0.9960
  18                   4.5000    0.0800    200.00    0.2000    0.5000    0.9960
  24                   4.5000    0.0300    400.00    0.0500    0.5000    0.9960
  26                   4.5000    0.0300    400.00    0.1000    0.5000    0.9960
  28                   4.5000    0.0300    200.00    0.2000    0.5000    0.9960
  34                   5.0000    2.0000    400.00    0.0500    0.3000    0.9960
  44                   5.0000    0.8000    400.00    0.0500    0.3000    0.9960
  45                   7.5000    0.0200    300.00    0.0700    0.0000    0.9960
  54                   4.0000    2.0000    100.00    0.0010    0.5000    0.9960
  64                   4.5000    0.1200    400.00    0.1000    0.5000    0.9990
  65                   5.0000    0.8000    400.00    0.0500    0.5000    0.9960
 END PWAT-PARM2
 PWAT-PARM3
   <PLS >***
```

```
    # -    #*** PETMAX     PETMIN      INFEXP     INFILD     DEEPFR     BASETP     AGWETP
   14                                  2.0000     2.0000       0.00       0.00        0.0
   16                                  2.0000     2.0000       0.00       0.00        0.0
   18                                  2.0000     2.0000       0.00       0.00        0.0
   24                                  2.0000     2.0000       0.00       0.00         0.
   26                                  2.0000     2.0000       0.00         0.         0.
   28                                  2.0000     2.0000       0.00         0.         0.
   34                                  2.0000     2.0000       0.00       0.00        0.0
   44                                  2.0000     2.0000       0.00         0.         0.
   45                                  2.0000     2.0000       0.00         0.         0.
   54                                  10.000     2.0000       0.00         0.        0.7
   64                                  2.0000     2.0000       0.00         0.        0.0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >                                                                ***
    # -    #      CEPSC       UZSN       NSUR      INTFW        IRC     LZETP***
   14            0.2000     1.0000     0.3500      2.000     0.1500     0.7000
   16            0.2000     0.5000     0.3500      2.000     0.1500     0.7000
   18            0.2000     0.3000     0.3500      2.000     0.1500     0.7000
   24            0.1000     0.5000     0.2500      2.000     0.1500     0.2500
   26            0.1000     0.2500     0.2500      2.000     0.1500     0.2500
   28            0.1000     0.1500     0.2500      2.000     0.1500     0.2500
   34            0.2000     0.5000     0.3500      0.000     0.5000     0.7000
   44            0.1000     0.5000     0.2500      0.000     0.5000     0.2500
   45            0.1000     0.2800     0.2500      6.000     0.1500     0.6000
   54            0.1000     3.0000     0.5000      1.000     0.7000     0.8000
   64            0.1000     0.2500     0.2500      3.000     0.5000     0.2500
   65            0.1000     0.5000     0.2500      0.000     0.5000     0.2500
  END PWAT-PARM4
  PWAT-STATE1
    <PLS >  PWATER state variables***
    # -    #***     CEPS       SURS        UZS       IFWS        LZS       AGWS       GWVS
   14              0.078         0.     0.2500       0.10      2.500       2.00      0.000
   16              0.078         0.     0.2500       0.10      2.500       2.00      0.000
   18              0.078         0.     0.2500       0.10      2.500       2.00      0.000
   24              0.051         0.     0.2500       0.10      2.500       2.00      0.000
   26              0.051         0.     0.2500       0.10      2.500       2.00      0.000
   28              0.051         0.     0.2500       0.10      2.500       2.00      0.000
   34              0.078         0.     0.2500       0.10      0.000       2.00      0.000
   44              0.051         0.     0.2500       0.10      0.000       2.00      0.000
   45              0.051         0.     0.2500       0.10      0.000       2.00      0.000
   54              0.051         0.     0.2500       0.10      2.000       2.00      0.000
   64              0.051         0.     0.2500       0.10      2.000      20.00      0.000
   65              0.051         0.     0.2500       0.10      0.000      20.00      0.000
  END PWAT-STATE1
END PERLND
IMPLND
  GEN-INFO
    <ILS >       Name                Unit-systems   Printer                         ***
    # -  #                         User  t-series Engl Metr                         ***
                                          in   out                                  ***
   14       IMPERVIOUS               1     1    1    60    0
  END GEN-INFO
  ACTIVITY
    <ILS > ************* Active Sections ****
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   14         0    0    1    0    0    0
```

```
  END ACTIVITY
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
   14         0    0    6    0    0    0    1    9
  END PRINT-INFO
  IWAT-PARM1
    <ILS >          Flags           ***                                    ***
    # -  # CSNO RTOP  VRS  VNN RTLI    ***                                 ***
   14         0    0    0    0    0
  END IWAT-PARM1
  IWAT-PARM2
    <ILS >                                                                 ***
    # -  #      LSUR     SLSUR      NSUR     RETSC                         ***
   14         100.00    0.0100    0.1000    0.1000
  END IWAT-PARM2
  IWAT-PARM3
    <ILS >                                                                 ***
    # -  #    PETMAX    PETMIN                                             ***
   14
  END IWAT-PARM3
  IWAT-STATE1
    <ILS >  IWATER state variables                                         ***
    # -  #      RETS      SURS                                             ***
   14      1.0000E-3 1.0000E-3
  END IWAT-STATE1
END IMPLND
                                                                           ***
EXT SOURCES
                                                                           ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes.
                                                                           ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM   1002 PREC     ENGLZERO  1.00         PERLND  14 200 EXTNL  PREC
WDM   1002 PREC     ENGLZERO  1.00         IMPLND  14     EXTNL  PREC
WDM      1 EVAP     ENGLZERO  0.8          PERLND  14  65 EXTNL  PETINP
WDM      1 EVAP     ENGLZERO  0.8          IMPLND  14     EXTNL  PETINP
*** PRECIP/EVAP TO LAKES
WDM   1002 PREC     ENGLZERO               RCHRES  20     EXTNL  PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  20     EXTNL  POTEV

END EXT SOURCES
                                                                           ***
EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
***WALKER NR MTH
RCHRES  18 HYDR   RO                       WDM     96 FLOW     ENGL      REPL
*** MISC (20=WALKER WETLAND, 55=SR509, 56=1ST AVE)
RCHRES  20 HYDR   RO                       WDM     97 FLOW     ENGL      REPL
COPY *** 2 OUTPUT MEAN   1 1     12.1      WDM     89 FLOW     ENGL      REPL
END EXT TARGETS
                                                                           ***
SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK     ***
```

```
<Name>   #                  <-factor->     <Name>   #   Tbl#    ***

***WALKER CREEK
  *** SUB-CATCHMENT  MC 8
PERLND  26                        4.10      COPY      1       8
PERLND  44                       18.57      COPY      1       8
PERLND  54                        2.72      COPY      1       8
IMPLND  14                        1.34      COPY      1       9
***  *** SUB-CATCHMENT  SDW2  10-75-15 PREDEVELOPMENT W/1994 IMP
***PERLND  16                       30.91      COPY      2       10
***PERLND  26                        7.16      COPY      2       10
***PERLND  34                        1.69      COPY      2       10
***PERLND  44                        0.39      COPY      2       10
***PERLND  54                        1.13      COPY      2       10
***PERLND  16                       30.91      COPY      1       11
***PERLND  26                        7.16      COPY      1       11
***PERLND  34                        1.69      COPY      1       11
***PERLND  44                        0.39      COPY      1       11
***PERLND  54                        1.13      COPY      1       11
***IMPLND  14                        3.31      COPY      2        9
  *** SUB-CATCHMENT  SDW2  10-75-15 PREDEVELOPMENT W/1994 IMP
PERLND  16                       16.38      COPY      2       10
PERLND  26                        4.37      COPY      2       10
PERLND  34                       16.47      COPY      2       10
PERLND  44                        4.39      COPY      2       10
PERLND  54                        1.05      COPY      2       10
PERLND  16                       16.38      COPY      1       11
PERLND  26                        4.37      COPY      1       11
PERLND  34                       16.47      COPY      1       11
PERLND  44                        4.39      COPY      1       11
PERLND  54                        1.05      COPY      1       11
IMPLND  14                        2.20      COPY      2        9
  *** SUB-CATCHMENT  MC 9
PERLND  26                        9.44      COPY      1       8
PERLND  44                        0.74      COPY      1       8
PERLND  54            ***         0.00      COPY      1       8
IMPLND  14                        0.24      COPY      1       9
  *** SUB-CATCHMENT 18
PERLND  16                        0.76      RCHRES  18        1
PERLND  26                       16.08      RCHRES  18        1
PERLND  34                       20.95      RCHRES  18        1
PERLND  44                       49.22      RCHRES  18        1
IMPLND  14                        3.30      RCHRES  18        2
  *** SUB-CATCHMENT 19
PERLND  16                       12.72      RCHRES  19        1
PERLND  26                       92.07      RCHRES  19        1
PERLND  34                        8.39      RCHRES  19        1
PERLND  44                       95.55      RCHRES  19        1
IMPLND  14                       30.53      RCHRES  19        2
  *** SUB-CATCHMENT 20
PERLND  26                       12.53      RCHRES  20        1
PERLND  44                       53.43      RCHRES  20        1
PERLND  54                       33.43      RCHRES  20        1
IMPLND  14                       52.83      RCHRES  20        2
*** DOWN STREAM OF WALKER CREEK GAGE
  *** SUB-CATCHMENT 21 33% OF GW GOES TO GAGE REST GOES TO SOUND
PERLND  16                        2.54      RCHRES  18        7
```

```
PERLND  26                        44.30     RCHRES  18        7
PERLND  34                         2.03     RCHRES  18        7
PERLND  44                        41.13     RCHRES  18        7
PERLND  16                         2.54     RCHRES  21        6
PERLND  26                        44.30     RCHRES  21        6
PERLND  34                         2.03     RCHRES  21        6
PERLND  44                        41.13     RCHRES  21        6
PERLND  16                         5.07     RCHRES  21        1
PERLND  26                        88.61     RCHRES  21        1
PERLND  34                         4.06     RCHRES  21        1
PERLND  44                        82.26     RCHRES  21        1
IMPLND  14                        33.09     RCHRES  21        2
IMPLND  14                        16.54     RCHRES  21        2
  *** SUB-CATCHMENT 22
PERLND  34                         4.30     RCHRES  22        1
PERLND  44                        19.49     RCHRES  22        1
PERLND  54                         3.21     RCHRES  22        1
IMPLND  14                         3.95     RCHRES  22        2

***GROUNDWATER FROM OUTSIDE OF WALKER CREEK

PERLND  64                       630.00     RCHRES  20        7
PERLND  65                 ***   130.00     RCHRES  20        7

***STREAM ROUTING
COPY     2                                  COPY     3       14
COPY     1                                  COPY     3       14
COPY     3                                  RCHRES  20       13
RCHRES  20                                  RCHRES  19        3
RCHRES  19                                  RCHRES  18        3

END SCHEMATIC


NETWORK
                                                                             ***
***         <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>       <-MEMBER->
<NAME>    # <NAME>    TEM STRG<-FACTOR->STRG <NAME>    #    # <-GRP> <NAME> # # ***
                                                                             ***
END NETWORK
                                                                             ***
RCHRES
  GEN-INFO
    RCHRES        Name         Nexits   Unit Systems   Printer               ***
    # -   #<------------------><---> User T-series  Engl Metr LKFG           ***
                                             in  out                         ***
   18     Trib (0371A) M 18        1     1    1    1    62    0    0
   19     Trib (0371A) M 19        1     1    1    1    62    0    0
   20     Trib    M 20             1     1    1    1    62    0    1
   21     Trib (0371H) M 21        1     1    1    1    62    0    0
   22     Trib (0371A) M 22        1     1    1    1    62    0    0

  END GEN-INFO
  ACTIVITY
    RCHRES *************** Active Sections *****************
    # -   # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG                 ***
    1   63    1    0    0    0    0    0    0    0    0    0
```

```
 END ACTIVITY
 PRINT-INFO
   RCHRES *************** Printout Flags ****************** PIVL  PYR
   # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
   1   63    5    0    0    0    0    0    0    0    0    0    1    9
 END PRINT-INFO
 HYDR-PARM1                                                                ***
   RCHRES  Flags for each HYDR Section
   # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each      FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit       possible  exit
            *  *  *  *    *  *  *  *  *        *  *  *  *  *           ***
   1   99   0  1  0  0    4  0  0  0  0        0  0  0  0  0       2  2  2  2  2
 END HYDR-PARM1
 HYDR-PARM2
   RCHRES                                                                  ***
   # -  #    FTABNO        LEN      DELTH      STCOR         KS       DB50    ***
 <------><--------><--------><--------><--------><--------><-------->         ***
  18             18   0.800                                  0.3
  19             19   0.568                                  0.3
  20             20   0.379                                  0.3
  21             21   0.450                                  0.3
  22             22   0.300                                  0.3
 END HYDR-PARM2
 HYDR-INIT
   RCHRES  Initial conditions for each HYDR section                        ***
   # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
 <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  18      0.1             4.0
  19      0.1             4.0
  20      10.0            4.0
  21      0.1             4.0
  22      0.1             4.0
 END HYDR-INIT
END RCHRES

FTABLES

 FTABLE     18
ROWS COLS ***
  3    4
    DEPTH       AREA     VOLUME    OUTFLOW   ***
     0.00       1.30       0.00       0.00
     1.00       1.30       1.30     166.00
     2.00       1.40       2.65     490.00
 END FTABLE 18

 FTABLE     19
ROWS COLS ***
  3    4
    DEPTH       AREA     VOLUME    OUTFLOW   ***
     0.00       1.10       0.00       0.00
     1.00       1.10       1.10      65.00
     2.00       1.20       2.25     223.00
 END FTABLE 19

 FTABLE     20
```

```
*** WALKER CREEK WETLAND
 ROWS COLS ***
   10    4
     DEPTH        AREA     VOLUME    OUTFLOW  OUTFLOW ***
      0.00        0.00       0.00       0.00
      1.00        2.50       1.25       7.04
      2.00        5.00       5.00      17.84
      3.00       12.00      13.50      32.17
      4.00       19.00      29.00      45.13
      5.00       22.00      49.50      54.95
      6.00       23.00      72.00      61.62
      6.10       23.00      74.30      62.15
      7.00       23.50      95.25      67.00
      7.24       24.10     101.10     100.00
  END FTABLE 20

  FTABLE     21
 ROWS COLS ***
    8    4
     DEPTH        AREA     VOLUME    OUTFLOW  ***
     0.000      0.0000     0.0000       0.00
     0.100      0.2259     0.0113       0.11
     0.500      0.2707     0.1106       4.27
     1.000      0.3268     0.2600      15.13
     1.500      0.3828     0.4374      31.67
     2.000      0.4389     0.6428      54.02
     2.500      0.4949     0.8763      82.52
     3.000      0.5510     1.1377     117.55
  END FTABLE 21

  FTABLE     22
 ROWS COLS ***
    9    4
     DEPTH        AREA     VOLUME    OUTFLOW  ***
     0.000      0.0000     0.0000       0.00
     0.100      0.3680     0.0184       0.25
     0.500      0.3717     0.1664       9.39
     1.000      0.3763     0.3534      31.06
     2.000      0.3819     0.7325      94.37
     3.000      0.3874     1.1171     174.33
     4.000      0.3930     1.5073     265.38
     5.000      0.3985     1.9030     364.68
     6.000      0.4040     2.3043     470.60
  END FTABLE 22
END FTABLES
MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK         1
  conversion from acre-inches to acre-ft (1/12)               ***
PERLND     PWATER PERO         0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK     1

  MASS-LINK         2
IMPLND     IWATER SURO         0.0833333     RCHRES         INFLOW IVOL
  END MASS-LINK     2
```

```
  MASS-LINK        3
RCHRES     ROFLOW                                 RCHRES         INFLOW
  END MASS-LINK    3

  MASS-LINK        4
RCHRES     OFLOW  OVOL    1                       RCHRES         INFLOW IVOL
  END MASS-LINK    4

  MASS-LINK        5
RCHRES     OFLOW  OVOL    2                       RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        6
PERLND     PWATER SURO         0.0833333          RCHRES         INFLOW IVOL
PERLND     PWATER IFWO         0.0833333          RCHRES         INFLOW IVOL
  END MASS-LINK    6

  MASS-LINK        7
PERLND     PWATER AGWO         0.0833333          RCHRES         INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        8
PERLND     PWATER PERO         0.0833333          COPY           INPUT  MEAN
  END MASS-LINK    8

  MASS-LINK        9
IMPLND     IWATER SURO         0.0833333          COPY           INPUT  MEAN
  END MASS-LINK    9

  MASS-LINK       10
PERLND     PWATER SURO         0.0833333          COPY           INPUT  MEAN
PERLND     PWATER IFWO         0.0833333          COPY           INPUT  MEAN
  END MASS-LINK   10

  MASS-LINK       11
PERLND     PWATER AGWO         0.0833333          COPY           INPUT  MEAN
  END MASS-LINK   11

  MASS-LINK       12
PERLND     PWATER AGWO         0.0833333          COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
COPY       OUTPUT MEAN                            RCHRES         INFLOW IVOL
  END MASS-LINK   13

  MASS-LINK       14
COPY       OUTPUT MEAN                            COPY           INPUT  MEAN
  END MASS-LINK   14

END MASS-LINK
END RUN
```

```
RUN
GLOBAL
  ***  COPY COMMAND ADDED
  ***  FILE: WCPREDT.inp REVISED OCTOBER 2000
  ***  SEATAC AIRPORT HSPF BASIN MODEL OF WALKER CREEK
  ***  CALIBRATION FILE USING FULL LENGTH RUN 1990 DATA FOR INTITIAL CONDITIONS
  WALKER CREEK BASIN HSPF MODEL
  START       1990 10  1  0  0  END    1994  9 30 24  0
  RUN INTERP OUTPUT LEVEL    3
  RESUME     0 RUN     1
END GLOBAL

FILES
<type>  <fun>***<------------fname------------------------------------------->
MESSU       24    D:\PARA\SEATAC\MILLER\LOWFLOW\WALKER.MES
WDM         25    D:\PARA\SEATAC\MILLER\LOWFLOW\mlowflow.WDM
            61    D:\PARA\SEATAC\MILLER\LOWFLOW\wPER.L61
            62    D:\PARA\SEATAC\MILLER\LOWFLOW\wRCH.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND      14
      PERLND      16
      PERLND      18
      PERLND      24
      PERLND      26
      PERLND      28
      PERLND      34
      PERLND      44
      PERLND      45
      PERLND      54
      PERLND      64
      PERLND      65
      IMPLND      14
      COPY         2
      COPY         1
      COPY         3
      RCHRES      20
      RCHRES      19
      RCHRES      18
    END INGRP
END OPN SEQUENCE
                                                                          ***
COPY
  TIMESERIES
  Copy-opn                                                                ***
    # -  #  NPT  NMN                                                      ***
    1    5         1
  END TIMESERIES
END COPY

PERLND
  GEN-INFO
    <PLS >      Name          NBLKS   Unit-systems   Printer              ***
    # -  #                          User  t-series Engl Metr              ***
                                           in   out                       ***
```

```
  14      TFF- TILL FOR FLT      1    1    1    1   61     0
  16      TFM- TILL FOR MOD      1    1    1    1   61     0
  18      TFS- TILL FOR STP      1    1    1    1   61     0
  24      TGF- TILL GR FLT       1    1    1    1   61     0
  26      TGM- TILL GR MOD       1    1    1    1   61     0
  28      TGS- TILL GR STP       1    1    1    1   61     0
  34      OF - OUTWASH FOR       1    1    1    1   61     0
  44      OG - OUTWASH GR        1    1    1    1   61     0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
  45      AIRPORT FILL           1    1    1    1   61     0
  54      SA - WETLANDS          1    1    1    1   61     0
  64      TGM DES MOINES         1    1    1    1   61     0
  65      OG  DES MOINES         1    1    1    1   61     0
 END GEN-INFO
 ACTIVITY
   <PLS > ************* Active Sections *****************************
   # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC         ***
  14  200    0    0    1    0    0    0    0    0    0    0    0    0
 END ACTIVITY
 PRINT-INFO
   <PLS > ********************* Print-flags ************************* PIVL  PYR
   # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
  14  200    0    0    5    0    0    0    0    0    0    0    0    0    1    9
 END PRINT-INFO
 PWAT-PARM1
   <PLS > ***************** Flags *******************
   # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE                        ***
  14         0    0    0    0    0    0    0    0    0
  16         0    0    0    0    0    0    0    0    0
  18         0    0    0    0    0    0    0    0    0
  24         0    0    0    0    0    0    0    0    0
  26         0    0    0    0    0    0    0    0    0
  28         0    0    0    0    0    0    0    0    0
  34         0    0    0    0    0    0    0    0    0
  44         0    0    0    0    0    0    0    0    0
  45         0    0    0    0    0    0    0    0    0
  54         0    0    0    0    0    0    0    0    0
  64         0    0    0    0    0    0    0    0    0
 END PWAT-PARM1
 PWAT-PARM2
   <PLS > ***
   # -  # ***FOREST        LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  14                     4.5000    0.0800    400.00    0.0500    0.5000    0.9960
  16                     4.5000    0.0800    400.00    0.1000    0.5000    0.9960
  18                     4.5000    0.0800    200.00    0.2000    0.5000    0.9960
  24                     4.5000    0.0300    400.00    0.0500    0.5000    0.9960
  26                     4.5000    0.0300    400.00    0.1000    0.5000    0.9960
  28                     4.5000    0.0300    200.00    0.2000    0.5000    0.9960
  34                     5.0000    2.0000    400.00    0.0500    0.3000    0.9960
  44                     5.0000    0.8000    400.00    0.0500    0.3000    0.9960
  45                     7.5000    0.0200    300.00    0.0700    0.0000    0.9960
  54                     4.0000    2.0000    100.00    0.0010    0.5000    0.9960
  64                     4.5000    0.1200    400.00    0.1000    0.5000    0.9990
  65                     5.0000    0.8000    400.00    0.0500    0.5000    0.9960
 END PWAT-PARM2
 PWAT-PARM3
   <PLS >***
```

```
  # -  #*** PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
 14                             2.0000    2.0000      0.00      0.00       0.0
 16                             2.0000    2.0000      0.00      0.00       0.0
 18                             2.0000    2.0000      0.00      0.00       0.0
 24                             2.0000    2.0000      0.00      0.00        0.
 26                             2.0000    2.0000      0.00        0.        0.
 28                             2.0000    2.0000      0.00        0.        0.
 34                             2.0000    2.0000      0.00      0.00       0.0
 44                             2.0000    2.0000      0.00        0.        0.
 45                             2.0000    2.0000      0.00        0.        0.
 54                             10.000    2.0000      0.00        0.       0.7
 64                             2.0000    2.0000      0.00        0.       0.0
END PWAT-PARM3
PWAT-PARM4
  <PLS >                                                         ***
  # -  #      CEPSC      UZSN      NSUR     INTFW       IRC    LZETP***
 14          0.2000    1.0000    0.3500     2.000    0.1500    0.7000
 16          0.2000    0.5000    0.3500     2.000    0.1500    0.7000
 18          0.2000    0.3000    0.3500     2.000    0.1500    0.7000
 24          0.1000    0.5000    0.2500     2.000    0.1500    0.2500
 26          0.1000    0.2500    0.2500     2.000    0.1500    0.2500
 28          0.1000    0.1500    0.2500     2.000    0.1500    0.2500
 34          0.2000    0.5000    0.3500     0.000    0.5000    0.7000
 44          0.1000    0.5000    0.2500     0.000    0.5000    0.2500
 45          0.1000    0.2800    0.2500     6.000    0.1500    0.6000
 54          0.1000    3.0000    0.5000     1.000    0.7000    0.8000
 64          0.1000    0.2500    0.2500     3.000    0.5000    0.2500
 65          0.1000    0.5000    0.2500     0.000    0.5000    0.2500
END PWAT-PARM4
PWAT-STATE1
  <PLS >  PWATER state variables***
  # -  #***     CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
 14            0.000        0.    0.0000      0.00     2.500      2.00     0.000
 16            0.000        0.    0.0010      0.00     0.020      3.51     0.047
 18            0.000        0.    0.0000      0.00     2.500      2.00     0.000
 24            0.000        0.    0.0000      0.00     2.500      2.00     0.000
 26            0.000        0.    0.0000      0.00     1.598      2.81     0.041
 28            0.000        0.    0.0000      0.00     2.500      2.00     0.000
 34            0.000        0.    0.0000      0.00     0.023      5.66     0.084
 44            0.000        0.    0.0000      0.00     2.756      6.25     0.134
 45            0.000        0.    0.0000      0.00     0.373      3.01     0.000
 54            0.000        0.    0.3650      0.00     0.561      0.00     0.000
 64            0.000        0.    0.0000      0.00     1.978     22.28     0.000
 65            0.000        0.    0.0000      0.00     0.000     20.00     0.000
END PWAT-STATE1
END PERLND
IMPLND
GEN-INFO
  <ILS >       Name             Unit-systems   Printer                      ***
  # -  #                      User  t-series Engl Metr                      ***
                                      in  out                               ***
 14      IMPERVIOUS              1     1    1   60    0
END GEN-INFO
ACTIVITY
  <ILS > ************* Active Sections ****
  # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
 14         0    0    1    0    0    0
```

```
  END ACTIVITY
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL *********
   14       0    0    6    0    0    0    1    9
  END PRINT-INFO
  IWAT-PARM1
    <ILS >           Flags           ***                                      ***
    # -  # CSNO RTOP  VRS  VNN RTLI  ***                                      ***
   14       0    0    0    0    0
  END IWAT-PARM1
  IWAT-PARM2
    <ILS >                                                                    ***
    # -  #      LSUR     SLSUR      NSUR     RETSC                            ***
   14         100.00    0.0100    0.1000    0.1000
  END IWAT-PARM2
  IWAT-PARM3
    <ILS >                                                                    ***
    # -  #    PETMAX    PETMIN                                                ***
   14
  END IWAT-PARM3
  IWAT-STATE1
    <ILS >  IWATER state variables                                            ***
    # -  #      RETS      SURS                                                ***
   14       1.0000E-3 1.0000E-3
  END IWAT-STATE1
END IMPLND
                                                                              ***
EXT SOURCES
                                                                              ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes.
                                                                              ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM   1002 PREC     ENGLZERO  1.00         PERLND  14 200 EXTNL  PREC
WDM   1002 PREC     ENGLZERO  1.00         IMPLND  14     EXTNL  PREC
WDM      1 EVAP     ENGLZERO  0.8          PERLND  14  65 EXTNL  PETINP
WDM      1 EVAP     ENGLZERO  0.8          IMPLND  14     EXTNL  PETINP
*** PRECIP/EVAP TO LAKES
WDM   1002 PREC     ENGLZERO               RCHRES  20     EXTNL  PREC
WDM      1 EVAP     ENGLZERO    0.8        RCHRES  20     EXTNL  POTEV

END EXT SOURCES
                                                                              ***
EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
***WALKER NR MTH
RCHRES  18 HYDR   RO          ***          WDM     96 FLOW     ENGL    .  REPL
*** MISC (20=WALKER WETLAND, 55=SR509, 56=1ST AVE)
RCHRES  20 HYDR   RO                       WDM   8097 FLOW     ENGL       REPL
COPY *** 2 OUTPUT MEAN   1 1     12.1      WDM     89 FLOW     ENGL       REPL
END EXT TARGETS
                                                                              ***
SCHEMATIC
<-Source->                   <--Area-->     <-Target->   MBLK    ***
```

```
<Name>   #                  <-factor->    <Name>   #   Tbl#    ***

***WALKER CREEK
  *** SUB-CATCHMENT  MC 8
PERLND  26                     4.10     COPY     1      8
PERLND  44                    18.57     COPY     1      8
PERLND  54                     2.72     COPY     1      8
IMPLND  14                     1.34     COPY     1      9
***   *** SUB-CATCHMENT  SDW2  10-75-15 PREDEVELOPMENT W/1994 IMP
***PERLND  16                     30.91     COPY     2      10
***PERLND  26                      7.16     COPY     2      10
***PERLND  34                      1.69     COPY     2      10
***PERLND  44                      0.39     COPY     2      10
***PERLND  54                      1.13     COPY     2      10
***PERLND  16                     30.91     COPY     1      11
***PERLND  26                      7.16     COPY     1      11
***PERLND  34                      1.69     COPY     1      11
***PERLND  44                      0.39     COPY     1      11
***PERLND  54                      1.13     COPY     1      11
***IMPLND  14                      3.31     COPY     2       9
  *** SUB-CATCHMENT  SDW2  10-75-15 PREDEVELOPMENT W/1994 IMP
PERLND  16                    16.38     COPY     2      10
PERLND  26                     4.37     COPY     2      10
PERLND  34                    16.47     COPY     2      10
PERLND  44                     4.39     COPY     2      10
PERLND  54                     1.05     COPY     2      10
PERLND  16                    16.38     COPY     1      11
PERLND  26                     4.37     COPY     1      11
PERLND  34                    16.47     COPY     1      11
PERLND  44                     4.39     COPY     1      11
PERLND  54                     1.05     COPY     1      11
IMPLND  14                     2.20     COPY     2       9
  *** SUB-CATCHMENT  MC 9
PERLND  26                     9.44     COPY     1       8
PERLND  44                     0.74     COPY     1       8
PERLND  54           ***       0.00     COPY     1       8
IMPLND  14                     0.24     COPY     1       9
  *** SUB-CATCHMENT 18
PERLND  16                     0.76     RCHRES  18       1
PERLND  26                    16.08     RCHRES  18       1
PERLND  34                    20.95     RCHRES  18       1
PERLND  44                    49.22     RCHRES  18       1
IMPLND  14                     3.30     RCHRES  18       2
  *** SUB-CATCHMENT 19
PERLND  16                    12.72     RCHRES  19       1
PERLND  26                    92.07     RCHRES  19       1
PERLND  34                     8.39     RCHRES  19       1
PERLND  44                    95.55     RCHRES  19       1
IMPLND  14                    30.53     RCHRES  19       2
  *** SUB-CATCHMENT 20
PERLND  26                    12.53     RCHRES  20       1
PERLND  44                    53.43     RCHRES  20       1
PERLND  54                    33.43     RCHRES  20       1
IMPLND  14                    52.83     RCHRES  20       2
*** DOWN STREAM OF WALKER CREEK GAGE
  *** SUB-CATCHMENT 21 33% OF GW GOES TO GAGE REST GOES TO SOUND
PERLND  16                     2.54     RCHRES  18       7
```

```
PERLND  26                      44.30     RCHRES  18       7
PERLND  34                       2.03     RCHRES  18       7
PERLND  44                      41.13     RCHRES  18       7
PERLND  16                       2.54     RCHRES  21       6
PERLND  26                      44.30     RCHRES  21       6
PERLND  34                       2.03     RCHRES  21       6
PERLND  44                      41.13     RCHRES  21       6
PERLND  16                       5.07     RCHRES  21       1
PERLND  26                      88.61     RCHRES  21       1
PERLND  34                       4.06     RCHRES  21       1
PERLND  44                      82.26     RCHRES  21       1
IMPLND  14                      33.09     RCHRES  21       2
IMPLND  14                      16.54     RCHRES  21       2
  *** SUB-CATCHMENT 22
PERLND  34                       4.30     RCHRES  22       1
PERLND  44                      19.49     RCHRES  22       1
PERLND  54                       3.21     RCHRES  22       1
IMPLND  14                       3.95     RCHRES  22       2

***GROUNDWATER FROM OUTSIDE OF WALKER CREEK

PERLND  64                     630.00     RCHRES  20       7
PERLND  65                *** 130.00     RCHRES  20       7

***STREAM ROUTING
COPY     2                                COPY     3      14
COPY     1                                COPY     3      14
COPY     3                                RCHRES  20      13
RCHRES  20                                RCHRES  19       3
RCHRES  19                                RCHRES  18       3

END SCHEMATIC


NETWORK
                                                                      ***
***        <MEMBER> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>        <-MEMBER->
<NAME>   # <NAME>   TEM STRG<-FACTOR->STRG <NAME>   #   # <-GRP> <NAME> # # ***
                                                                      ***
END NETWORK
                                                                      ***
RCHRES
  GEN-INFO
    RCHRES        Name          Nexits   Unit Systems   Printer           ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG         ***
                                              in  out                     ***
   18     Trib (0371A) M 18       1     1    1    1   62    0    0
   19     Trib (0371A) M 19       1     1    1    1   62    0    0
   20     Trib   M 20             1     1    1    1   62    0    1
   21     Trib (0371H) M 21       1     1    1    1   62    0    0
   22     Trib (0371A) M 22       1     1    1    1   62    0    0

  END GEN-INFO
  ACTIVITY
    RCHRES *************** Active Sections *****************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG              ***
    1   63    1    0    0    0    0    0    0    0    0    0
```

```
  END ACTIVITY
  PRINT-INFO
    RCHRES *************** Printout Flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
    1   63    5    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible   exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *        *  *  *  *  *          ***
    1   99   0  1  0  0    4  0  0  0  0        0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1
  HYDR-PARM2
    RCHRES                                                                 ***
    # -  #     FTABNO       LEN      DELTH      STCOR        KS       DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
   18             18    0.800                                  0.3
   19             19    0.568                                  0.3
   20             20    0.379                                  0.3
   21             21    0.450                                  0.3
   22             22    0.300                                  0.3
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***    VOL     Initial  value  of COLIND    Initial  value  of OUTDGT
           *** ac-ft      for each possible exit       for each possible exit
  <------><-------->      <---><---><---><---><---> *** <---><---><---><---><--->
   18      0.1             4.0
   19      0.1             4.0
   20      10.0            4.0
   21      0.1             4.0
   22      0.1             4.0
  END HYDR-INIT
END RCHRES

FTABLES

  FTABLE     18
 ROWS COLS ***
    3    4
     DEPTH      AREA     VOLUME    OUTFLOW   ***
      0.00      1.30      0.00       0.00
      1.00      1.30      1.30     166.00
      2.00      1.40      2.65     490.00
  END FTABLE 18

  FTABLE     19
 ROWS COLS ***
    3    4
     DEPTH      AREA     VOLUME    OUTFLOW   ***
      0.00      1.10      0.00       0.00
      1.00      1.10      1.10      65.00
      2.00      1.20      2.25     223.00
  END FTABLE 19

  FTABLE     20
```

```
*** WALKER CREEK WETLAND
 ROWS COLS ***
   10     4
     DEPTH       AREA     VOLUME    OUTFLOW  OUTFLOW ***
      0.00       0.00       0.00       0.00
      1.00       2.50       1.25       7.04
      2.00       5.00       5.00      17.84
      3.00      12.00      13.50      32.17
      4.00      19.00      29.00      45.13
      5.00      22.00      49.50      54.95
      6.00      23.00      72.00      61.62
      6.10      23.00      74.30      62.15
      7.00      23.50      95.25      67.00
      7.24      24.10     101.10     100.00
  END FTABLE 20

  FTABLE     21
 ROWS COLS ***
    8     4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0000     0.0000       0.00
     0.100     0.2259     0.0113       0.11
     0.500     0.2707     0.1106       4.27
     1.000     0.3268     0.2600      15.13
     1.500     0.3828     0.4374      31.67
     2.000     0.4389     0.6428      54.02
     2.500     0.4949     0.8763      82.52
     3.000     0.5510     1.1377     117.55
  END FTABLE 21

  FTABLE     22
 ROWS COLS ***
    9     4
     DEPTH       AREA     VOLUME    OUTFLOW    ***
     0.000     0.0000     0.0000       0.00
     0.100     0.3680     0.0184       0.25
     0.500     0.3717     0.1664       9.39
     1.000     0.3763     0.3534      31.06
     2.000     0.3819     0.7325      94.37
     3.000     0.3874     1.1171     174.33
     4.000     0.3930     1.5073     265.38
     5.000     0.3985     1.9030     364.68
     6.000     0.4040     2.3043     470.60
  END FTABLE 22
END FTABLES
MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>        <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                 <Name> # #***
  MASS-LINK         1
  conversion from acre-inches to acre-ft (1/12)               ***
PERLND     PWATER PERO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK     1

  MASS-LINK         2
IMPLND     IWATER SURO       0.0833333     RCHRES          INFLOW IVOL
  END MASS-LINK     2
```

```
  MASS-LINK        3
RCHRES      ROFLOW                                    RCHRES         INFLOW
  END MASS-LINK    3

  MASS-LINK        4
RCHRES      OFLOW  OVOL   1                           RCHRES         INFLOW IVOL
  END MASS-LINK    4

  MASS-LINK        5
RCHRES      OFLOW  OVOL   2                           RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        6
PERLND      PWATER SURO          0.0833333            RCHRES         INFLOW IVOL
PERLND      PWATER IFWO          0.0833333            RCHRES         INFLOW IVOL
  END MASS-LINK    6

  MASS-LINK        7
PERLND      PWATER AGWO          0.0833333            RCHRES         INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        8
PERLND      PWATER PERO          0.0833333            COPY           INPUT  MEAN
  END MASS-LINK    8

  MASS-LINK        9
IMPLND      IWATER SURO          0.0833333            COPY           INPUT  MEAN
  END MASS-LINK    9

  MASS-LINK       10
PERLND      PWATER SURO          0.0833333            COPY           INPUT  MEAN
PERLND      PWATER IFWO          0.0833333            COPY           INPUT  MEAN
  END MASS-LINK   10

  MASS-LINK       11
PERLND      PWATER AGWO          0.0833333            COPY           INPUT  MEAN
  END MASS-LINK   11

  MASS-LINK       12
PERLND      PWATER AGWO          0.0833333            COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
COPY        OUTPUT MEAN                               RCHRES         INFLOW IVOL
  END MASS-LINK   13

  MASS-LINK       14
COPY        OUTPUT MEAN                               COPY           INPUT  MEAN
  END MASS-LINK   14

END MASS-LINK
END RUN
```