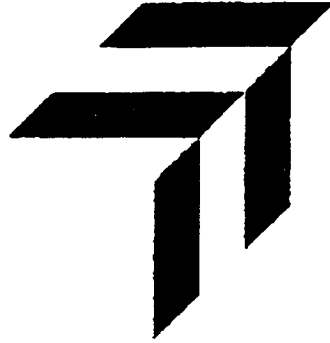


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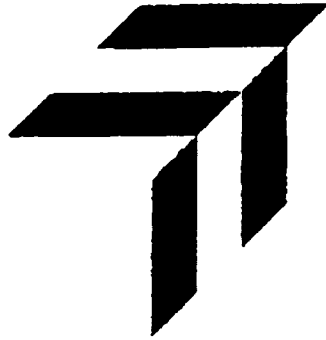
Seattle-Tacoma Airport Master Plan Update Low Streamflow Analysis

Prepared for:
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December 2000

AR 043961



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PORT of SEATTLE

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PORT of SEATTLE

**Seattle-Tacoma Airport Master Plan Update
Low Streamflow Analysis**

This report presents analyses performed to estimate the timing and volume of discharges to local receiving streams and wetlands during low flow periods from the Sea-Tac International Airport (STIA) considering proposed improvements to the STIA defined in the Port of Seattle's Master Plan Update. This report is submitted for consideration by the Department of Ecology and U.S. Army Corps of Engineers in reviewing various permit applications from the Port of Seattle related to the Third Runway project. The analyses build upon those performed in completing the *Sea-Tac Runway Fill Hydrologic Studies Report* for the Department of Ecology (Pacific Groundwater Group, 2000). The analyses presented in this report were prepared by Earth Tech, Inc., and Pacific Groundwater Group, Inc.; HSPF hydrologic model results were provided by Parametrix, Inc., in a December 2000 memorandum (Parametrix, 2000b).

For purposes of discussion in this report, the term "low streamflow" refers to total flow in a given stream reach during dry weather conditions, particularly the months of August and September. Low streamflow in this context includes water in a stream derived from groundwater, interflow and surface water discharges, including stormwater control facility discharges.

EXISTING STREAMFLOW CONDITIONS

Stream gage data available from King County at four sites in the Miller, Walker and Des Moines Creek watersheds are summarized in Table 1 for average monthly flows in August and September.

**Table 1:
Recorded Average Flows
August and September**

Gauge No. and Location	Period of Record	Average August Flow (cfs)	Average September Flow (cfs)
42A – Miller Creek near mouth	1989-1996	2.35	2.03
42B – Miller Creek at RDF	1990-1996	0.48	0.41
42E – Walker Creek near mouth	1993-1996	1.56	1.24
11 F – Des Moines Creek near So. 200 th St.	1996-1998	1.55	1.62

WATERSHED MODELING OF CURRENT AND PROPOSED CONDITIONS

The draft *Preliminary Comprehensive Stormwater Management Plan (SMP)* (Parametrix, August 2000a) for the Master Plan Update Improvements to STIA describes the watershed modeling prepared to define the anticipated hydrologic effects of proposed airport improvements and actions proposed to mitigate those effects on receiving waters. Watershed modeling of the Des Moines, Walker and Miller Creek basins was performed using the Hydrologic Simulation Program-Fortran (HSPF) model. This empirical watershed model is appropriate for quantifying the hydrologic effects due to changes in surface runoff conditions across the STIA area.

1994 was selected as the base year for defining pre-project hydrologic conditions for the STIA Master Plan Update (MPU). As is discussed in the SMP, the 1994 conditions represent a conservative baseline in that total impervious area in the drainage basins located within the STIA had decreased from 1974 to 1994 and that forested cover had replaced developed land coverage in some areas.

The HSPF model for each watershed produces simulations of stream flows at locations downstream of proposed STIA land modifications. The locations used to evaluate low streamflows were selected so as to be proximate to the proposed STIA construction: Miller Creek near SR 509, Walker Creek near 12th Avenue South, and Des Moines Creek near South 200th Street. The HSPF model results are included in Appendix D. The HSPF modeling results include the average monthly flows for August and September, as shown in Table 2, for land uses present in the watersheds in the 1994 pre-project condition.

**Table 2:
HSPF Model Streamflow in August and September
for 1994 Land Use Conditions**

Location	Rainfall Record Used in HSPF Simulation	Average August Flow (cfs)	Average September Flow (cfs)
Miller Creek at RDF ¹	1949-1996	0.45	0.70
Miller Creek near SR 509	1949-1996	1.27	1.50
Miller Creek near mouth ¹	1949-1996	2.70	3.23
Walker Creek near 12 th Avenue So.	1949-1996	0.033	0.035
Walker Creek near mouth ¹	1949-1996	1.37	1.37
Des Moines Creek near So. 200 th St.	1949-1996	1.08	1.64

¹Included for purposes of comparison with observed flows.

Seven-day low flow rates were derived from the HSPF model results for those locations immediately downstream of the limits of proposed STIA construction activity. The low flow results are summarized in Table 3.

**Table 3:
Seven-Day Low Flows (cfs)
Per HSPF Model of 1994 Land Use Conditions**

Location	Return Interval			
	2 years	5 years	10 years	20 years
Miller Creek near SR 509	0.79	0.68	0.63	0.59
Walker Creek near 12 th Avenue So.	0.021	0.019	0.017	0.016
Des Moines Creek near So. 200 th St.	0.35	0.28	0.24	0.21

In constructing models of the proposed project conditions, referred to herein as the 2006 land use conditions, the 1994 conditions HSPF model was revised to reflect proposed changes in land cover, surficial soils (fill placement), and the operation of proposed stormwater flow control facilities. The memoranda in Appendix D to this report present details of the model.

The HSPF model results of low streamflows with proposed STIA construction in place are summarized in Table 4 (average monthly flows for August and September) and Table 5 (7-day low flows).

**Table 4:
HSPF Model Streamflow in August and September
For 2006 Land Use Conditions**

Location	Rainfall Record Used in HSPF Simulation	Average August Flow (cfs)	Average September Flow (cfs)
Miller Creek near SR 509	1949-1996	1.10	1.40
Walker Creek near 12 th Avenue So.	1949-1996	0.031	0.039
Des Moines Creek near So. 200 th St.	1949-1996	1.07	1.73

**Table 5:
Seven-Day Low Flows (cfs)
Per HSPF Model of 2006 Land Use Conditions**

Location	Return Interval			
	2 years	5 years	10 years	20 years
Miller Creek near SR 509	0.64	0.54	0.48	0.44
Walker Creek near 12 th Avenue So.	0.015	0.012	0.010	0.009
Des Moines Creek near So. 200 th St.	0.27	0.21	0.18	0.15

The HSPF modeling indicates that August and September streamflows (average monthly flows and 7-day low flow rates) below the STIA in Miller Creek would be reduced by an amount ranging from 0.10 to 0.17 cfs as a result of the changes proposed by the Port. In the upper reach of Walker Creek the HSPF model results indicate a decrease in average August streamflows and an increase in average September streamflows; the 7-day low flow values are predicted to decrease by 0.007 cfs in the HSPF modeling. In Des Moines Creek, the modeling indicates a decrease of 0.01 cfs in August flows, an increase of 0.08 cfs in average September flows, and a decrease of 0.06 to 0.08 cfs in 7-day low flow values.

The foregoing HSPF modeling results utilize a different approach to low flow analysis from that used in developing earlier estimates published in the 1999 draft SMP (Parametrix, 1999). The 1999 draft SMP estimated low stream flow impacts based on a model of infiltration and groundwater recharge potential, which differs from statistical comparisons of low stream flow described above. The HSPF model was used to predict the amount of precipitation available for groundwater recharge that contributes to stream flow. This water mass balance approach compared the difference of water available for stream base flow between existing (pre-project) conditions and after full construction of the MPU projects. The mass balance approach predicted flow reductions in Miller and Des Moines Creeks of 0.05 cfs and 0.13 cfs respectively for the 1 in 10 dry year. While this simplified approach does not account for other hydrologic changes, such as the construction of detention ponds or stormwater infiltration, it can provide conservative results that are representative of very small flow changes. These low stream flows are normally difficult to model precisely in watershed models.

In addition to the different approaches used to estimate low stream flow impacts, the HSPF model used for the low stream flow statistics is an updated version of the model used for the mass balance calculations. Therefore, the results are not directly comparable. Differences between the results, while on the same order of magnitude, can be explained primarily by changes in infiltration parameters in the Miller Creek model, and the influence of detention facilities and storm runoff on low streamflows.

In assessing quantitative effects on streamflow, the HSPF modeling results provide a partial characterization of the impact. As discussed in the Pacific Groundwater Group report, the HSPF model does not consider three identified factors with potential to influence summer low flows:

1. *Late summer discharge of infiltrated water stored in the proposed Third Runway embankment fill.* Precipitation that falls on pervious areas of the proposed fill infiltrates through the fill, delaying its discharge through the drainage layer to area wetlands and streams by several months.
2. *Changes in non-hydrologic flows within the buy-out area in the watersheds.* Discontinued irrigation withdrawals from within the watershed and discontinued discharges of imported water through septic system drainfields.

3. *Secondary recharge of runoff from pavement atop the proposed Third Runway embankment fill.* Runoff from runway and taxiways would traverse pervious biofiltration strips with opportunity to infiltrate into the fill, enhancing the recharge effect of the first factor identified above and reducing peak storm runoff rates from those predicted in the HSPF model.

Modifications have been made to the proposed design of stormwater control facilities in the Master Plan Update in response to review comments from the Department of Ecology. The modifications were developed in part to address low flow conditions in area streams and include:

4. *Extended duration discharge* from stormwater detention facilities through infiltration galleries that would provide input to the shallow groundwater regime adjacent to Miller Creek. The effects of these discharges were incorporated into the HSPF modeling for the 2006 proposed project condition and are reflected in the HSPF model results presented in Tables 4 and 5.
5. *Managed release of stormwater from reserved storage* to ensure that low flow discharges in streams do not fall below preproject levels. Such stormwater would be collected from winter season runoff, treated, and stored until needed during the dry season, and then aerated and released to sustain desired flow rates in streams. The effects of these discharges are not included in the HSPF modeling and must be added to the model results.

The results of the HSPF modeling should be considered together with estimates of the low streamflow impacts to accrue from each of the above factors. All five of the factors are present in the Miller Creek watershed. Walker Creek would have two of the factors present: late summer discharge from both pervious and secondary impervious recharge to the embankment fill. The buy-out area does not extend into the Des Moines Creek watershed, and the area of the runway fill within that watershed is small; therefore, the first three factors are not considered in Des Moines Creek streamflows. There also are no provisions in the Des Moines Creek drainage for proposed extended duration discharge. Discussion of the effects of extended duration discharge through infiltration is discussed in Appendix D. The remaining four factors are evaluated in the corresponding sections that follow in this report.

HYDROLOGIC BEHAVIOR OF RUNWAY FILL

In preparing the Pacific Groundwater Group (PGG) report, an analysis was conducted to model the behavior of infiltrated rainfall as it passes through the proposed fill. The analysis included modeling of a cross-section of the fill for a range of fill depths ranging from 30 feet to 150 feet. The study concluded the fill would act to store infiltrated water as it seeps through the fill and to delay the discharge of the water to wetlands and creeks. Because of the time lag through the fill, the analyses predicted that winter precipitation would be discharged through the drainage layer underlying the fill in the summer months, and this would be considered to have a generally beneficial effect on low summer flow in local streams. However, the PGG report also noted that

the quantity of delayed discharge is dependent on runoff and evapotranspiration changes caused by new construction.

This section of the report applies the results of the PGG analyses to estimate the effect the delayed discharges through the embankment fill would have on August and September flows in Miller and Walker creeks.

As noted above, the HSPF model does not effectively model the mechanisms of deep percolation through the fill and subsequent discharge through the drainage layer. HSPF cannot adequately incorporate into the watershed model the effects of the fill for several reasons:

- HSPF is not designed for detailed modeling of relatively small areas with atypical geologic features such as deep fill.
- Interflow as defined in the HSPF typically has a recession duration of 1 to 7 days, which is much shorter than the transit time expected through the fill. The interflow parameter is a "lumped" parameter that is subsequently measured downstream.
- The duration of the upper zone groundwater storage is short (approximately 1 day) prior to splitting of stored water to the lower zone storage. This is inconsistent with the behaviors of the deep fill.
- HSPF does not provide for a time delay shift to represent extended groundwater travel.
- HSPF is an empirical model intended to be calibrated against a data set. There is insufficient data available to effectively calibrate the parameter for the fill effects. One month of flow data was collected from January to February 1998 measuring discharge from the base of recently placed fill. The limited data set does not provide for an estimate of the storage within the fill volume and only extends through one short segment of time within the heart of a wet season.

Within the area of the fill, changes to the volume and timing of groundwater discharge to local wetlands and streams are predicted as a result of the proposed fill embankment. As discussed in the PGG report, the fill would provide greater storage capacity for infiltrated precipitation than exists under pre-project conditions. Infiltrated precipitation would seep through the fill to the relatively porous drainage layer underlying the fill. The water seeping to the drainage layer would then discharge from the base of the fill after a transit period of up to several months from the time it first fell on the surface of the fill. The travel time is a function of both the vertical thickness of the fill and the lateral length of travel through the drainage layer. Because the runway would create more impervious surface area than existed within the fill footprint prior to construction, the total volume of infiltration (assuming no secondary recharge of pavement runoff) would be reduced. The delayed discharge of the volume of water that does infiltrate through the fill, however, would provide increased discharge from the fill area during the critical low flow periods in area wetlands and streams.

The PGG study, conducted for the Department of Ecology, modeled the behavior of infiltrated rainfall as it passes through the proposed fill. The analysis included modeling of a cross-section of the fill that ranged from 30 feet to 150 feet thick. The analysis estimated the amount of rainfall that would percolate through the pervious areas of the fill surface (impervious surfaces were assumed to runoff to tightline systems and surface water discharges, consistent with the HSPF model) and how much of the infiltrated water would be taken up through evapotranspiration. A second model (Hydrus-2D) used soil characteristics to estimate the time of vertical travel through the fill mass to the drainage layer for varying depths of fill. A third model (Slice) then summed the flows within the drainage layer over time and translated them into a discharge at the toe of the fill embankment. A repeating cycle of average monthly rainfall depths was used in the PGG model, and the model was run with this repeating rainfall cycle until the discharge pattern stabilized.

Hart Crowser later prepared an independent analysis of the behavior of infiltrated rainfall through the proposed embankment fill for the Port of Seattle. This analysis utilized the same model for estimating surface infiltration of precipitation to pervious areas. A different model was used to predict the water behavior in the fill, and some of the soil parameters and assumptions differed from those used in the PGG study. The conveyance of infiltrated water through the drainage layer was not modeled by the Hart Crowser work. The Hart Crowser analysis used a ten-year time series of daily precipitation as input to the modeling. The results of the Hart Crowser analysis support the findings of the PGG report, specifically that there would be a delayed discharge of infiltrated water and that this would provide increased discharge from the fill area during the low flow periods in area streams. Appendix A presents a comparison of various aspects of the PGG and Hart Crowser analyses. Based on this comparison it was concluded that the PGG model application was more appropriate for the modeling of the embankment fill behavior as it: (1) more accurately represents the effects of gravel within the fill; (2) simulates the variable slope and permeability of the native soil aquifer and wetland soils below the fill; and (3) models the recharge through variable thicknesses of fill.

The results of the PGG model analyses were applied across the footprint of the proposed fill within the Miller Creek watershed to derive a quantified estimate of the effects of delayed discharges through the fill on August and September flows in the creek. The model results were applied across the fill footprint for both the existing condition (year 1994) landscape and the pervious areas of the built condition (year 2006) fill. The analysis is presented in Appendix B and the results are summarized in Table 6 along with the HSPF model results for Miller Creek.

**Table 6:
Estimates of Miller Creek Streamflow Effects
from Fill Infiltration Discharge¹**

Period of Flow	HSPF Model Streamflow (cfs)		Increase from Fill Discharge (cfs)	2006 Condition w/ Fill Discharge (cfs)
	1994 Condition	2006 Condition		
August	1.27	1.10	0.108	1.21
September	1.50	1.40	0.065	1.47
7-Day/2-Year Low Flow	0.79	0.64	0.065 ²	0.71

¹Miller Creek at SR 509

²Calculated as 75 percent of the average increase in discharge over August and September.

The analysis predicts that delayed discharge of water through the fill will have a mitigating effect on low streamflows in Miller Creek during August-September flow conditions. A similar positive effect on 7-day low flow discharges would be expected. Results from the Hart Crowser analysis provide insights into how the fill is expected to behave through periods of varying rainfall. The analysis indicates that during years with lower total precipitation, the lag between the times of minimum discharge for existing soil conditions and the fill conditions lengthens. In addition, the analysis predicts that the volume of discharge from the fill during August and September would fluctuate less with changes in precipitation than under existing soil conditions within the fill footprint. Based on the 10 years of rainfall used in the Hart Crowser analysis, the standard deviation for the differences in August and September discharge volumes between fill and existing conditions is 25 percent. This suggests that approximately 75 percent of the average increase from fill discharge could be expected during drier years when extreme low stream flows could be expected.

Applying similar techniques to the fill footprint area within Walker Creek produces the results shown in Table 7. The depth and shape of the fill section within the Walker Creek basin differs from that which typifies Miller Creek. Whereas the fill in Walker Creek would produce a shorter delay of infiltrated water, the discharged water must travel a greater distance in the Walker Creek basin (as shallow groundwater and surface flow) from the fill to the stream channel; therefore, comparable results are anticipated. Further, the area of proposed fill within Walker Creek is small (6.7 acres pervious fill surface) which limits the effect of differences between the fill sections on the results.

**Table 7:
Estimates of Walker Creek Streamflow Effects
from Fill Infiltration Discharge¹**

Period of Flow	HSPF Model Streamflow (cfs)		Increase from Fill Discharge (cfs)	2006 Condition w/ Fill Discharge (cfs)
	1994 Condition	2006 Condition		
August	0.033	0.031	0.005	0.036
September	0.035	0.039	0.003	0.042
7-Day/2-Year Low Flow	0.021	0.015	0.003 ²	0.018

¹Walker Creek near 12th Avenue South

²Calculated as 75 percent of the average increase in discharge over August and September

CHANGES IN NON-HYDROLOGIC FLOWS

The November 1999 and the August 2000 drafts of the SMP identified 18 water right certificates and claims within the property buy-out area in the Miller Creek watershed. Based on assumptions regarding residential and farm property uses of these water rights, the November 1999 Plan concluded that water use from these claims during the low-flow period in August would be reduced by 0.13 cfs (SMP, Appendix G).

The PGG report identified several non-hydrologic factors with potential to affect total groundwater recharge, and hence low flows in Miller Creek. PGG included the summer irrigation quantity cited in the SMP of 0.13 cfs, or 84,000 gpd. PGG identified the following changes in water use in the buy-out area with the potential to affect streamflows:

**Table 8:
Non-Hydrologic Changes In Summer Streamflow
(PGG Report)**

Change in Water Use	Potential Streamflow Effect (gallons per day)
Cessation of summer irrigation with local water sources	+ 84,000
Cessation of septic discharge of imported water	- 66,000
Cessation of excess lawn irrigation with imported water	- 10,000
Leakage of imported water from water supply pipes	unknown
Net Change During Irrigation Season	~0

Since the August 2000 draft SMP was published, Parametrix has consulted with former property owners to update estimates of historic water withdrawal under the 18 acquired water rights in Miller Creek. Based on these contacts, Parametrix concludes that historic irrigation season consumption totaled 0.079 cfs (51,000 gpd) rather than the previously cited 0.13 cfs (refer to

Appendix C). Integrating this revised estimate into the summation presented in **Table 8** would produce an estimated reduction in Miller Creek streamflow of 25,000 gpd (0.04 cfs).

EFFECTS OF SECONDARY RECHARGE

As noted earlier, the HSPF model assumes that all pavement runoff is effective impervious area, and that such runoff is completely conveyed via tightline systems to ponds or vaults and then to area streams. The PGG model of infiltration through the fill followed the same assumption for reasons of consistency with the HSPF modeling in maintaining the accounting of the hydrologic water balance. This assumption ignores the opportunity for runoff from proposed runway and taxiway pavements to infiltrate into surrounding pervious soils. The effects of this assumption on the hydrologic computations presented above are to: (1) increase the computed peak discharge rates during the majority of storm events; and (2) reduce the volume of infiltrated runoff to pass through the fill and be discharged to streams during low flow periods.

A review of the proposed runway and taxiway sections presented in the Preliminary Comprehensive Stormwater Plan suggests that substantial opportunity would be provided for pavement runoff to infiltrate into pervious ground as this runoff transits across biofiltration strips and along biofiltration swales to catch basins. Taxiways and runways are proposed to be constructed with filter strips having travel lengths of 75 feet. Shorter connecting taxiways would be constructed with filter strips 30 feet in width.

Analyses were performed to estimate the quantity of pavement runoff that would infiltrate the fill as it passes through filter strips. Infiltration within bioswales was not considered as the travel lengths within the swales varies widely and the soils within the swales are expected to be saturated a greater percentage of the year due to the concentration of flow in them. The pavement runoff that infiltrates into the filter strips is termed "secondary recharge" for purposes of this discussion. The procedure followed in the analysis is described below:

1. Compile flow exceedence probabilities for impervious surfaces from the HSPF model. The flows calculated are strictly surface runoff, as there are no interflow or groundwater flow components in impervious areas.
2. Estimate the maximum infiltration capacity of the filter strip, assuming that water can infiltrate the soil at its saturated hydraulic conductivity rate over the entire area of the filter strip. Soil conductivity is based on the matrix conductivity used for the fill in the Hydrus-2D modeling (matrix includes the silt and sand components) corrected for the presence of gravel with an empirical formula. Hydraulic gradient is assumed to be 1 (gravity). Infiltrating area is assumed to be 100 percent of total area of the filter strip.
3. For each exceedence probability range, calculate the portion of the total water input to the filter strip going to infiltration and runoff. Total water input is assumed to be expected runoff from runway/taxiway pavement (based on pavement area and HSPF flow values) plus the direct rainfall on the filter strip. If

total input exceeds total infiltration capacity, the excess water volume is considered to be runoff and the infiltrated volume is limited by the infiltration capacity. If total water input is less than the infiltration capacity, runoff is zero and infiltration equates to the total water input.

4. Plot the exceedence probability curves for: runoff from the pavement, direct rainfall to filter strip, infiltration within filter strip, and runoff from the filter strip.
5. Estimate recharge for each calendar month by summing the product of the exceedence probability range for each month and the predicted infiltration value. Because exceedence statistics never reach zero percent, there is always an upper region representing the extreme flows where there are no values. For purposes of estimating infiltration, this is not a concern because the available infiltration capacity is exceeded by the pavement runoff only in extreme event. Potential evapotranspiration (PET) values were obtained from the previous PGG analysis for grass over outwash soils, and it was conservatively assumed that actual evapotranspiration (AET) equals PET. Finally, PET was subtracted from infiltration to calculate the net recharge, which can never be less than zero.
6. Plot the monthly values of predicted infiltration, PET and recharge.

The results of the analysis indicate that nearly all runoff from the runways should infiltrate in the filter strips. Based on HSPF data provided by others, pavement runoff (and, hence, precipitation) occurs about 18 percent of the time. **Figure 1** shows the annual flow duration curves for a one-foot wide half-section of runway with a slope length of 105 feet and a 75-foot wide filter strip. The analyses indicate that runoff from the filter strips would occur less than 5 percent of the time because of the infiltration capacity of the filter strips. The runoff in the 18-to-5 percent exceedence interval completely infiltrates in the filter strips along with incident precipitation falling directly on the filter strips. When runoff does occur in the analysis, it is at lower rates than that predicted by the HSPF modeling as a result of secondary recharge.

Figure 2 presents results of a similar analysis for a taxiway having a maximum 140-foot slope length and a 75-foot wide filter strip. For this situation the infiltration capacity of the filter strip exceeds the pavement runoff and direct rainfall on the filter strip for nearly all rainfall occurrences. **Figure 3** presents results of a similar analysis for connecting taxiways having a maximum slope length of 140 feet and a 30-foot wide filter strip. In this scenario, the total water input exceeds the infiltration approximately 6 percent of the time. In all three scenarios, nearly all of the pavement runoff volume can be infiltrated in the filter strips.

Figure 1. Annual Flow Duration Curves for a One-foot Wide Half-Section of Runway (105 feet) and Adjoining Filter Strip (75 feet)

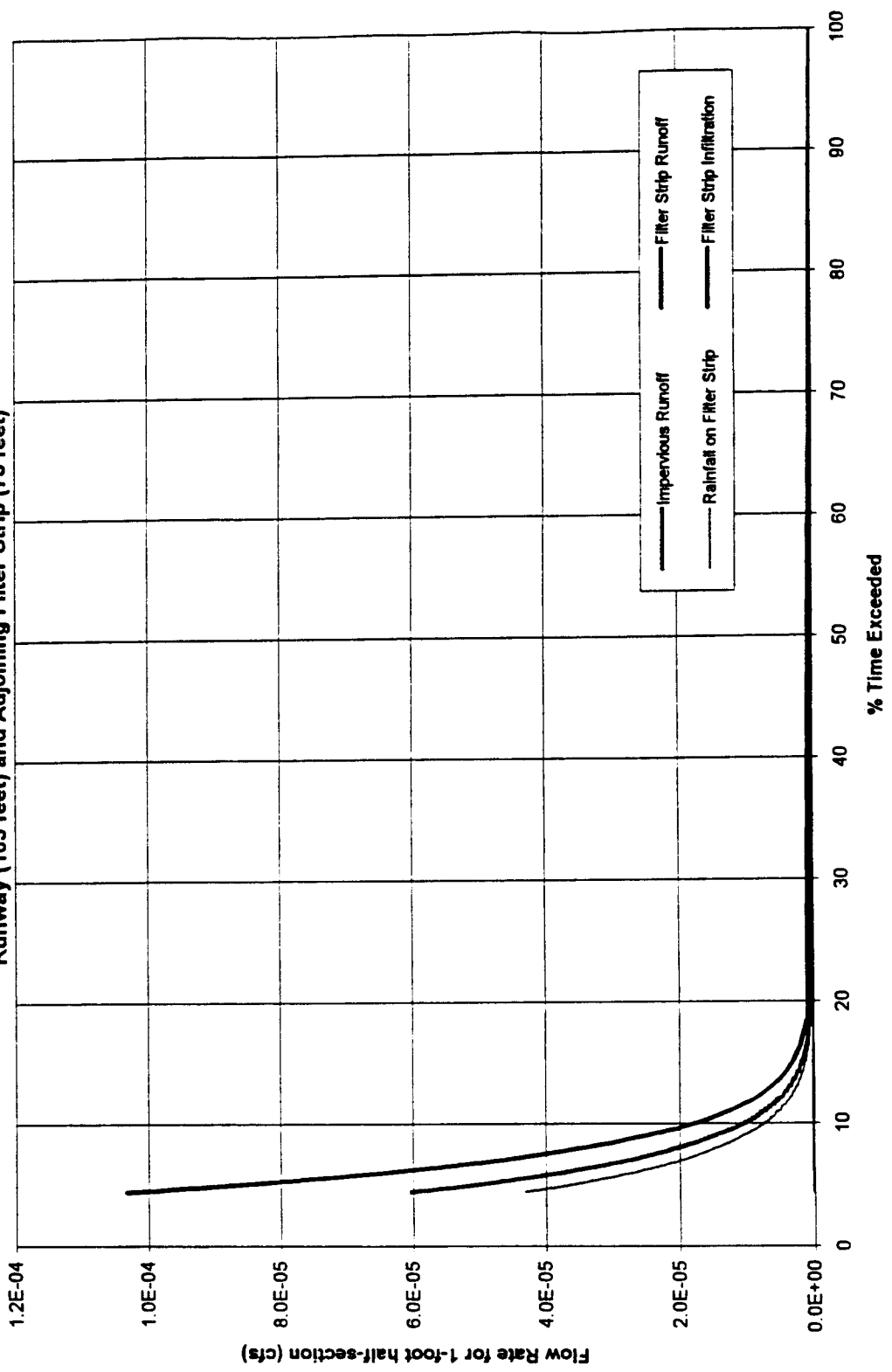


Figure 2. Annual Flow Duration Curves for a One-foot Wide Section of Taxiway (140 feet slope length) and Adjoining Filter Strip (75 feet)

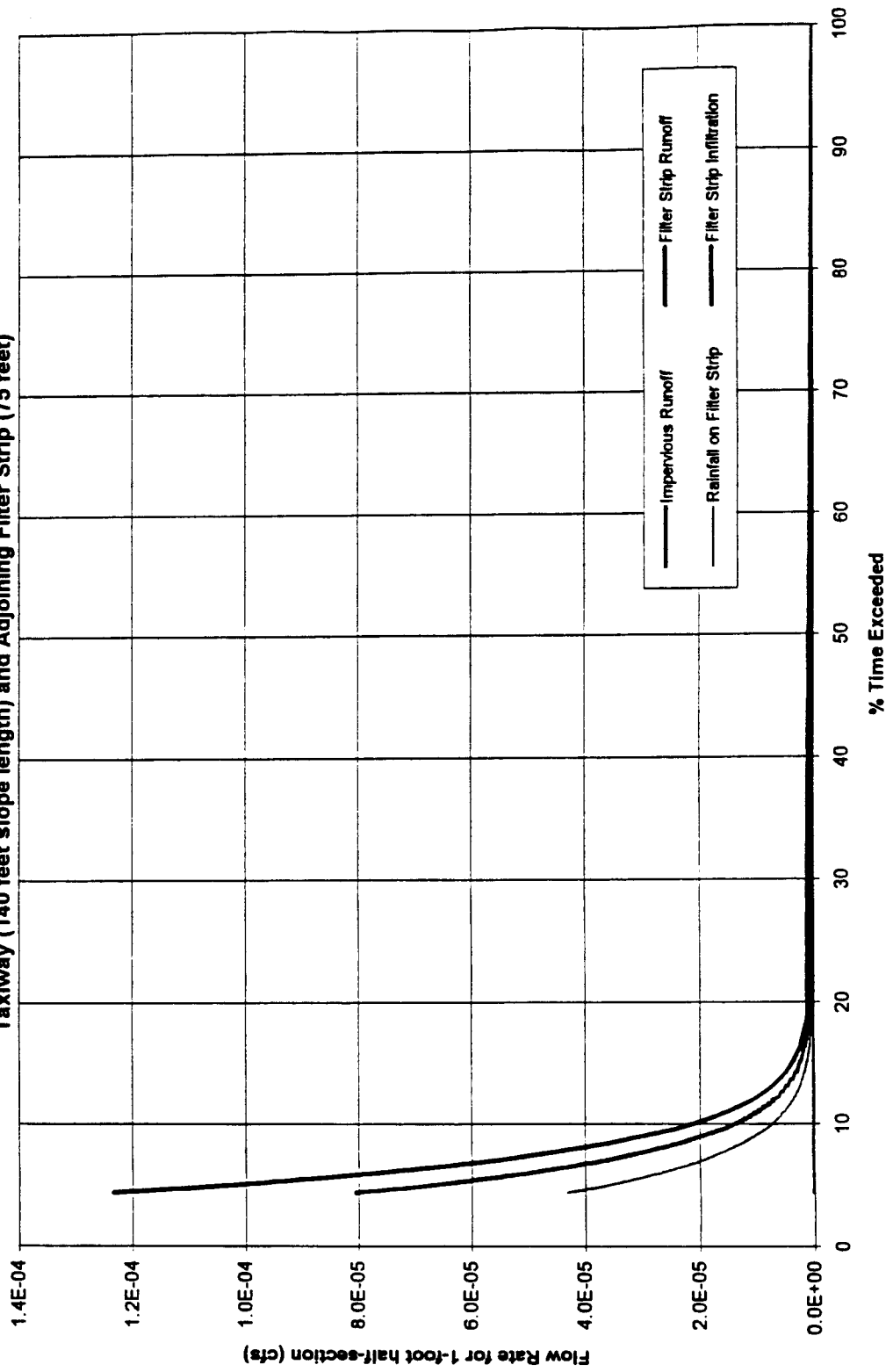
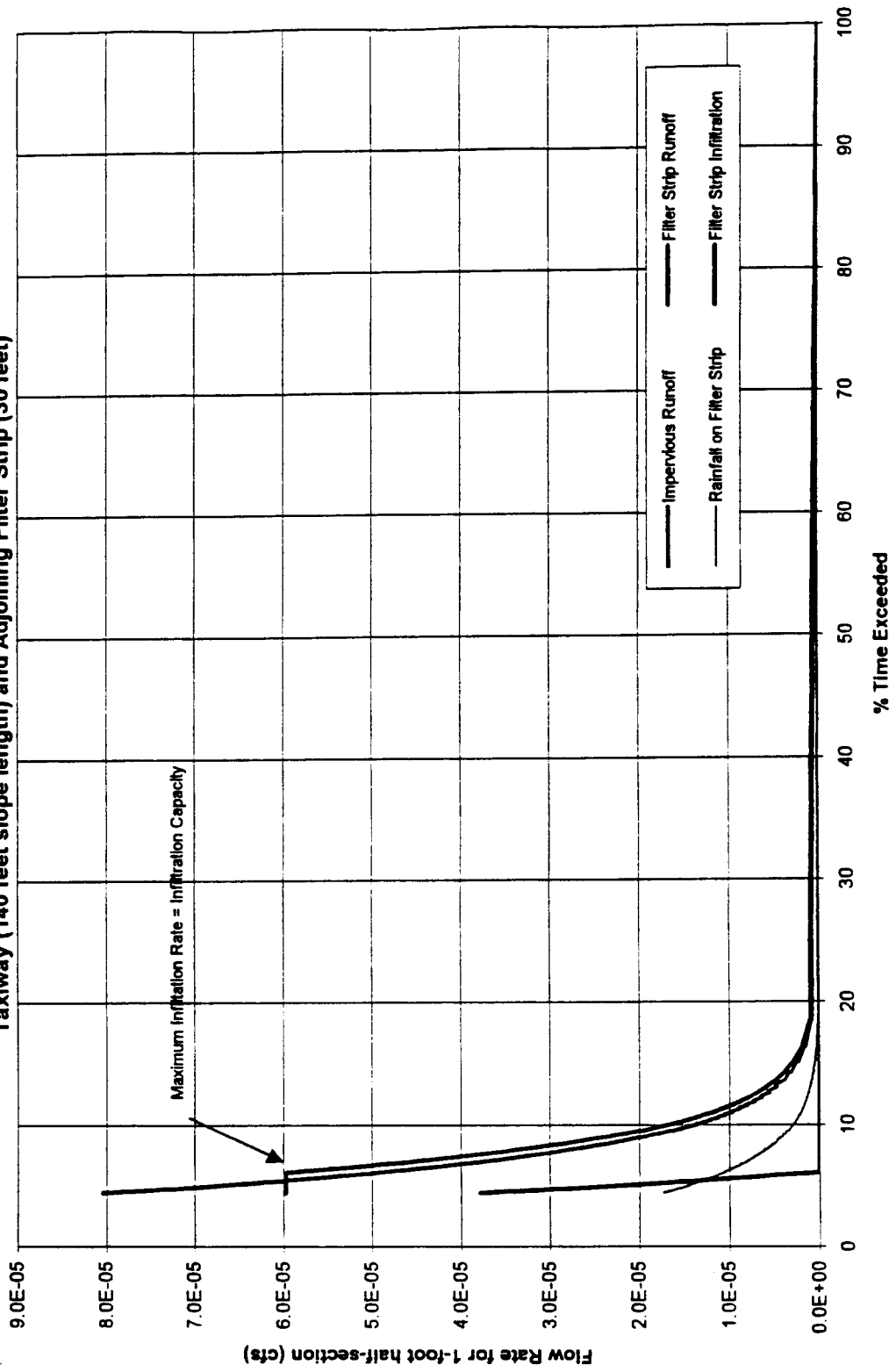


Figure 3. Annual Flow Duration Curves for a One-foot Wide Section of Connecting Taxiway (140 feet slope length) and Adjoining Filter Strip (30 feet)



Figures 4, 5 and 6 present the monthly recharge rate for the three filter strip scenarios described above (incident precipitation and pavement runoff). The figures show the total infiltration, potential evapotranspiration and net recharge below the root zone into the fill. The recharge volume is the product of the infiltration rate and the area of the filter strip.

The effect of the additional infiltrated water to the fill would be to enhance the effect of delayed discharge from the fill's drainage layer during the August-September low flow period in Miller and Walker creeks. A simple extrapolation of the Hydrus-2D/Slice model results on a per-acre basis would suggest that secondary recharge would have the potential to increase Miller Creek August flows by an additional 0.04 cfs and September flows by 0.025 cfs. Using the same extrapolation approach, Walker Creek flows would increase in August by 0.005 cfs and in September by 0.003 cfs. This simple extrapolation does not consider geographic and hydraulic effects that are present, and the extrapolation may overestimate delay times for this groundwater flow. This is because the recharge is not uniform across the surface of the impervious fill area, localized areas of the fill will experience elevated saturation compared to other sections, and the added volumes may pass more quickly through the wetter zones than was calculated in the Hydrus-2D analysis. However, during drier years, saturation levels will be reduced and delay times would not be expected to shorten. Therefore, the simple extrapolation is considered a reasonable estimate and has been used directly in this assessment.

RESERVED STORMWATER RELEASE

The Port proposes to construct additional stormwater storage facilities that would collect and store winter season runoff until needed to support low flows during the dry season. When low flow conditions would occur in the stream, the stored stormwater would be released at a prescribed rate, aerated and discharged to the stream system to sustain desired instream flow rates. The reserved stormwater release facilities are proposed by the Port in the Des Moines Creek and Miller Creek basins. The facilities are proposed to be constructed as additional storage volume in the base of selected detention facilities, with each facility having a dedicated, gated discharge outlet, allowing the stormwater to be discharged when needed.

The required storage volume to be held in reserve can be determined based on the necessary rate and duration of discharge to support low flows in the respective stream system. In both Des Moines and Miller Creeks, additional discharge is predicted to be needed to sustain 7-day low flows to preproject (1994) levels. In Miller Creek at the SR 509 crossing, the predicted deficit in 7-day duration/2-year frequency stream discharge rate was determined to be 0.10 cfs, after accounting for the hydrologic changes on the STIA site, the discharge of pervious fill recharge and secondary impervious runoff recharge, and changes in non-hydrologic flows. In Des Moines Creek, the predicted deficit would be 0.08 cfs. **Tables 9 and 10** describe how the required discharge rates were determined for Miller and Des Moines Creeks, respectively.

Figure 4. Predicted Infiltration, PET and Total Recharge on Runway Filter Strip (75 feet)

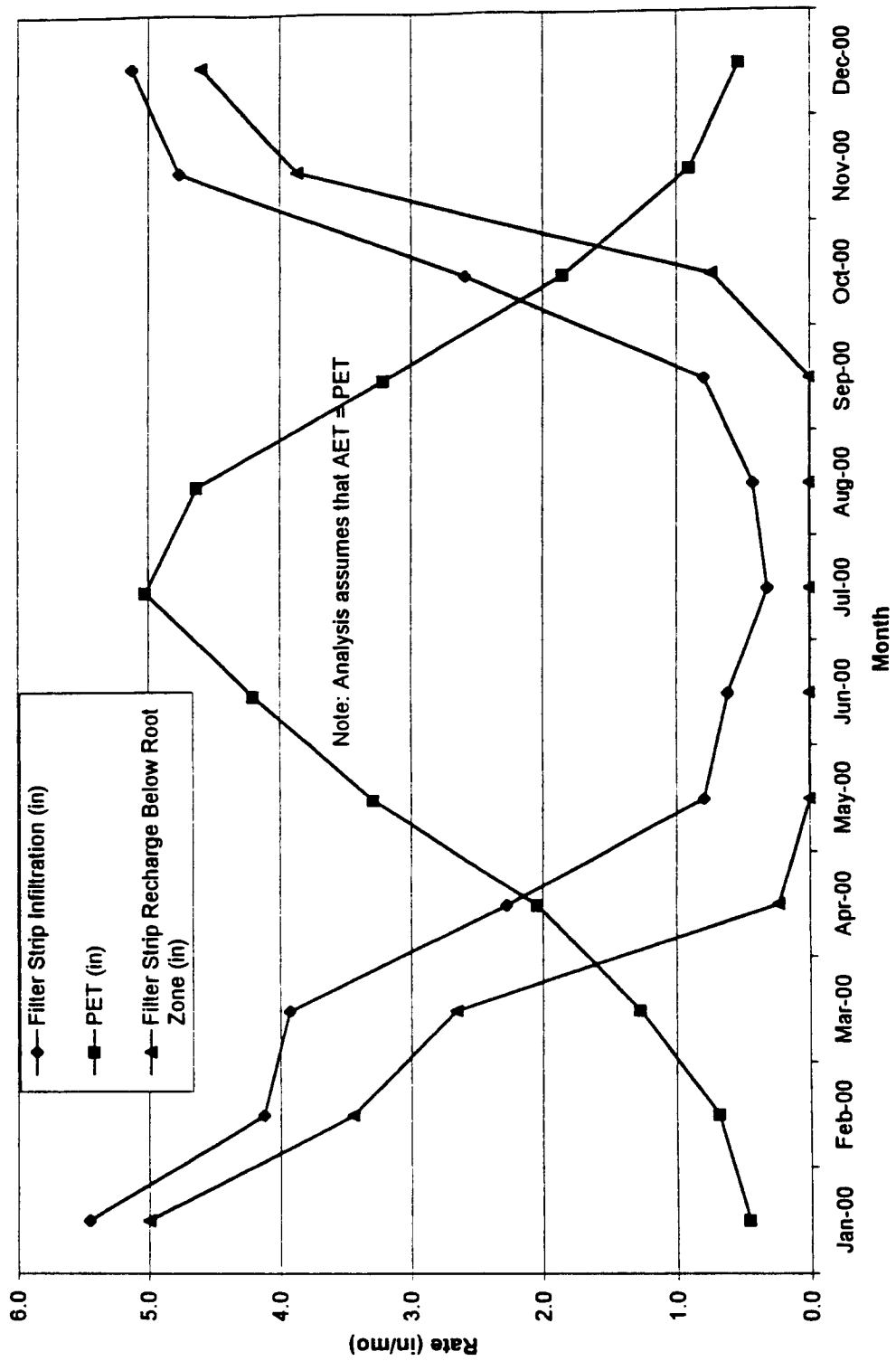


Figure 5. Predicted Infiltration, PET and Total Recharge on Taxiway Filter Strip (75 feet)

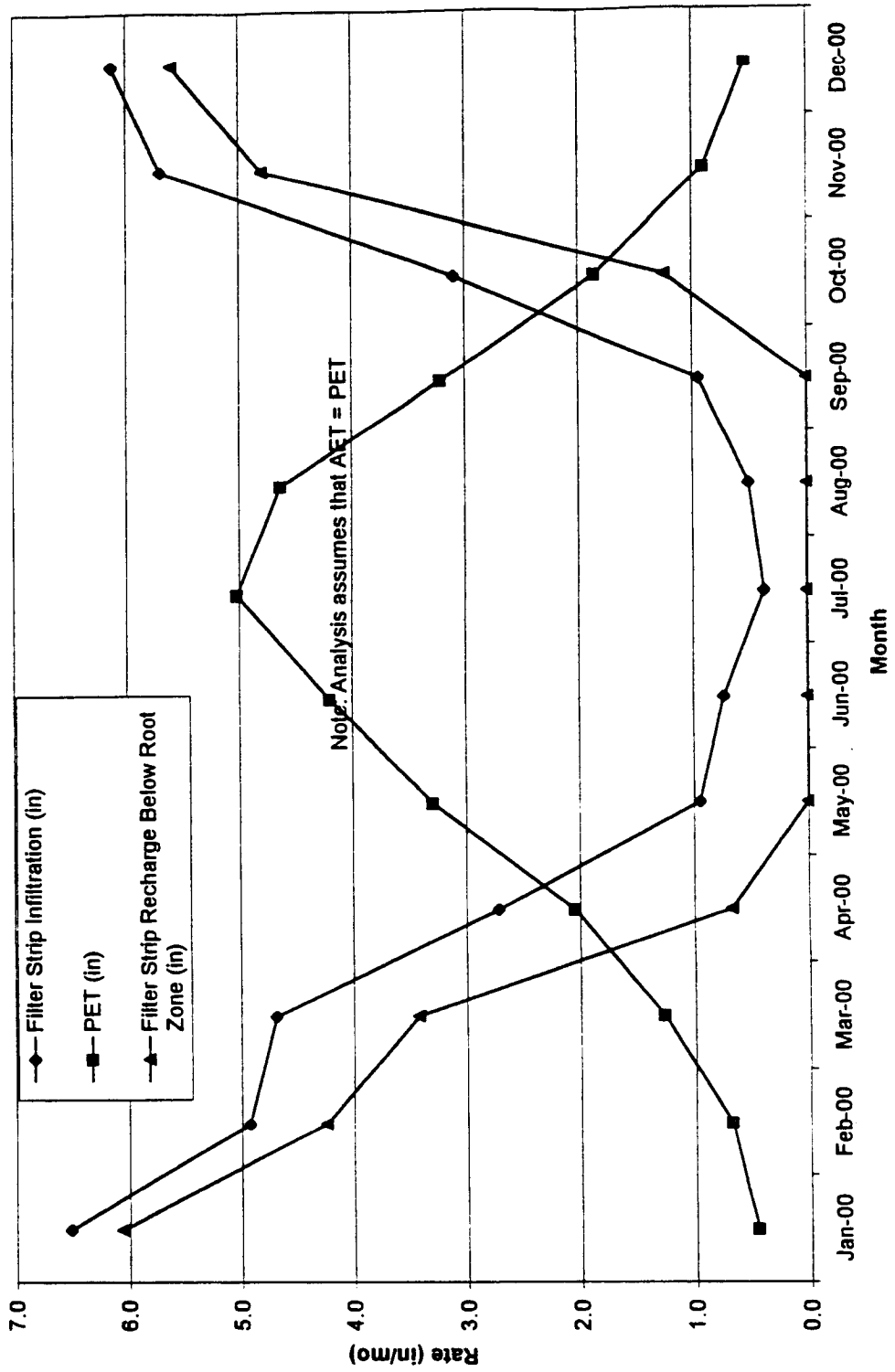
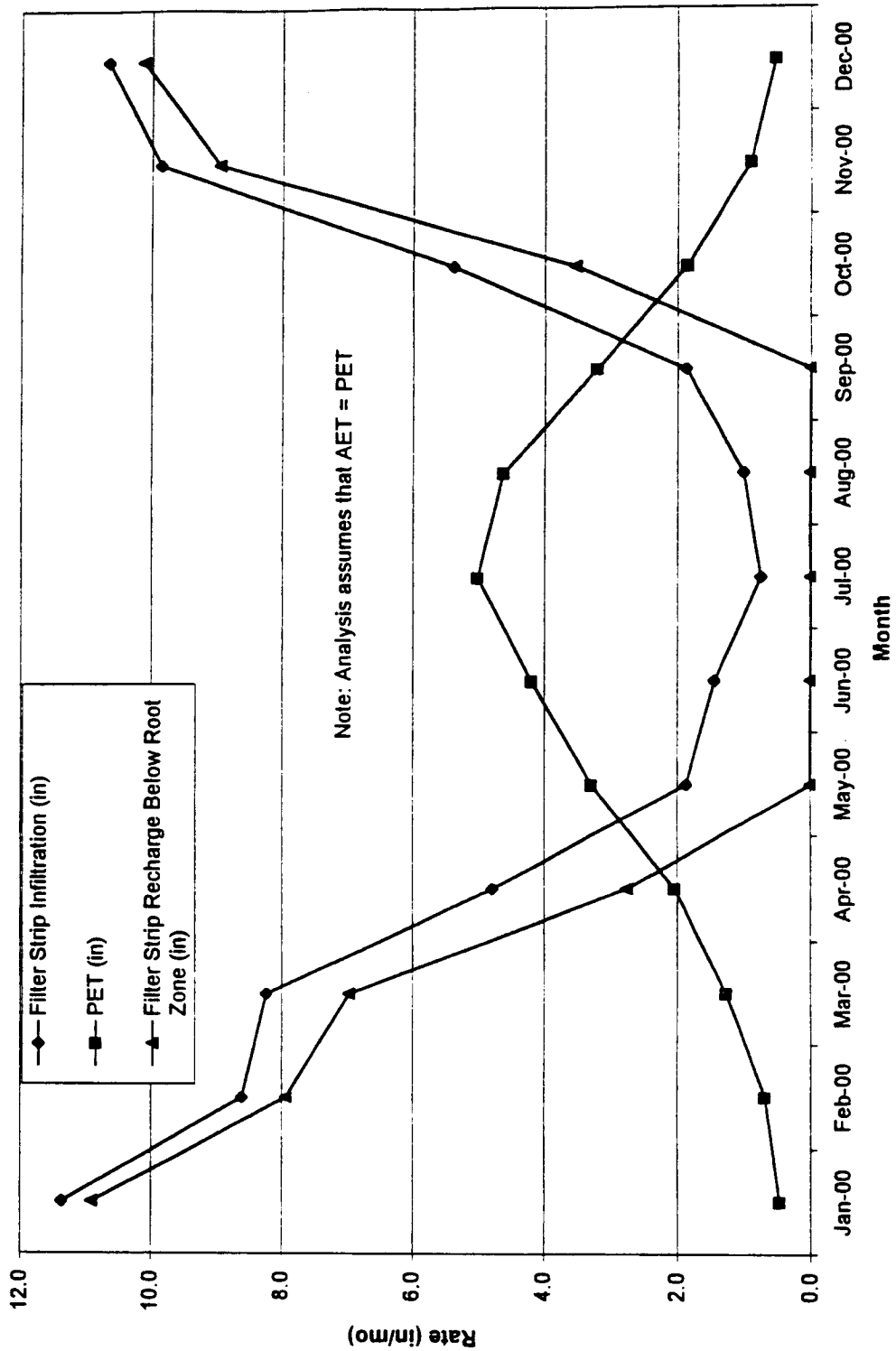


Figure 6. Predicted Infiltration, PET and Total Recharge on Connecting Taxiway Filter Strip (30 feet)



**Table 9:
Miller Creek Reserved Stormwater Release Rate Determination**

Period of Flow	HSPF Model Streamflow (cfs)		Discharge of Pervious Fill Recharge (cfs)	Non-Hydrologic Changes (cfs)	Discharge of Secondary Impervious Recharge ² (cfs)	2006 Condition with Fill Discharge and Non-Hydrologic Changes ³ (cfs)	Net Deficit from 1994 Condition = Reserved Release Rate (cfs)
	1994 Condition	2006 Condition					
August	1.27	1.10	0.108	(0.04)	0.04	1.21	0.06
September	1.50	1.40	0.065	(0.04)	0.025	1.45	0.05
August/September	1.39	1.25	0.09	(0.04)	0.03	1.33	0.06
7-day/ 2-year low flow	0.79	0.64	0.065 ⁴	(0.04)	0.024 ⁴	0.69	0.10

¹Miller Creek at SR 509

²Assumes secondary recharge volumes from impervious areas behave similar to pervious area recharge volumes.

³Sum of 2006 HSPF streamflow, fill pervious recharge, non-hydrologic changes and secondary impervious recharge.

⁴Calculated as 75 percent of the average increase in discharge over August and September.

**Table 10:
Des Moines Creek Reserved Stormwater Release Rate Determination¹**

Period of Flow	HSPF Model Streamflow (cfs)		Discharge of Pervious Fill Recharge (cfs)	Non-Hydrologic Changes (cfs)	Discharge of Secondary Impervious Recharge ² (cfs)	2006 Condition with Fill Discharge and Non-Hydrologic Changes ³ (cfs)	Net Deficit from 1994 Condition = Reserved Release Rate (cfs)
	1994 Condition	2006 Condition					
August	1.08	1.07	—	—	—	1.07	0.01
September	1.64	1.73	—	—	—	1.73	—
August/September	1.36	1.40	—	—	—	1.40	—
7-day/ 2-year low flow	0.35	0.27	—	—	—	0.27	0.08

¹Des Moines Creek at South 200th Street

²Assumes secondary recharge volumes from impervious areas behave similar to pervious area recharge volumes.

³Sum of 2006 HSPF streamflow, fill pervious recharge, non-hydrologic changes and secondary impervious recharge.

A review of the differences between 1994 and 2006 low flow conditions predicted by the HSPF modeling for varying return frequencies and durations (refer to Appendix D) concluded that the greatest differences in flow rates were predicted for the 2-year return frequency, and that the differences in flow rates were consistent across durations ranging from 7 days to 90 days. Hence

the 7-day/2-year low flow condition was selected as the criteria for establishing the reserve stormwater release rate.

Criteria for establishing the appropriate duration of the reserved stormwater release was made based upon a review of the pattern of low flow occurrences. **Figure 7** is a histogram showing when Day 1 of the 7-day duration low flow periods would occur in Miller Creek at SR 509 based on HSPF modeling of the 2006 condition. The analysis extends over a 47-year period from 1949 through 1995. A similar analysis for Des Moines Creek at South 200th Street is presented in **Figure 8**. The figures indicate that in both basins, if the reserved stormwater release commenced at a fixed calendar date and extended over a 60-day period, the release would coincide with the 7-day low flow period in 83 to 85 percent of the years. Similarly, if a 45-day-long release were initiated each year on a fixed date, the release would coincide with the 7-day low flow period in 72 to 74 percent of the years. The clustering of the 7-day low flow occurrences within August and September allows a release over a limited timeframe to provide a high level of confidence that the release will coincide with low flow conditions in the streams.

The effectiveness of the reserved stormwater release in mitigating 7-day low flows in Miller and Des Moines Creeks can be enhanced through active management of the release in response to measured flows in the streams. Rather than initiating the release on a fixed date each year, the reserve would be released when the discharge in the stream drops to a predetermined rate. It is recommended that data from existing King County stream gages be used to decide when the release of the reserve should commence. Using existing gages provides the benefit of historic gage data and eliminates the uncertainty of whether a new gage is properly rated. These gages can also be monitored in real time, facilitating reserve management and allowing rapid response to changing stream conditions. Utilizing such an active management procedure, a reserve discharge duration of 45 days would be sufficient to ensure the release would support necessary stream discharges throughout portions of all low flow events, including extended drought conditions, and throughout the full duration of the vast majority of low flow events.

Based on a 45-day discharge duration and the release rate identified in Table 9, the required reserved stormwater storage volume in Miller Creek above SR 509 would be $(010 \text{ cfs} \times 3600 \text{ seconds} \times 24 \text{ hours} \times 45 \text{ days} / 43,560 \text{ sq. ft.} =)$ 8.9 acre-feet. Similarly, the required reserved stormwater storage volume in Des Moines Creek above South 200th Street would be 7.1 acre-feet.

SUMMARY OF LOW STREAMFLOW EFFECTS

The predicted effects of the various factors on low streamflows in Miller, Walker and Des Moines Creeks are compiled in **Tables 11, 12 and 13**, respectively. In all three streams, average August and September flows are predicted to increase, and 7-day low flows are expected to match pre-project conditions. A net increase of 3 percent in August/September average flows is predicted in Miller Creek at SR 509. In the upper reach of Walker Creek, average August and September flows are predicted to increase by 26 percent. Des Moines Creek average August and September discharges at South 200th Street would increase by 9 percent.

Figure 7: 7-Day Low Flow Occurrences in Miller Creek, 1949-1995

Derived from HSPF model results for proposed (2006) conditions

■ - Occurrence of Day 1 of 7-day low flow event for calendar year

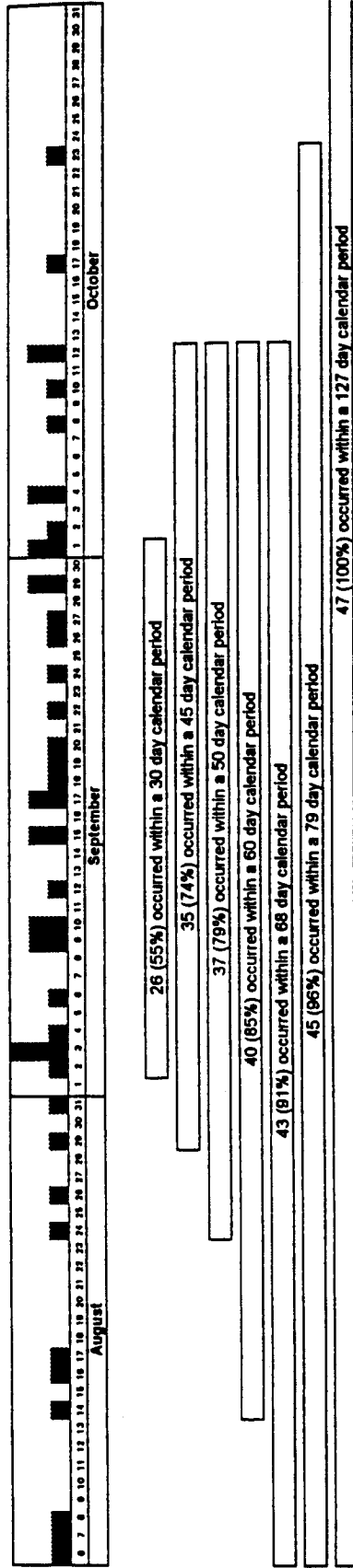
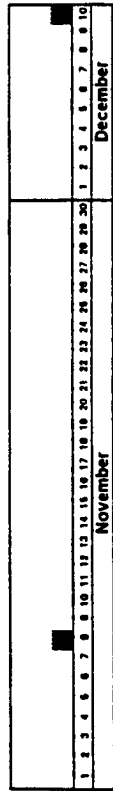


Figure 7: 7-Day Low Flow Occurrences in Miller Creek, 1949-1995

Derived from HSPF model results for proposed (2006) conditions

■ - Occurrence of Day 1 of 7-day low flow event for calendar year

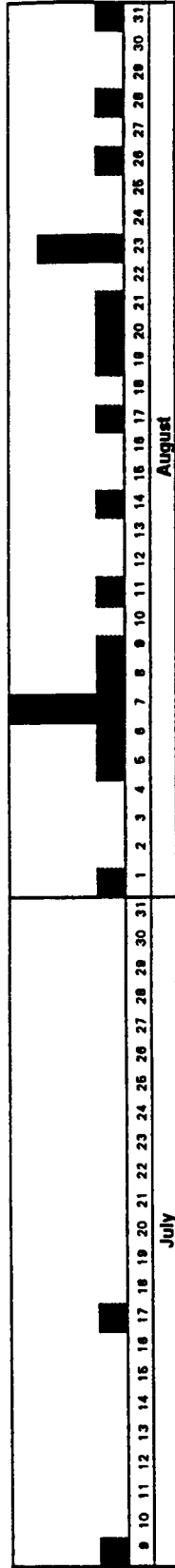


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Figure 8: 7-Day Low Flow Occurrences in Des Moines Creek, 1949-1995

Derived from HSPF model results for proposed (2006) conditions

■ - Occurrence of Day 1 of 7-day low flow event for calendar year



25 (53%) occurred within a 30 day calendar period

34 (72%) occurred within a 45 day calendar period

36 (77%) occurred within a 47 day calendar period

39 (83%) occurred within a 60 day calendar period

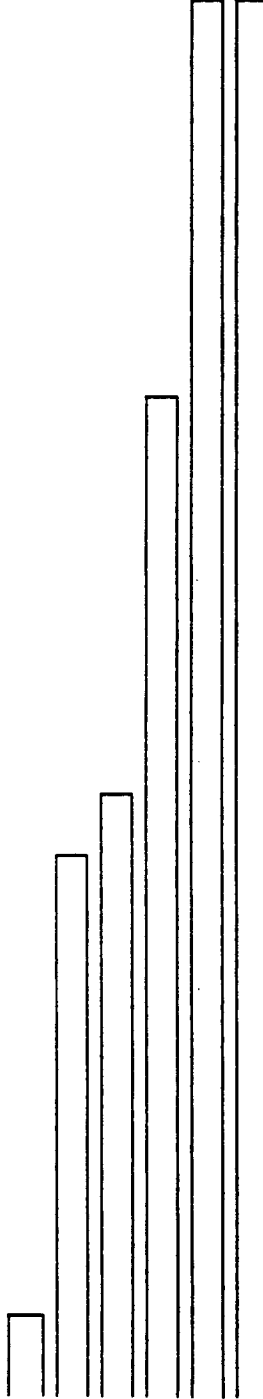
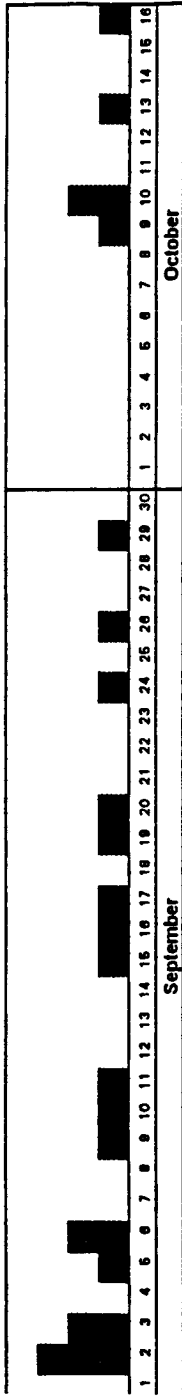
44 (94%) occurred within a 73 day calendar period

47 (100%) occurred within a 100 day calendar period

Figure 8: 7-Day Low Flow Occurrences in Des Moines Creek, 1949-1995

Derived from HSPF model results for proposed (2006) conditions

■ - Occurrence of Day 1 of 7-day low flow event for calendar year



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In Walker Creek, the discharge from recharge to the runway fill is estimated to be sufficient to maintain 7-day duration/2-year frequency low flows to pre-project levels. In Miller and Des Moines Creeks, 7-day/2-year low flows would be supplemented by reserved stormwater releases to maintain pre-project discharge rates in the streams.

**Table 11:
Summary of Miller Creek Streamflow Effects¹**

Period of Flow	HSPF Model Streamflow (cfs)		Discharge of Pervious Fill Recharge (cfs)	Non-Hydrologic Changes (cfs)	Discharge of Secondary Impervious Recharge ² (cfs)	Reserved Stormwater Release (cfs)	Predicted 2006 Condition ³ (cfs)	Net Change from 1994 Condition (cfs)
	1994 Condition	2006 Condition						
August	1.27	1.10	0.108	(0.04)	0.04	0.10	1.31	+0.04
September	1.50	1.40	0.065	(0.04)	0.025	0.10	1.55	+0.05
August/September	1.39	1.25	0.09	(0.04)	0.03	0.10	1.43	+0.04
7-day/2-year low flow	0.79	0.64	0.0654	(0.04)	0.0244	0.10	0.79	-0-

¹Miller Creek at SR 509

²Assumes secondary recharge volumes from impervious areas behave similar to pervious area recharge volumes.

³Sum of 2006 HSPF: streamflow, fill pervious recharge, non-hydrologic changes, secondary impervious recharge, and reserved stormwater release.

⁴Calculated as 75 percent of the average increase in discharge over August and September.

**Table 12:
Summary of Walker Creek Streamflow Effects¹**

Period of Flow	HSPF Model Streamflow (cfs)		Discharge of Pervious Fill Recharge (cfs)	Non-Hydrologic Changes (cfs)	Discharge of Secondary Impervious Recharge ² (cfs)	Reserved Stormwater Release (cfs)	Predicted 2006 Condition ³ (cfs)	Net Change from 1994 Condition (cfs)
	1994 Condition	2006 Condition						
August	0.033	0.031	0.005	—	0.005	—	0.041	+ 0.008
September	0.035	0.039	0.003	—	0.003	—	0.045	+ 0.010
August/September	0.034	0.035	0.004	—	0.004	—	0.043	+ 0.009
7-day/2-year low flow	0.021	0.015	0.003 ⁴	—	0.003 ⁴	—	0.021	-0-

¹ Walker Creek near 12th Avenue South

² Assumes secondary recharge volumes from impervious areas behave similar to pervious area recharge volumes.

³ Sum of 2006 HSPF streamflow, fill pervious recharge, non-hydrologic changes, secondary impervious recharge, and reserved stormwater release.

⁴ Calculated as 75 percent of the average increase in discharge over August and September.

**Table 13:
Summary of Des Moines Creek Streamflow Effects¹**

Period of Flow	HSPF Model Streamflow (cfs)		Discharge of Pervious Fill Recharge (cfs)	Non-Hydrologic Changes (cfs)	Discharge of Secondary Impervious Recharge ² (cfs)	Reserved Stormwater Release (cfs)	Predicted 2006 Condition ³ (cfs)	Net Change from 1994 Condition (cfs)
	1994 Condition	2006 Condition						
August	1.08	1.07	—	—	—	0.08	1.15	+ 0.07
September	1.64	1.73	—	—	—	0.08	1.81	+ 0.17
August/September	1.36	1.40	—	—	—	0.08	1.48	+ 0.12
7-day/2-year low flow	0.35	0.27	—	—	—	0.08	0.35	-0-

¹Des Moines Creek at South 200th Street

²Assumes secondary recharge volumes from impervious areas behave similar to pervious area recharge volumes.

³Sum of 2006 HSPF streamflow, fill pervious recharge, non-hydrologic changes and secondary impervious recharge.

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APPENDIX A

Comparison of Pacific Groundwater and Hart Crowser Fill Modeling Approaches

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Appendix A
Comparison of Pacific Groundwater and Hart Crowser Fill Modeling Approaches

Estimation of Recharge Generated at the Land Surface

Study Factor	Approach	Significance
PGG	Steady monthly rates based on long-term monthly averages	Coarser resolution of precipitation input, step-wise specification of changes in monthly recharge, doesn't account for high intensity storm events.
HC	13-year actual and synthetic daily precipitation record	Finer resolution of precipitation input, portrays variability within a given month, simulates high intensity storm events.
PGG	Assumed zero runoff.	Magnitude consistent with HSPF modeling except for till and wetland surfaces. However, runoff from till and wetland surfaces handled independently as "rejected recharge" by slice model.
HC	HELP model used SCS runoff curve method. Values range from 0 to 1 in/yr.	Not significantly different than PGG values for HC modeled areas (lower runoff). HC model did not include conditions associated with wetland soils.
PGG	Blaney Criddle calculations, based on temperature, plant type and latitude.	Numbers are very similar between methods.
HC	SoilCover uses modified Penman approach based on plant type, temperature, humidity and solar radiation.	Numbers are very similar between methods.
PGG	Daily soil moisture balance, accounts for root zone extending into shallow perched water table.	PGG recharge based on monthly average precipitation, therefore presented as monthly averages. Allows negative recharge where plants tap the water table during hot summer months.
HC	Daily soil moisture balance, water table always outside of root zone.	HC recharge method allows for variability with daily precipitation numbers. Recharge generally not estimated for areas where root zone reaches water table (e.g. wetlands, over very shallow till).

Appendix A
Comparison of Pacific Groundwater and Hart Crowser Fill Modeling Approaches

Modeling of 1-D, Vertically Downward Flow in the Vadose Zone

Study	Factor	Approach	Significance
PGG	range of soil types	Uses averaged combination of soil groups for general fill. Assumes instantaneous flow for coarse sand and gravel (Group 1a)	Generalized fill did not allow comparison between various likely fill properties, but assumed a representative combination.
HC		Separately simulates three different soil groups for embankment fill as well as natural outwash soils. Does not assume instantaneous flow for sand and gravel (Group 1b)	Comparison suggested little difference in vertically downward, 1-D, unsaturated flow between three fill types modeled.
PGG	soil characteristic curve	Based on Rosetta database and methods by Van Genuchten and Maulem.	HC approach same as PGG.
HC		Based on Rosetta database and methods by Van Genuchten and Maulem.	PGG approach same as HC.
PGG	presence of gravel in soil	Assumes no flow in gravelly pockets. Recharge inflow distributed to non-gravelly portions of soil. Exception for Group 1a soils, where flash flow is modeled.	More accurately represents role of gravel in general fill. May overestimate immediate water delivery in Group 1a soils near wall.
HC		Adjusts soil properties used in characteristic curve generation for presence of gravel. Does not exclude unsaturated flow from gravelly component of soil.	Reduces the intensity of recharge loading on unsaturated flow pathways. May cause additional dampening of recharge pulse due to a more "spread out" moisture distribution.
PGG	recharge input	Step-wise, monthly values.	Reduces model resolution to monthly recharge steps. Average recharge values over a month, so that October values are low whereas (in actuality) late October recharge is high).
HC		Continuous daily values.	Better resolution of recharge inflow. May lead to more gradual ascension of 1-D flow at bottom of modeled vadose zone.
PGG	discretization of model cells	Used Hydrus 2D with 6-inch model cells.	Well suited discretization for unsaturated flow problems.
HC		Used HELP, which automatically creates model cells of approximately 17-foot thickness in berm fill.	Numerical dispersion associated with thick model cells may artificially "smear" out the recharge pulse, thus affecting the timing and maximum intensity of discharge at the bottom of the vadose zone.
PGG	thickness of vadose zone in native soil	Vadose zone modeling not performed for native soil, assumed that small depth to water causes negligible lagging and dampening of the recharge pulse	Likely minor underestimation of lagging and dampening over 5-foot soil distance.
HC		Modeled 5 feet of vertical downward unsaturated flow in native soil using HELP model.	Estimates some lagging and dampening of recharge pulse over 5 feet of soil. Cannot readily compare with PGG data.
PGG	thickness of embankment fill	Multiple simulations used for thicknesses ranging from 30 to 150 feet.	Allows representation of different timing of recharge from different thicknesses of fill, to be summed up for lateral, saturated flow "slice model".
HC		All simulations use thickness of 100 feet.	Single thickness represents conditions along one portion of the "embankment slice". Multiple conditions expected. Data from single thickness do not represent combined timing of all recharge along slice.
PGG	application of predicted discharge	Used as input to slice model.	Slice model simulates variable slopes and permeabilities of native soil aquifer, variable recharge of variable thickness embankment fill, and effects of storage and flow accumulation along saturated flowpath beneath berm.
HC		Presented as discharge to native soil aquifer beneath the berm.	Representative for 100-foot thick berm only. Discharge in aquifer is not cumulative over the entire cross-section beneath the berm, and does not allow for effects of storage and flow accumulation.

Appendix A
Comparison of Pacific Groundwater and Hart Crowser Fill Modeling Approaches

Modeling of Lateral Saturated Flow Towards Wetland and Miller Creek

Study Factor	Approach	Significance
PGG vertically downward inflow to water table	Imported from 1-D unsaturated flow modeling using a variety of berm thicknesses.	Variable thicknesses and flow properties needed to simulate combined recharge input along the slice, and therefore to model flow accumulation along entire slice (with storage effects).
HC	Excerpted from 1-D unsaturated modeling using a single berm thickness and variable soil properties for berm.	Slice model not performed. Cumulative flow along saturated shallow aquifer cross-section not modeled.
PGG variation in slope and permeability of shallow aquifer	Based on slope of till surface and land surface, and on different native materials in upland and wetland.	Important because gentle slope and lower permeability beneath wetland causes groundwater flow to come to surface (existing condition) or to drain (built condition).
HC	Assumed constant, does not extend to lower slopes and permeabilities beneath wetland.	Because wetland was not modeled, no groundwater flow is forced to the surface (existing condition) or to the drain (built condition). Drain discharge equals zero.
PGG aquifer storage along slice and time lags for GW flow	Modeled using forward difference, finite element approach.	Causes lags and dampening of inflow from vadose zone to discharge at toe of cross-section model.
HC	Not modeled.	Lags and dampening of inflow from vadose zone to discharge at toe of saturated cross-section not modeled.

APPENDIX B

Estimates of Miller Creek Streamflow Effects As Predicted with Slice Model

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Appendix B Estimates of Miller Creek Streamflow Effects as Predicted with Slice Model

Slice Model Length	1150 feet		
Slice Model Width	1 feet		
Slice Model Area	0.0264 acres		
Embankment Distance Along Miller Creek	5400 feet		
Idealized Area of Slices Along Miller Creek	142.6 acres		
Existing Condition			
Predicted GW Discharge from Native Soil Aquifer	8.68E-06	8.68E-06	cubic feet per second per foot width (from Fig. 3-6)
Predicted SW Discharge over Native Soil Aquifer	0	0	cubic feet per second per foot width
Predicted Total Flow to Creek/Wetlands	8.68E-06	8.68E-06	cubic feet per second per foot width
Predicted GW Discharge from Native Soil Aquifer	4.69E-02	4.69E-02	cubic feet per second along reach of Miller Creek
Predicted SW Discharge over Native Soil Aquifer	0	0	cubic feet per second along reach of Miller Creek
Predicted Total Flow to Creek/Wetlands	0.0469	0.0469	cubic feet per second along reach of Miller Creek
Built Condition			
Predicted GW Discharge from Native Soil Aquifer	8.68E-06	8.68E-06	cubic feet per second per foot width (from Fig. 3-13)
Predicted GW Discharge in Drain at Toe	2.03E-05	1.22E-05	cubic feet per second per foot width (from Fig. 3-13)
Predicted Total Flow to Creek/Wetlands	2.89E-05	2.08E-05	cubic feet per second per foot width
Predicted GW Discharge from Native Soil Aquifer	4.69E-02	4.69E-02	cubic feet per second along reach of Miller Creek
Predicted GW Discharge in Drain at Toe	1.09E-01	6.58E-02	cubic feet per second along reach of Miller Creek
Predicted Total Flow to Creek/Wetlands	0.1563	0.1125	cubic feet per second along reach of Miller Creek
Differences between Built and Existing Conditions			
Increase in Predicted Baseflow Contribution: Built - Existing Condition	2.03E-05	1.22E-05	cubic feet per second per foot width
Increase in Predicted Baseflow Contribution: Built - Existing Condition	0.1094	0.0656	cubic feet per second along reach of Miller Creek
Ratio of Baseflow Contribution: Built/Existing Condition	333%	240%	
Increase in Predicted Baseflow	0.00077	0.00046	cubic feet per second per idealized acre
Application Across Miller Creek Fill Footprint			
Pervious Fill Area in Miller Creek basin	141.4	141.4	acres
Increase in Predicted Baseflow for Pervious Fill Area in Miller Creek	0.108	0.065	cubic feet per second

APPENDIX C

Estimates of Historic Withdrawal In Miller Creek Buy-Out Area

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APPENDIX C
FROM SMP (DECEMBER 2000)
APPENDIX G

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1. INTRODUCTION AND DEFINITIONS

1.1 INTRODUCTION

As part of the acquisition of private properties along Miller Creek, the Port of Seattle will be acquiring the water right permits, certificates, and claims associated with those properties. Existing water rights along Miller Creek give the property owners the right to withdraw water from Miller Creek for domestic personal use, lawn and yard watering, and commercial irrigation. After acquiring these rights through the process of property acquisition, the Port of Seattle proposes to relinquish them back to the State of Washington as part of the mitigation for the Master Plan projects. Because the water rights allow property owners to divert water directly from Miller Creek during the summer when stream flows are at a minimum, there will be a direct and immediate benefit to the stream when the stream diversions are eliminated.

1.2 DEFINITIONS

The terms water right permit, certificate, and claim (from Ecology) are defined as follows:

Water Right Permit: A water right permit is permission given by the state to applicants to develop a water right. Water right permits remain in effect until the water right certificate is issued, if all terms of the permit are met, or the permit has been canceled.

Water Right Certificate: A water right certificate is issued by the Department of Ecology to certify that water users have the authority to use a specific amount of water for beneficial use as specified in the permit.

Water Right Claim: A water right claim is a statement of claim to a water use that began before the State Water Codes were adopted and is not covered by a permit or certificate (i.e., vested right).

For the initial analysis, it was assumed that all holders of permits, certificates and claims had equal likelihood of withdrawing water from Miller Creek. Although a water right claim is not a specific legal authorization to use water from the stream, the validity of whether the claim is legal cannot be determined until those vested rights are confirmed through a process known as a general water right adjudication, which is conducted through the Superior Court. Only a relatively few watersheds in Washington have undergone this process. In the meantime, persons with water right claims are assumed to continue to withdraw water. This is a valid assumption because, for a property owner to file a claim, they must have a current documented water use. Although most claims were filed in the 1970s during the claims registration period, it is likely that this water use is still occurring. In addition, it is very likely that more individuals are withdrawing water from Miller Creek, but did not file a water right claim with the state at the time when they had an opportunity to do so.

2. WATER RIGHTS RECORDED BY STATE

Ecology maintains a database of recorded water right permits, certificates, and claims. A search of those files at the Northwest Regional Office identified five water right certificates and 13 water right claims in the acquisition area. These are listed in Table G-1 along with the current parcel number and property owner. Not all certificate and claims reference a street address or tax parcel number. Also, the name on the certificate or claim often was not the same as the current property owner due to transfer of ownership since the water right documents were filed (the water right typically stays with the property). Therefore, a few of the certificates and claims could not be located precisely. However, it is highly likely that all certificates and claims in Table G-1 are located within the acquisition area.

Table G-1 lists surface water rights only. The water rights database was also reviewed for groundwater, but it was determined that most or all uses were for domestic use only. It also cannot be determined whether these groundwater withdrawals are affecting streamflows. Therefore, the potential benefits of relinquishment of groundwater rights was not evaluated.

Table G-1. Water rights, claims, and uses in Port of Seattle acquisition area.

Water Right Certificate	Water Right Claim	Rate (Q)	Quantity (Qa)	Acres	Parcel	Tax ID.	Site Address	First Name	Owner's Last Name
RESIDENTIAL PROPERTIES									
	121808 (Lora Lake)	—	—	—	060R	202304-8347	15016 Des Moines Memorial Dr.	William F.	Eisiminger
	96247 (Miller Creek)	20 gpm	6.1 acf	1	143R	202304-8090	15818 Des Moines Memorial Dr.	David P. & Frances	Brale
	14424 (Miller Creek)	20 gpm	3 acf	1	214R	725120-0015	15914 Des Moines Memorial Dr.	Karla A.	Kamp, Martin D. Martinez & Theresa
	106884 (Miller Creek)	—	—	—	088R	369680-0015	15419 9th Place S.	Helen V. Carl M. & Nanny E.	Goodmansen
	115026 (Miller Creek)	—	—	—	185R	725120-0045	16823 9th Ave. S.		Berry
	160107 (Miller Creek)	120 gpm	1 acf	0.6	097R	202304-8071	16454 Des Moines Memorial Dr.	Roy C.	Smith
	117834 (Miller Creek)	15 gpm	1.5 acf	0.75	142R	847930-0010-0100	15500 Des Moines Memorial Dr.		Wind of the Willows Condos
s1-20949c (Miller Creek)		0.01 cfs	1.0 acf		322R	384660-0080	16628 8th Ave. S.	David C.	Longridge
s1-05991c (Miller Creek)		0.01 cfs	—	1.7	311R	384660-0145	16422 8th Ave. S.	Clifford C. Commander	Rhoton
	42012 (Miller Creek)	20 gpm	1.0 acf	0.75	321R	384660-0115	16616 8th Ave. S.	F.X. Lee & Bonnie J.	Beaudin II
	41157 (Miller Creek)	—	—	—	298R	292304-9196	849 S. 164th St.		Wamar
	112315 (Miller Creek)	10 gpm	2.0 acf	0.5	253R	384660-0060	632 S. 168th St.	PegI John & Joseph	Kobela
	137815 (Miller Creek)	20 gpm	1.0 acf	0.75	246R	384660-0035	16483 8th Ave. S. actual: 15836, closest: 15820 Des Moines Memorial Dr.		Galando
	14425 (Miller Creek)	5 gpm	1.0 acf	1	182R	202304-8426	15820 Des Moines Memorial Dr.	Paul R. Richard H./Bette M.	Ilies
s1-04903c (Miller Creek)		0.01 cfs	—	0.25	316R	384660-0125	raw land		Rouillard/Martley
s1-04904c (Miller Creek)		0.01 cfs	—	0.50 ac	244R	384660-0030	16609 8th Ave. S.	Earl D. Alfredo & Roberta	Randall & Veart Sandback
s1-06355c (Miller Creek)		0.01 cfs	—	—	302R	292304-8270	16428 12th Ave. S.		Lopez
Total water use: Assume 17 certificates/claims at minimum rate of 0.01 cfs each, assuming only 50% are continuously active. Q = 17 * 0.01 cfs * 50% = 0.09 cfs									
FARM PROPERTIES									
	55350 (Miller Creek)	25 gpm (not used)	7 acf (not used)	3.5	093R	202304-9229	15416 Des Moines Memorial Dr.	attn: Ray Rosatto	RST Enterprises (Nick Raffo)
	none (city water)				055R	202304-8068	15127 12th Ave. S.		Port of Seattle (Mason)
	none (city water)				060R	202304-9100	15208 Des Moines Memorial Dr.		Port of Seattle (Vacca)
	none (city water)				061R	202304-8099	raw land		Port of Seattle (Vacca)
	No permit, but pumps from Miller Creek				062R	202304-9144	raw land	Tony	Scarsella
	No permit, but pumps from Miller Creek				068R	202304-9122	15225 12th Ave. S.	Anthony	Genzale, Trustee
Total water use: Assume 5.2 acres total farm (based on 1988 aerial photo) pumped from stream for Genzale and Scarsella properties. (Source: Phil Vacca, 5/19/98). Other properties are supplied by municipal water. Water consumption: assume 0.008 cfs/acre (equal to 2 acre-feet per acre over 4 month irrigation season) Q = 5.2 acres * 0.008 cfs/acre = 0.04 cfs									
TOTAL WATER USE TO BE RELINQUISHED INSIDE ACQUISITION AREA = 0.13 CFS									

3. ESTIMATE OF WATER USE BY CURRENT WATER RIGHTS HOLDERS

3.1 INITIAL ANALYSIS

The amount of water currently being withdrawn by the water rights holders along Miller Creek was estimated from the information recorded on the certificates and claims. In general, the documents should identify the maximum instantaneous withdrawal rate, the annual quantity, and the number of acres of irrigation. Because information on the water right claim forms was often incomplete (e.g., the quantity of water used was not specified), the quantity of water being used had to be assumed in many cases. Also, if the rate of withdrawal was specified, it represents only the maximum instantaneous rate that the property owner can divert from the stream. The actual average rate of withdrawal is probably less than the maximum rate allowed.

Of the 18 identified water rights certificates and claims on Miller Creek, all but one are for domestic use or irrigation of about 1 acre or less of land. The allowed instantaneous withdrawal rates for these mostly vary between 5 gpm (0.01 cfs) and 20 gpm. Typically, a water right for a single domestic use is set to 0.01 cfs when a certificate is issued.

Of the five large properties that are commercially irrigated (i.e., Genzales, Raffo, Scarsella, Vacca, and Mason), only Raffo has a recorded water right claim. Although the remaining properties do not appear to have a recorded water right or claim in Ecology's files, it is assumed that the farmer either has a permit that is not filed with Ecology, or feels that they have a valid vested right for the water.

Phil Vacca, whose family has farmed their property (known locally as the "pumpkin patch") along with Mason's and Raffo's property for many years, said that they irrigate their property with municipal water. Although the Raffo property has a water right claim, Mr. Vacca said it has been at least 30 years since they pumped from the stream. These low-lying properties are naturally wet and require only infrequent watering. Mr. Vacca said that the Genzales and Scarsella properties (farmed by Genzales) are irrigated on a regular basis by water that is pumped from Miller Creek. At least one, and probably two (according to Mr. Vacca) pump stations with 5 horsepower pumps are located on the stream. Because they are on private property that cannot be accessed by the Port, the pumps could not be inspected to verify their capacities. The Genzales and Scarsella properties are on higher ground and require more irrigation.

To estimate the average rate of withdrawal from Miller Creek by the property owners, the following assumptions were used:

- For the 17 domestic users, it was assumed that 50 percent of these users withdraw water at a 0.01 cfs rate at any given time during the critical low-flow period in August.
- For the commercial irrigation users, it was assumed that 5.2 acres (the amount of farm area on the Genzales and Scarsella parcels) are irrigated at a rate of 0.008 cfs per acre. This rate is the amount needed to apply 24 inches of total water use over a 4-month irrigation season. No water use was assumed under the Raffo claim.

Based on these assumptions, the total quantity of water used by the identified water rights holders and the commercial irrigation users was estimated to be 0.13 cfs. Of this amount, 0.09 cfs is from

the domestic users and 0.04 cfs is from the commercial irrigation users. The calculation is summarized in Table G-1.

3.2 REFINED ANALYSIS

The water withdrawal analysis described above in Section 3.1 was further refined by conducting the following steps:

- Obtaining contact names and telephone numbers (from the Port of Seattle) of former property owners listed in Table G-1 as users of water from Miller Creek.
- Calling these contacts to inquire about their recollections of withdrawals from Miller Creek, including pumpage rate, time of year when pumpage occurred, and acres irrigated.
- Tabulating the information and calculating a revised estimated total historical withdrawal from Miller Creek.

The results of this refined analysis are summarized in Table G-2. In cases where attempted telephone contacts were unsuccessful, assumed Miller Creek withdrawal rates from Table G-1 were used. The refined estimate of 0.079 cfs is a little more than half the original estimate (0.13 cfs) of total water use to be relinquished (see Table G-1).

Table G2. Update of estimated water pumpage from Miller Creek.

Table G-2. Update of Estimated Water Pumpage from Miller Creek.

Parcel	Notes	Last Name	Available Pumping Rate, (gpm)	Acres	Estimated Months of Water Use Per Year	Estimated Actual Pumping Rate, (gpm) ⁵	Updated Usage Estimate, (cfs)	Comments
068R	1	Genzale	2.5	4	5	0.52	0.001	4 acres, 2.5 gpm June to mid October
185R	1	Berry	5	1	6	1.25	0.003	less than 1 acre, summer only
244R	1	Randall	5	0.5	6	1.25	0.003	only in summer/garden
097R	1	Smith	120	0.6	4	20.00	0.045	Pump 4 months for orchard, lawn and garden
311R	1	Rhoton	5	1.7	6	1.25	0.003	Water in summer - unknown quantity
316R	1	Rouillard	0	0.25			0.000	1940-60 Maximum, 1990's No Water Usage
050R	1	Eisinger	0				0.000	None to very little
246R	1	Gallardo	0	0.75			0.000	Unknown - doesn't remember had pumping water
093R	2	Raffo	0	3.5			0.000	Table indicates no water
055R	1	Mason	0				0.000	Municipal Water
060R	1	Vacca	0				0.000	Municipal Water
061R	1	Vacca	0				0.000	Municipal Water
143R	1	Brade	0	1			0.000	No water
182R	1	Illes	0	1			0.000	No water
253R	1	Kobela	0	0.5			0.000	No water
298R	1	Warner	0				0.000	No water
302R	1	Lopez	0				0.000	No water
062R	1	Scarsella	0	1.2			0.000	No water
316R	1	Rouillard	0	0.25			0.000	No water
142R	1	Wind of the Willows Condos	0	0.75			0.000	No water
214R	3	Kamp	20	1	6	5.00	0.011	Information from table G-1 only
321R	3	Beaudin	20	0.75	6	5.00	0.011	Information from table G-1 only
088R		Goodman		?			0.000	Information from table G-1 only
322R	4	Longridge	4.5	?	6	1.12	0.003	Information from table G-1 only
Estimated Historical Water Use						35.39	0.079	

NOTES gpm = gallons per minute cfs = cubic feet per second

¹ Information from owner

² Table G-1 indicates that Miller Creek water was not used

Comprehensive Stormwater Management Plan

STIA Master Plan Update Improvements

³ Table G-1 indicates 20 gpm; assume 6 months of water use for irrigation

⁴ Table G-1 indicates no information; assume minimum water right of 0.01 cfs

⁵ Available pumping rate X estimated months of water use per year

December 2000
556-2912-001 (78)

APPENDIX D

HSPF Model Input and Results For Low Streamflow Conditions

*Port of Seattle
Seattle-Tacoma Airport Master Plan Update
Low Streamflow Analysis*
\\4281601\STREAMFLOW ANALYSIS.DOC

AR 044009



DRAFT MEMORANDUM

Date: **November 28, 2000**
To: **Rick Schaefer**
Earth Tech
From: **Jim Dexter**
Subject: **Baseflow Analysis of Miller, Walker, and Des Moines Creek Using HSPF**
cc: **Paul Fendt**
Norm Crawford

Project Number: **556-2912-001-1-28**

Project Name: **POS Stormwater**

Summary of Contents

This memo summarizes our analyses of baseflow impacts using the HSPF models for Miller, Walker, and Des Moines Creeks. For each watershed, three types of information are presented:

1. an annual water movement and storage diagram at selected locations in each watershed for 1994 and 2006 conditions shown in Figures 1, 2, and 3;
2. mean August through September total streamflow and baseflow values at selected locations in each watershed for 1994 and 2006 conditions; and
3. low flow frequency statistics for 1-, 7-, 30-, and 90-day average daily flows at selected locations in each watershed for 1994 and 2006 conditions.

The presentation of HSPF runoff (SURO, IFWO, AGWO) results in units of inches of water over the pervious portions of each watershed *eliminates the effect of changes from pervious to impervious cover* in the water balance diagram and allows one to see how the change in pervious cover, e.g. from till grass to airport fill, affects components like baseflow and evapotranspiration. The flow component in the model called AGWO (groundwater) is considered to represent baseflow. The impervious cover water transfers consist of SURO (surface runoff) and ET (evapotranspiration). These are both presented to show that ET accounts for a significant portion (about 23 percent) of the total rainfall on impervious surfaces in the HSPF model.

By converting the baseflow depth (of water) over a unit area to a baseflow value in flow units from the total pervious area, the effect of the loss of pervious cover in the watershed can be estimated. The conversions are calculated and shown on Tables 2, 3, and 4. However, the total streamflow is also of interest, in addition to baseflow. Therefore, these tables also show streamflow estimates at each location.

AR 044010

Selected locations for comparisons are: 1) Miller Creek at SR509, 2) Walker Creek at S. 12th Ave., and Des Moines Creek at S. 200th St. These locations are closest to the point in each model where the full effects of project conditions can be estimated.

The HSPF results in this memo for total streamflow reflect the current (as of this date) detention facility planning. This planning is under review and therefore these results may need to be updated later as the detention facility sizes affect the total average streamflow. In addition to the changes in release rates, there are changes in soil cover related to the size of the planned detention facilities. The resulting changes in the land use cover are not shown in Table 5 but are considered in the HSPF model. The only open, unlined detention facility (SASA) is identified in Table 6. Its effects are also included in the HSPF model.

August and September typically have relatively less surface runoff or shallow groundwater interflow as the attached Figure 4 indicates. Therefore average daily flows for the period between August 1st through September 30th are a good indicator of base flow conditions, i.e. streamflow sustained by groundwater and this period was chosen to evaluate project effects using results from the HSPF model. However, there is also a significant portion of total streamflow that is sustained by summer storm runoff (surface and interflow) and detention releases (in the future).

The streamflow calculated for each location presented herein is based upon the HSPF algorithms and soil parameters affecting groundwater movement. The HSPF soil parameters for these watersheds are shown in Table 1. Differences between parameter values account for the differences between flow components between each watershed. In addition, as shown in Figure 4, the model algorithms result in groundwater flow that responds closely to the annual rainfall pattern. The model may not adequately predict rates of groundwater movement through deep soils, e.g. 150 feet deep, with extended transport time.

Low flow statistics provide an indication of extreme low flow values at intervals less than two months. This information was developed using the SWSTAT post-processor program used with HSPF. Results are summarized in three attachments.

Miller Creek Summary

As shown in Figure 1, average annual baseflow from pervious land segments is estimated to change at SR509 from 12.38 inches in 1994 to 11.37 inches in 2006; a decrease in baseflow of approximately 8.2 percent. This represents the average annual change due to pervious cover changes. The change is not uniform throughout the year as will be discussed in the last section of the memo.

As Figure 4 shows, the magnitude of baseflow calculated by the HSPF model changes throughout the year. For August and September, the total change in streamflow and its baseflow component is shown in Table 2. Average August through September daily baseflow is estimated to decrease from 0.671 cfs to 0.556 cfs; a decrease of approximately 0.115 cfs (17.1 percent) in the low flow period.

However, if we consider total streamflow, the percentage decrease is less. It is estimated to decrease from 1.386 cfs to 1.250 cfs, or 0.136 cfs, a decrease of 9.8 percent in the August through September period. Total streamflow includes the effect of summer

storms and releases from detention facilities. It represents the actual instream flow estimate as opposed to a single component of the hydrologic process.

A summary of low flow statistics is attached as Attachment I to show the variation of low (stream) flow around the average condition, and for periods shorter than two months. The difference between 1994 and 2006 2-year 1- and 90-day daily flows is between approximately 0.151 to 0.172 cfs depending upon the averaging time interval.

Walker Creek Summary

As shown in Figure 2, average annual baseflow from pervious land segments is estimated to change at S. 12th Ave. from 9.22 inches in 1994 to 8.66 inches in 2006; a decrease of approximately 6.1 percent. As shown on Table 3, average August through September daily baseflow is estimated to decrease from 0.012 cfs to 0.011 cfs; a decrease of approximately 0.2 percent.

However, total streamflow is estimated to increase from 0.034 cfs to 0.035 cfs, an increase of 2.9 percent in the August through September period.

A summary of low flow statistics is attached as Attachment II. The difference between 1994 and 2006 2-year 1- and 90-day daily flows is between approximately 0.004 to 0.008 cfs depending upon the averaging time interval.

Des Moines Creek Summary

As shown in Figure 3, average annual baseflow from pervious land segments is estimated to change at S. 200th St. from 7.06 inches in 1994 to 7.09 inches in 2006; a very slight increase of approximately 0.4 percent. Evapotranspiration is indicated to decrease slightly between 1994 and 2006, probably due to the difference in forested pervious cover. However, overall there are relatively minor changes in one type of pervious cover to another in the land use coverages for 1994 and 2006 which accounts for the insignificant difference due to pervious cover. The major land use change is from pervious to impervious cover.

As shown on Table 4, average August through September daily baseflow is estimated to decrease by 0.046 cfs from 0.352 cfs to 0.306 cfs; a decrease of approximately 13.1 percent. This is due to the conversion of approximately 174 acres from pervious to impervious cover.

However, total average streamflow (including storm surface and detention flow) is estimated to increase from 1.364 cfs to 1.399 cfs, an increase of 2.6 percent in the August through September period (Table 4). Figure 5 shows that flows in the range of between 0.1 to about 0.5 cfs are more likely to occur in 2006 than 1994.

A summary of low flow statistics is attached as Attachment III. The difference between 1994 and 2006 2-year 1- and 90-day daily flows is between approximately 0.043 to 0.090 cfs depending upon the averaging time interval. The low flow statistics in Attachment III are based on moving averages between April 1 and October 30 and therefore the low 30 and 90 low flow periods may not include September. September has a higher average flow in 2006 than 1994 in 34 out of the 48 years (see Table 4).

Interpretation and Further Analysis

The following two subsections further discuss reasons for the changes in baseflow due to pervious soil cover changes.

Miller/Walker Watershed Pervious Cover Trends. Figures 1 and 2 indicate the HSPF model estimates an increase in interflow and pervious surface runoff rates under project (2006) conditions. Infiltration is slightly less in the 2006 condition and there is a corresponding reduction in soil moisture storage and loss to deep aquifers. These trends are related to changes in soil cover (and corresponding model parameters) between the two conditions. Compared to Miller till forest/grass parameters (see Table 1), airport fill is estimated to be slightly less permeable at the surface (lower INFILT), less upper zone storage (smaller UZSN), and has faster interflow (lower IRC).

Figures 6, 7, and 8 show flow duration results for each soil/cover type and the impervious cover for the Miller Creek model (based on an analysis by Hydrocomp). Note that (Figure 6) 80 percent of the time the runoff rates (cfs per 10,000 acres) are fairly close together except for the impervious cover. Ten percent of the time or less, the unit runoff response is significantly different. Airport fill (45) has a unit runoff rate between impervious (14) and till grass (26) ten percent of the year.

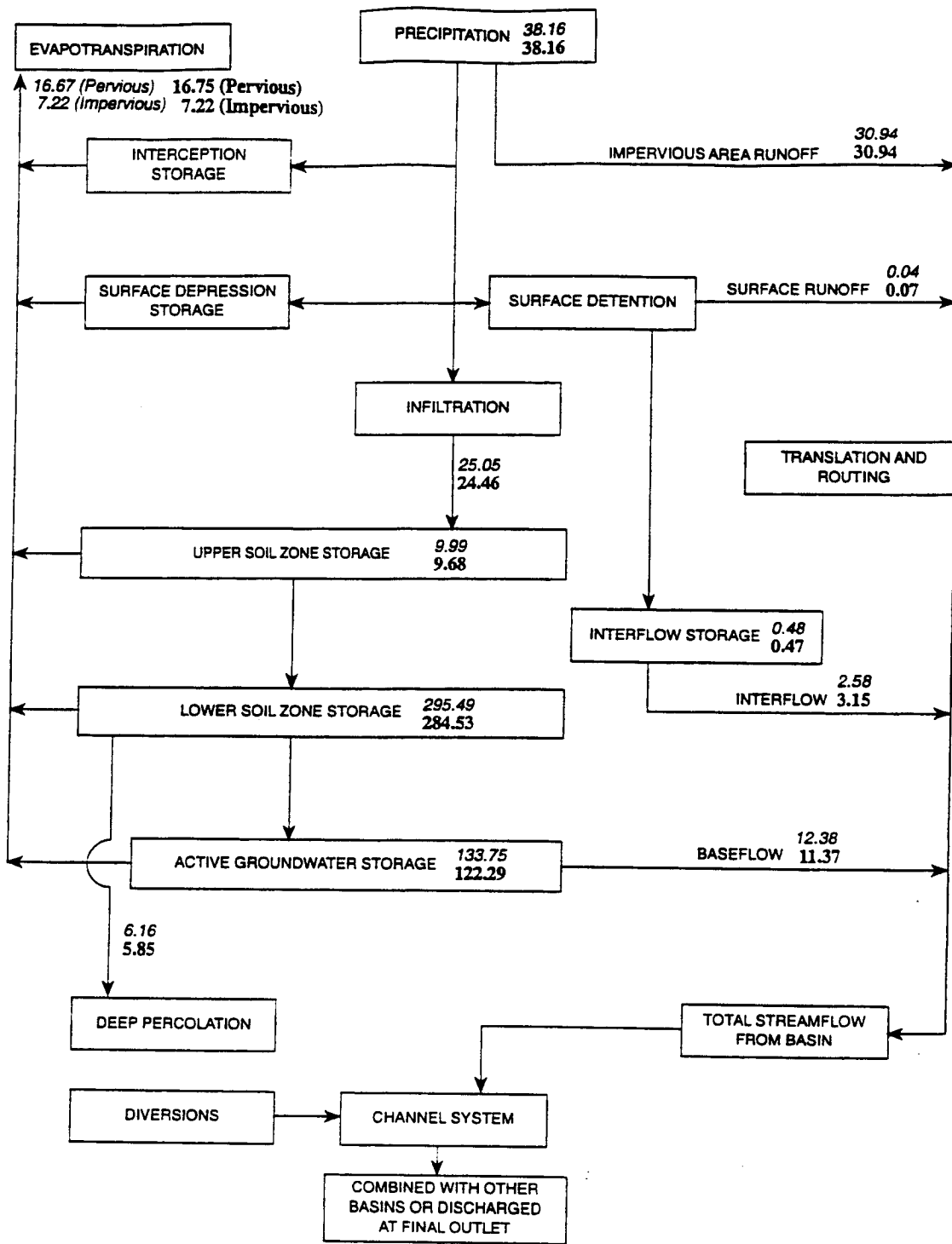
The average annual AGWO change from various pervious land segments in the Miller Creek watershed was calculated using the unit AGWO values obtained from the Hydrocomp analysis. This provided a second method for verifying the results of the HSPF model results. Table 5 indicates that in addition to the approximately 149 acres of pervious area that is converted to airport fill, approximately 115 acres is converted from pervious to impervious cover. Using Table 5 and 7, the total average annual baseflow effect of land use conversion (pervious to fill and pervious to impervious) was estimated in Table 8. This indicates the total average annual decrease in baseflow due to this conversion is on the order of 0.393 cfs.

Using the average annual baseflow unit depths from the HSPF model (Figure 1), and the pervious land areas for the 1994 and 2006 condition, the average annual baseflows were calculated as 2.38 and 2.00 cfs for 1994 and 2006 respectively. The difference, 0.38 cfs corresponds closely to the results from Table 8. There are about five months difference in the time interval used for the hydrologic time series by HSPF and Hydrocomp.

Figures 7 and 8 show that during the baseflow period (August through September) the magnitude of the runoff response of airport fill more closely resembles wetland in this season than the other pervious land segments. The PERO (sum of SURO, IFWO, & AGWO) from airport fill is less than one-half the rate of other pervious land segments.

In addition, there are other hydrologic impacts that are not related to these factors, including reduction in water well pumping in buyout areas that may partially mitigate baseflow impacts.

Des Moines Watershed Pervious Cover Trends. Figure 3 indicates the HSPF model estimates a very slight decrease in interflow and (slight) evapotranspiration rates under project (2006) conditions. Infiltration is also slightly greater in the 2006 condition and there is a corresponding very slight increase in soil moisture storage, and baseflow overall on an annual basis.



Parametrix, Inc. Port of Seattle/HSPF Calibration/556-2912-001/01(28) 11/00 (K)

1994 - Depth based on:
2,351.61 ac. Pervious Area
480.09 ac. Impervious Area (Effective)

2006 - Depth based on:
2,228.9 ac. Pervious Area
559.08 ac. Impervious Area (Effective)

Values are expressed
per unit area

→ Water Movement Values
are average flows (in/yr)

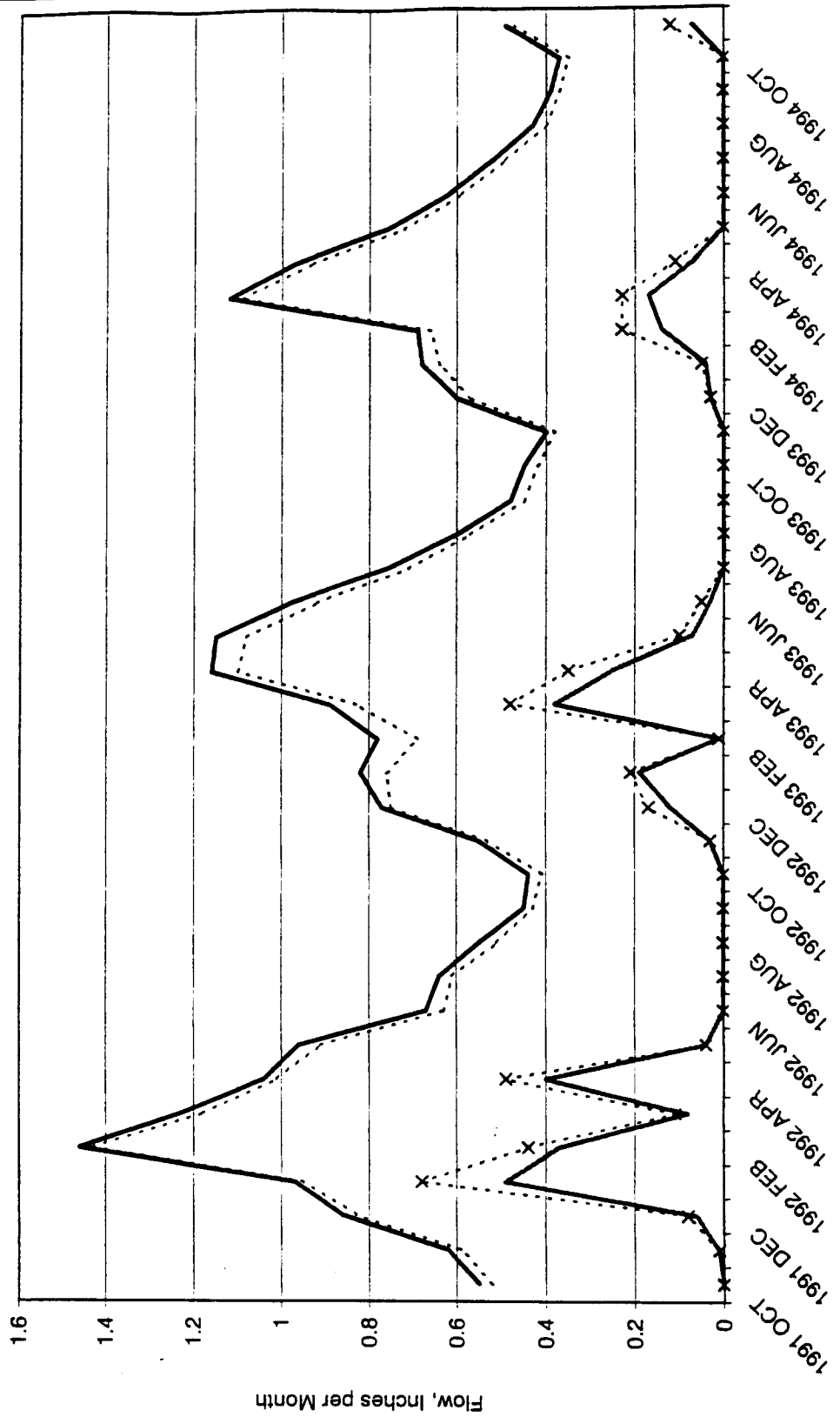
▭ Storages are
average (in)

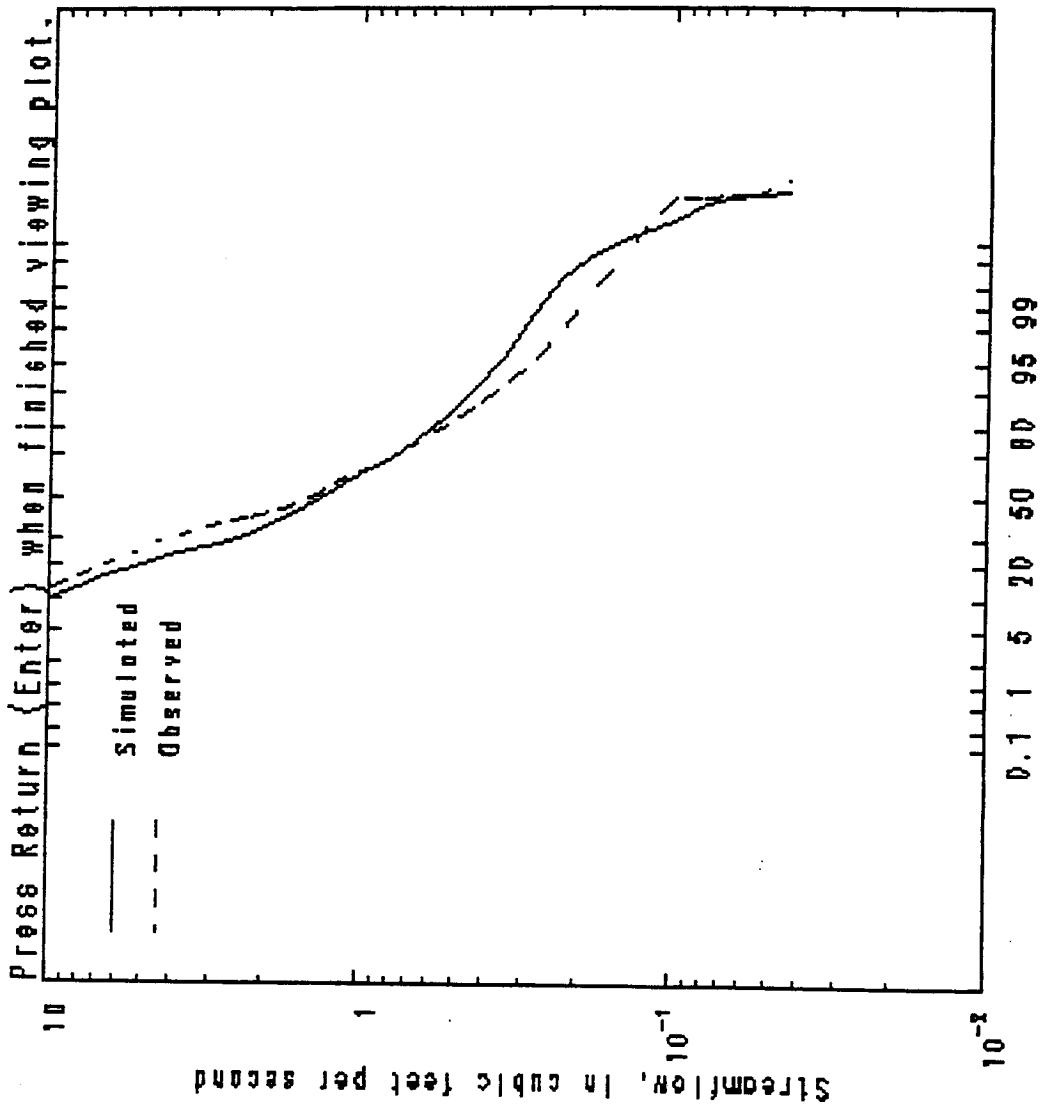
Figure 1
Miller Creek at SR 509
Flow Diagram of Water Movement
and Storage in HSPF Model

AR 044014

Figure 4. Miller Creek at SR509

---*---06IFWO ———94IFWO - - - - -06AGWO ———94AGWO





Percent chance flow exceeded

Simulated - EXIST. COND. SIN SOUTH 200TH STREET

Observed - 2006 SIN SOUTH 200TH STREET

FIGURE 5

Figure 6. Flow Duration, All Seasons

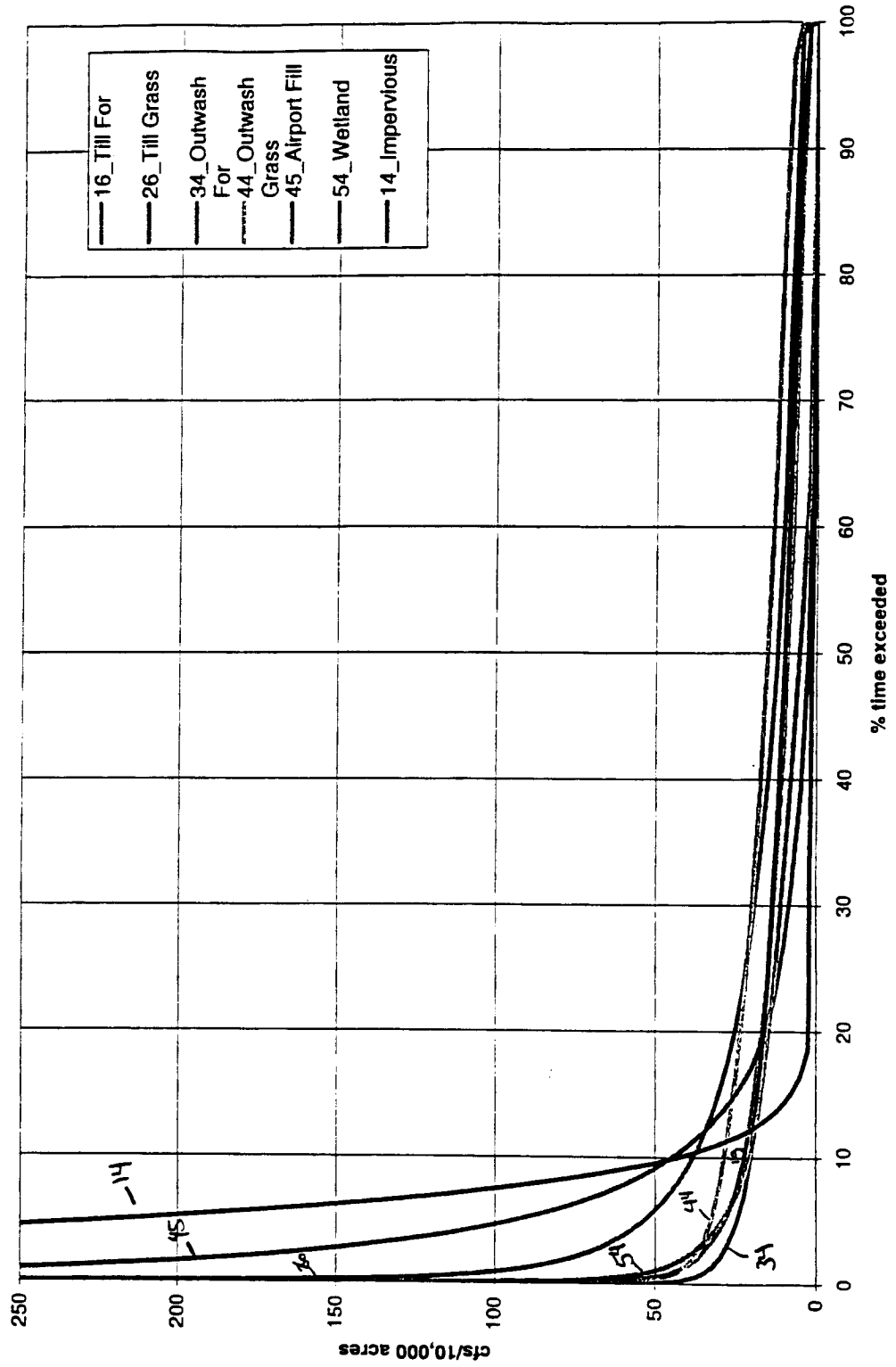
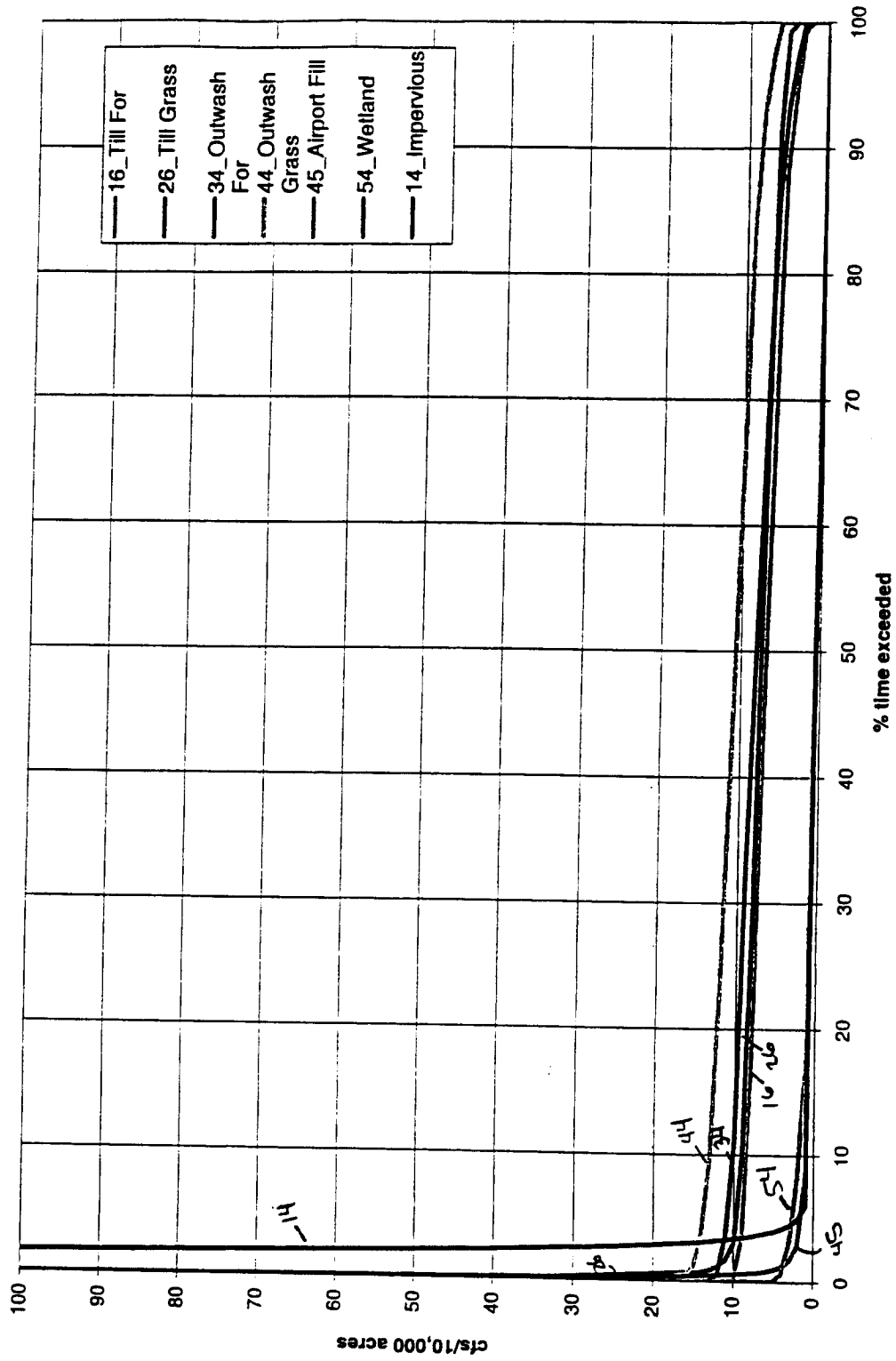


Figure 7. Flow Duration, August



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Figure 8. Flow Duration, September

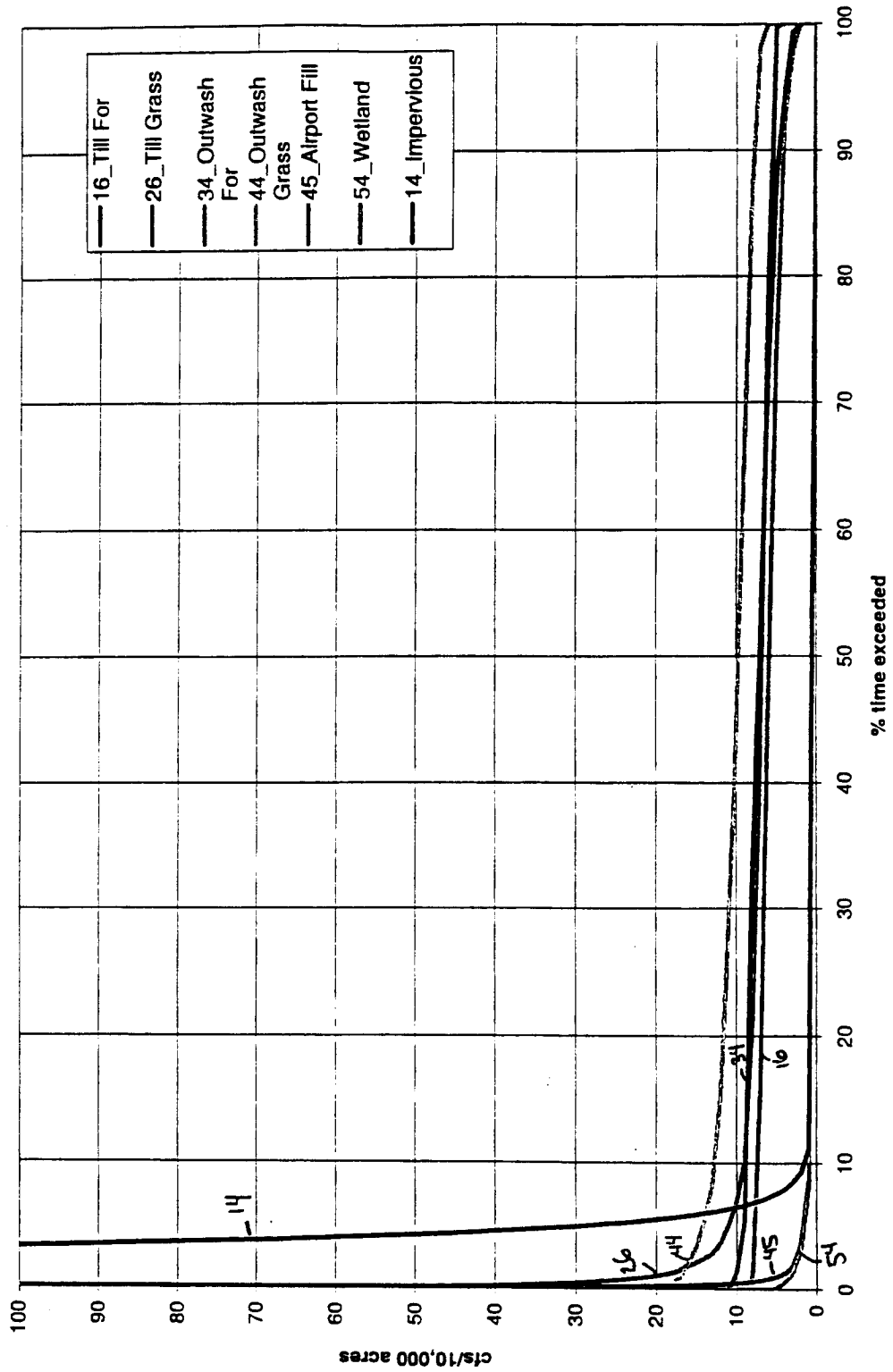


Table 1. Calibration values for selected HSPF parameters. (moderate slope)

Parameter	Category (Miller, Walker, and Des Moines)	MILLER CK Calibration Value	WALKER CK Calibration Value	DES MOINES CK Calibration Value	AIRPORT FILL Calibration Value
LZSN	Till Forest	9.0	4.5	4.5	7.5
	Till Grass	9.0	4.5	4.5	
	Outwash Forest	10.0	5.0	5	
	Outwash Grass	10.0	5.0	5	
INFILT	Till Forest	0.32	0.08	0.2	0.02
	Till Grass	0.12	0.03	0.075	
	Outwash Forest	2.0	2.0	2.0	
	Outwash Grass	0.8	0.8	0.8	
KVARY	Till Forest	0.5	0.5	0.5	0
	Till Grass	0.5	0.5	0.5	
	Outwash Forest	0.3	0.3	0.3	
	Outwash Grass	0.3	0.3	0.3	
INFEXP	Till Forest	2	2	2.0	2.0
	Till Grass	2	2	2.0	
	Outwash Forest	2	2	2.0	
	Outwash Grass	2	2	2.0	
DEEPR	Till Forest	0.33	0.0	0.55	0.10
	Till Grass	0.33	0.0	0.55	
	Outwash Forest	0.33	0.0	0.55	
	Outwash Grass	0.33	0.0	0.55	
BASETP	Till Forest	0	0	0	0
	Till Grass	0	0	0	
	Outwash Forest	0	0	0	
	Outwash Grass	0	0	0	
UZSN	Till Forest	0.75	0.5	0.5	0.28
	Till Grass	0.375	0.25	0.25	
	Outwash Forest	0.75	0.5	0.5	
	Outwash Grass	0.75	0.5	0.5	
AGWRC	Till Forest	0.996	0.996	0.996	0.90
	Till Grass	0.996	0.996	0.996	
	Outwash Forest	0.996	0.996	0.996	
	Outwash Grass	0.996	0.996	0.996	
INTFW	Till Forest	9.0	2.0	3	6.0
	Till Grass	9.0	2.0	3	
	Outwash Forest	0	0	0	
	Outwash Grass	0	0	0	
LZTEP	Till Forest	0.70	0.70	0.7	0.7
	Till Grass	0.25	0.25	0.25	
	Outwash Forest	0.70	0.70	0.7	
	Outwash Grass	0.25	0.25	0.25	
IRC	Till Forest	0.7	0.15	0.5	0.15
	Till Grass	0.7	0.15	0.5	
	Outwash Forest	0.7	0.5	0.7	
	Outwash Grass	0.7	0.5	0.7	
AGWETP	Till Forest	0	0	0	0
	Till Grass	0	0	0	
	Outwash Forest	0	0	0	
	Outwash Grass	0	0	0	

TABLE 2. MILLER CREEK BASEFLOW AT SR509

Data-set	38	118	67	63
Data-set	FLOW	FLOW	AGWO	AGWO
1949 AUG	0.87	0.47	0.54	0.32
1949 SEP	1.17	0.84	0.47	0.28
1950 AUG	1.89	1.76	0.73	0.64
1950 SEP	1.78	1.59	0.65	0.57
1951 AUG	1.25	1.06	0.6	0.55
1951 SEP	1.4	1.24	0.55	0.5
1952 AUG	0.93	0.77	0.52	0.47
1952 SEP	0.73	0.59	0.45	0.41
1953 AUG	1.15	0.98	0.61	0.55
1953 SEP	1.88	1.65	0.52	0.47
1954 AUG	1.42	1.24	0.73	0.67
1954 SEP	1.48	1.35	0.65	0.59
1955 AUG	1.2	1.06	0.7	0.65
1955 SEP	1.28	1.14	0.57	0.52
1956 AUG	1.24	1.04	0.69	0.63
1956 SEP	1.66	1.54	0.61	0.55
1957 AUG	1.47	1.34	0.68	0.62
1957 SEP	0.99	0.82	0.54	0.49
1958 AUG	0.84	0.65	0.54	0.49
1958 SEP	0.86	0.73	0.46	0.42
1959 AUG	1.12	0.88	0.66	0.6
1959 SEP	2.79	2.79	0.71	0.65
1960 AUG	1.47	1.31	0.65	0.6
1960 SEP	1.25	1.11	0.62	0.57
1961 AUG	1.15	0.91	0.67	0.61
1961 SEP	1.09	0.95	0.59	0.53
1962 AUG	1.52	1.46	0.57	0.52
1962 SEP	1.62	1.53	0.5	0.46
1963 AUG	1.04	0.87	0.61	0.55
1963 SEP	0.86	0.71	0.5	0.46
1964 AUG	1.41	1.22	0.74	0.68
1964 SEP	1.75	1.61	0.63	0.57
1965 AUG	1.68	1.59	0.62	0.56
1965 SEP	1.05	0.92	0.56	0.51
1966 AUG	0.98	0.8	0.58	0.53
1966 SEP	1.44	1.37	0.52	0.47
1967 AUG	0.93	0.72	0.6	0.55
1967 SEP	1	0.86	0.51	0.47
1968 AUG	3.88	3.81	0.82	0.75
1968 SEP	2.41	2.45	0.88	0.81
1969 AUG	1.03	0.82	0.64	0.58
1969 SEP	3.81	3.75	0.69	0.63
1970 AUG	0.91	0.75	0.55	0.5
1970 SEP	1.59	1.55	0.51	0.47
1971 AUG	1.11	0.91	0.66	0.6
1971 SEP	2.45	2.38	0.68	0.62
1972 AUG	1.58	1.38	0.8	0.73
1972 SEP	3.45	3.32	0.78	0.71
1973 AUG	0.83	0.66	0.53	0.48

1973 SEP	1.37	1.3	0.46	0.42
1974 AUG	1.09	0.86	0.71	0.65
1974 SEP	0.91	0.71	0.57	0.51
1975 AUG	2.79	2.71	0.62	0.57
1975 SEP	1.25	1.22	0.68	0.62
1976 AUG	1.89	1.8	0.71	0.65
1976 SEP	1.38	1.24	0.64	0.59
1977 AUG	2.01	1.96	0.42	0.38
1977 SEP	1.5	1.6	0.47	0.43
1978 AUG	0.99	0.84	0.58	0.53
1978 SEP	3.88	3.92	0.65	0.6
1979 AUG	0.81	0.71	0.42	0.38
1979 SEP	1.54	1.57	0.43	0.39
1980 AUG	0.94	0.76	0.56	0.51
1980 SEP	1.19	1.1	0.51	0.46
1981 AUG	0.87	0.69	0.56	0.51
1981 SEP	2.18	2.08	0.5	0.45
1982 AUG	1.06	0.87	0.6	0.55
1982 SEP	1.22	1.1	0.53	0.48
1983 AUG	1.79	1.59	0.73	0.67
1983 SEP	2.09	2.1	0.75	0.69
1984 AUG	1.01	0.8	0.65	0.59
1984 SEP	1.17	1.03	0.55	0.5
1985 AUG	0.82	0.67	0.48	0.44
1985 SEP	1.26	1.22	0.43	0.39
1986 AUG	0.77	0.61	0.51	0.46
1986 SEP	1.18	1.1	0.44	0.4
1987 AUG	0.87	0.7	0.54	0.49
1987 SEP	0.98	0.86	0.47	0.42
1988 AUG	0.79	0.64	0.49	0.45
1988 SEP	1.21	1.13	0.42	0.38
1989 AUG	1.19	1.05	0.59	0.54
1989 SEP	0.86	0.71	0.5	0.45
1990 AUG	1.03	0.83	0.61	0.56
1990 SEP	0.83	0.66	0.51	0.46
1991 AUG	1.78	1.61	0.68	0.62
1991 SEP	1.06	0.94	0.64	0.58
1992 AUG	1.05	0.91	0.55	0.5
1992 SEP	0.98	0.86	0.45	0.41
1993 AUG	0.92	0.73	0.6	0.54
1993 SEP	0.76	0.59	0.48	0.43
1994 AUG	0.67	0.52	0.43	0.39
1994 SEP	1.01	0.95	0.39	0.35
1995 AUG	1.64	1.55	0.63	0.57
1995 SEP	1	0.86	0.53	0.48
AVG,cfs	1.386	1.250		0.48 Contributing Pervious
AVG,inch			0.584	0.528 1668.42 1528.71
AVG,cfs			0.671	0.556

AR 044022

TABLE 3. WALKER CREEK BASEFLOWS AT S.12TH AVE.

Data-set	29	109	57	53
Data-set	FLOW	FLOW	AGWO	AGWO
-----	CFS	CFS	INCHES	INCHES
1949 AUG	0.02	0.01	0.36	0.36
1949 SEP	0.02	0.02	0.31	0.3
1950 AUG	0.05	0.05	0.53	0.53
1950 SEP	0.03	0.04	0.45	0.46
1951 AUG	0.03	0.03	0.44	0.46
1951 SEP	0.03	0.03	0.38	0.41
1952 AUG	0.02	0.02	0.41	0.43
1952 SEP	0.02	0.01	0.35	0.36
1953 AUG	0.03	0.03	0.47	0.48
1953 SEP	0.05	0.04	0.4	0.41
1954 AUG	0.03	0.03	0.54	0.54
1954 SEP	0.03	0.03	0.48	0.48
1955 AUG	0.03	0.03	0.54	0.54
1955 SEP	0.03	0.03	0.43	0.44
1956 AUG	0.03	0.03	0.52	0.54
1956 SEP	0.03	0.04	0.44	0.46
1957 AUG	0.03	0.03	0.52	0.53
1957 SEP	0.03	0.02	0.42	0.43
1958 AUG	0.02	0.01	0.42	0.44
1958 SEP	0.02	0.02	0.35	0.37
1959 AUG	0.03	0.02	0.52	0.53
1959 SEP	0.06	0.09	0.51	0.52
1960 AUG	0.03	0.04	0.5	0.51
1960 SEP	0.03	0.03	0.45	0.47
1961 AUG	0.03	0.02	0.5	0.52
1961 SEP	0.02	0.03	0.42	0.44
1962 AUG	0.04	0.04	0.45	0.45
1962 SEP	0.03	0.04	0.38	0.39
1963 AUG	0.03	0.02	0.48	0.49
1963 SEP	0.02	0.02	0.39	0.41
1964 AUG	0.03	0.03	0.57	0.57
1964 SEP	0.04	0.05	0.47	0.48
1965 AUG	0.03	0.04	0.43	0.45
1965 SEP	0.02	0.02	0.38	0.39
1966 AUG	0.03	0.02	0.45	0.46
1966 SEP	0.03	0.04	0.38	0.4
1967 AUG	0.03	0.02	0.46	0.48
1967 SEP	0.02	0.02	0.39	0.41
1968 AUG	0.11	0.14	0.56	0.56
1968 SEP	0.05	0.06	0.61	0.59
1969 AUG	0.03	0.02	0.49	0.51
1969 SEP	0.1	0.13	0.48	0.49
1970 AUG	0.02	0.02	0.4	0.41
1970 SEP	0.03	0.04	0.35	0.36
1971 AUG	0.03	0.02	0.52	0.53
1971 SEP	0.05	0.07	0.48	0.5
1972 AUG	0.04	0.03	0.59	0.61
1972 SEP	0.1	0.13	0.53	0.55

1973 AUG	0.02	0.02	0.41	0.42
1973 SEP	0.03	0.04	0.34	0.36
1974 AUG	0.03	0.02	0.54	0.56
1974 SEP	0.03	0.02	0.43	0.46
1975 AUG	0.08	0.1	0.46	0.47
1975 SEP	0.03	0.02	0.48	0.48
1976 AUG	0.04	0.05	0.53	0.54
1976 SEP	0.03	0.03	0.47	0.48
1977 AUG	0.06	0.07	0.34	0.34
1977 SEP	0.03	0.04	0.36	0.36
1978 AUG	0.03	0.02	0.45	0.46
1978 SEP	0.11	0.14	0.48	0.48
1979 AUG	0.02	0.02	0.34	0.35
1979 SEP	0.04	0.05	0.32	0.32
1980 AUG	0.03	0.02	0.44	0.45
1980 SEP	0.03	0.03	0.38	0.39
1981 AUG	0.02	0.02	0.44	0.44
1981 SEP	0.06	0.08	0.37	0.38
1982 AUG	0.03	0.02	0.45	0.47
1982 SEP	0.03	0.03	0.39	0.4
1983 AUG	0.05	0.05	0.55	0.55
1983 SEP	0.04	0.06	0.54	0.54
1984 AUG	0.03	0.02	0.49	0.5
1984 SEP	0.03	0.03	0.4	0.42
1985 AUG	0.02	0.02	0.38	0.39
1985 SEP	0.02	0.03	0.32	0.33
1986 AUG	0.02	0.01	0.4	0.41
1986 SEP	0.03	0.03	0.34	0.35
1987 AUG	0.02	0.02	0.41	0.42
1987 SEP	0.02	0.02	0.34	0.35
1988 AUG	0.02	0.02	0.39	0.39
1988 SEP	0.02	0.03	0.32	0.33
1989 AUG	0.03	0.03	0.48	0.5
1989 SEP	0.02	0.02	0.4	0.41
1990 AUG	0.03	0.02	0.47	0.48
1990 SEP	0.02	0.01	0.39	0.4
1991 AUG	0.04	0.04	0.48	0.5
1991 SEP	0.03	0.02	0.44	0.45
1992 AUG	0.03	0.02	0.41	0.42
1992 SEP	0.02	0.02	0.34	0.35
1993 AUG	0.03	0.02	0.48	0.48
1993 SEP	0.02	0.02	0.38	0.39
1994 AUG	0.02	0.01	0.37	0.38
1994 SEP	0.02	0.03	0.32	0.33
1995 AUG	0.04	0.04	0.46	0.47
1995 SEP	0.02	0.02	0.39	0.4
1996 AUG	0.04	0.04	0.53	0.54
1996 SEP	0.03	0.03	0.44	0.46
AVG,cfs	0.034	0.035		
AVG,inch			0.437	0.448
AVG,cfs			0.012	0.011
				Contributing Pervious area:
				1994 acres 2006 acres
				41.29 35.09

AR 044024

TABLE 4. DES MOINES CREEK BASEFLOW AT S. 200TH ST

Data-set	41	241	73	63
Data-set	FLOW	FLOW	AGWO	AGWO
	cfs	cfs	inch	inch
1949 AUG	0.37	0.35	0.26	0.26
1949 SEP	1.17	1.27	0.22	0.22
1950 AUG	2.17	2.31	0.47	0.48
1950 SEP	1.98	2.05	0.41	0.42
1951 AUG	0.99	0.91	0.43	0.44
1951 SEP	1.5	1.45	0.38	0.38
1952 AUG	0.61	0.57	0.35	0.36
1952 SEP	0.4	0.36	0.3	0.3
1953 AUG	0.84	0.8	0.42	0.42
1953 SEP	2.57	2.18	0.35	0.35
1954 AUG	1.06	1.03	0.48	0.48
1954 SEP	1.43	1.48	0.42	0.42
1955 AUG	0.84	0.87	0.46	0.46
1955 SEP	1.13	1.14	0.37	0.38
1956 AUG	0.85	0.79	0.47	0.48
1956 SEP	1.83	1.93	0.4	0.41
1957 AUG	1.41	1.46	0.44	0.45
1957 SEP	0.6	0.54	0.37	0.37
1958 AUG	0.32	0.22	0.38	0.38
1958 SEP	0.63	0.59	0.32	0.32
1959 AUG	0.58	0.47	0.47	0.47
1959 SEP	3.95	4.36	0.43	0.44
1960 AUG	1.36	1.37	0.45	0.45
1960 SEP	1.07	1.1	0.4	0.41
1961 AUG	0.67	0.54	0.47	0.48
1961 SEP	0.79	0.81	0.4	0.4
1962 AUG	1.8	1.95	0.35	0.36
1962 SEP	2.06	2.14	0.3	0.3
1963 AUG	0.67	0.62	0.41	0.41
1963 SEP	0.51	0.45	0.34	0.35
1964 AUG	1.08	1.05	0.49	0.49
1964 SEP	1.9	1.93	0.41	0.42
1965 AUG	1.94	2.08	0.4	0.4
1965 SEP	0.77	0.77	0.34	0.35
1966 AUG	0.54	0.47	0.38	0.39
1966 SEP	1.66	1.78	0.33	0.33
1967 AUG	0.38	0.27	0.43	0.43
1967 SEP	0.77	0.74	0.36	0.36
1968 AUG	5.2	5.56	0.5	0.5
1968 SEP	2.27	2.53	0.5	0.5
1969 AUG	0.52	0.42	0.45	0.45
1969 SEP	5.64	6.09	0.42	0.42
1970 AUG	0.54	0.5	0.37	0.37
1970 SEP	2.03	2.22	0.32	0.32
1971 AUG	0.64	0.55	0.46	0.47
1971 SEP	3.34	3.56	0.42	0.42
1972 AUG	1.25	1.24	0.54	0.54
1972 SEP	4.56	4.85	0.48	0.48

1973 AUG	0.34	0.26	0.35	0.36
1973 SEP	1.67	1.78	0.3	0.3
1974 AUG	0.49	0.4	0.5	0.5
1974 SEP	0.39	0.29	0.41	0.41
1975 AUG	4.09	4.29	0.41	0.41
1975 SEP	0.7	0.88	0.4	0.41
1976 AUG	2.16	2.32	0.46	0.46
1976 SEP	1.25	1.29	0.4	0.41
1977 AUG	3.19	3.43	0.25	0.25
1977 SEP	1.75	2.08	0.25	0.25
1978 AUG	0.67	0.67	0.38	0.38
1978 SEP	5.67	6.14	0.37	0.37
1979 AUG	0.69	0.68	0.27	0.27
1979 SEP	2.18	2.42	0.25	0.25
1980 AUG	0.52	0.43	0.39	0.39
1980 SEP	1.2	1.25	0.33	0.33
1981 AUG	0.38	0.31	0.37	0.38
1981 SEP	3.21	3.3	0.32	0.32
1982 AUG	0.67	0.61	0.42	0.42
1982 SEP	1.15	1.16	0.36	0.36
1983 AUG	1.92	1.83	0.47	0.48
1983 SEP	2.25	2.64	0.44	0.45
1984 AUG	0.44	0.35	0.44	0.44
1984 SEP	0.98	0.97	0.37	0.37
1985 AUG	0.47	0.42	0.32	0.32
1985 SEP	1.6	1.73	0.27	0.27
1986 AUG	0.33	0.26	0.34	0.34
1986 SEP	1.36	1.43	0.29	0.29
1987 AUG	0.43	0.35	0.38	0.38
1987 SEP	0.85	0.83	0.32	0.32
1988 AUG	0.38	0.31	0.33	0.33
1988 SEP	1.48	1.55	0.28	0.28
1989 AUG	0.96	0.93	0.4	0.41
1989 SEP	0.53	0.49	0.34	0.34
1990 AUG	0.54	0.45	0.43	0.43
1990 SEP	0.41	0.35	0.35	0.36
1991 AUG	1.94	1.98	0.46	0.46
1991 SEP	0.66	0.7	0.4	0.41
1992 AUG	0.8	0.79	0.35	0.36
1992 SEP	0.85	0.84	0.3	0.3
1993 AUG	0.43	0.35	0.4	0.4
1993 SEP	0.31	0.22	0.33	0.33
1994 AUG	0.28	0.21	0.3	0.3
1994 SEP	1.23	1.32	0.26	0.26
1995 AUG	1.9	2.04	0.4	0.4
1995 SEP	0.69	0.67	0.34	0.34
1996 AUG	1.34	1.36	0.52	0.52
1996 SEP	2.07	2.21	0.44	0.44
AVG,cfs	1.364	1.399		
AVG,inch			0.386	0.389
AVG,cfs			0.352	0.306
				0.44 Contributing Pervious
				1994 acres 2006 acres
				1323.27 1141.65

AR 044026

Table 6. Area changes from 1994 base flow to 2006 - Des Moines Creek (acres)

	DM-3	DM-4	DM-5	SDE-4	SDS-1	SDS-3	SDS-3A	SDS-4	SDS-2	SDS-5	SDS-6	Subtotal
sasa-df	7.42		0.28	0.03	0.04							7.77
16 Till forest		-0.07	-0.01						-2.76			0.00
26 Till grass	-1.10		-0.11	-10.61	0.46	-21.22	-28.08	-2.37	2.82	-3.79	1.08	-2.84
34 Outwash forest			-0.04					-0.14	-4.06			-62.92
44 Outwash grass								-10.80	4.46			-4.20
45 Fill												-6.38
54 Wetland	-0.09		-0.01									0.00
Pervious	-1.19	-0.07	-0.17	-10.61	0.46	-21.22	-28.08	-13.31	0.46	-3.79	1.08	-0.10
Impervious	-6.23	0.07	-0.21	10.64	-0.49	21.22	28.08	13.31	-0.46	3.79	-1.08	68.64
Fill	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other pervious	-1.19	-0.07	-0.17	-10.61	0.46	-21.22	-28.08	-13.31	0.46	-3.79	1.08	-76.44
Impervious	-6.23	0.07	-0.21	10.64	-0.49	21.22	28.08	13.31	-0.46	3.79	-1.08	68.64
sasa-df	7.42	0.00	0.28	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	7.77
sasa-df		SDS-7	SASA	IWS-NSPS	IWS-SASA	Subtotal						
16 Till forest			-22.79			-36.57						
26 Till grass	-32.57	-1.74	-0.01			-9.97						
34 Outwash forest		-0.23				-0.24						
44 Outwash grass	-0.66	-0.01				-3.58						
45 Fill	5.48					5.48						
54 Wetland	-0.39	-0.54				-1.33						
Pervious	-28.14	-25.31	-0.01			-51.69						
Impervious	28.14	25.31	-0.04			51.78						
Fill	5.48	0.00	0.00			0.00						
Other pervious	-33.62	-25.31	-0.01			-51.69						
Impervious	28.14	25.31	-0.04			51.78						
sasa-df	0.00	0.00	0.00			0.00						
Total Pervious Change												-181.59
Total Impervious Change												173.83
SASA detention facility												7.77

Monthly_AGWO

Table 7. Average monthly and annual active groundwater runoff in inches

	IMPLND	PERLND	PERLND	PERLND	PERLND	PERLND	PERLND
Month:	4	6	26	34	42	15	24
1	0.00	1.13	1.45	1.06	1.77	0.76	0.92
2	0.00	1.29	1.42	1.21	1.76	0.68	1.03
3	0.00	1.45	1.48	1.39	1.87	0.63	1.16
4	0.00	1.20	1.21	1.21	1.57	0.40	0.95
5	0.00	0.93	0.95	1.00	1.29	0.19	0.66
6	0.00	0.72	0.75	0.81	1.05	0.13	0.38
7	0.00	0.60	0.65	0.70	0.92	0.05	0.17
8	0.00	0.49	0.55	0.59	0.79	0.02	0.03
9	0.00	0.41	0.50	0.50	0.72	0.02	0.02
10	0.00	0.38	0.56	0.46	0.78	0.05	0.05
11	0.00	0.43	0.78	0.48	1.02	0.27	0.22
12	0.00	0.76	1.21	0.74	1.49	0.62	0.60
Total	0.000	9.788	11.495	10.134	15.019	3.819	6.189

Table 8. Change in Miller/Walker Average Annual Baseflows Resulting from Conversion (1994-2006) of Pervious Area

		<u>Subbasin Area Changes in Acres</u>													
		M-10	M-16	MC-1	MC-2	MC-3	MC-4	MC-5	MC-6	MC-7	MC-8	MC-9	CARGO	NEPL	M-6
To convert from depth to flow factor=	0.00012														
Avg Ann															
AGWO (Inches)															
9.788															
11.495															
10.134															
15.019															
3.819															
6.189															
0															
		<u>Change in baseflow (cfs) as a result of change in pervious to new pervious or impervious area</u>													
14 Imperviou	0.00002	-0.0001	-0.00686	-0.00311	-0.00919	0.00489	0.00104	0.00504	0.00181	-0.00024	-0.00831	-0.08165	-0.00005		
		Total STIA -0.07743													

		<u>Subbasin Area Changes in Acres</u>													
		SDN-1	SDN1-LW	SDN1-OF	SDN-2X	SDN-3	SDN-3A	SDN-3X	SDN-4	SDN-4X	IWS- NCPS	IWS- NSMPS	SDW-1A	SDW-1B	SDW-2
Avg Ann															
AGWO (Inches)															
9.788															
11.495															
10.134															
15.019															
3.819															
6.189															
0															
		<u>Change in baseflow (cfs) as a result of change in pervious to new pervious or impervious area</u>													
14 Imperviou	-0.00408	-0.00033	0.00347	-0.00518	-0.01296	-0.05156									
		-0.01537 -0.02245 -0.00284 -0.00281 -0.0844 -0.11689 -0.01965													
		Total SDS -0.31551 -0.020													
		Total Miller -0.393													
		Total Walker -0.020													

Note: Sign convention - + Indicates gain in soil category; - Indicates loss in soil category

ATTACHMENT I

MILLER CK @ SR 509 - SUMMARY LOW FLOW STATISTICS

AVERAGE RETURN NUMBER INTERNAL DAYS YEARS	CFS		DIFFERENCE (1994-2006) (GPM)		
	1994	2006			
1-DAY	2-YR	0.774	0.620	0.154	69.1
	5-YR	0.668	0.521	0.147	66.0
	10-YR	0.615	0.469	0.146	65.5
	20-YR	0.573	0.427	0.146	65.5
7-DAY	2-YR	0.791	0.634	0.157	70.5
	5-YR	0.684	0.532	0.152	68.2
	10-YR	0.630	0.479	0.151	67.8
	20-YR	0.587	0.435	0.151	67.8
30-DAY	2-YR	0.879	0.707	0.172	77.2
	5-YR	0.753	0.587	0.166	74.5
	10-YR	0.693	0.532	0.161	72.3
	20-YR	0.647	0.496	0.157	70.5
90-DAY	2-YR	1.127	0.975	0.152	68.2
	5-YR	0.953	0.790	0.163	73.1
	10-YR	0.883	0.716	0.167	74.9
	20-YR	0.835	0.663	0.172	77.2

ATTACHMENT II

WALKER CK @ S. 12TH - SUMMARY LOW FLOW STATISTICS

AVERAGE NUMBER DAYS	RETURN INTERVAL YEARS	CFS		DIFFERENCE	
		1994	2006	(1994-2006)	(GPM)
1-DAY	2-YR	0.021	0.013	0.008	3.6
	5-YR	0.018	0.011	0.007	3.1
	10-YR	0.017	0.009	0.008	3.6
	20-YR	0.016	0.008	0.008	3.6
7-DAY	2-YR	0.021	0.015	0.006	2.7
	5-YR	0.019	0.012	0.007	3.1
	10-YR	0.017	0.010	0.007	2.7
	20-YR	0.016	0.009	0.007	3.1
30-DAY	2-YR	0.023	0.017	0.006	2.7
	5-YR	0.021	0.014	0.007	3.1
	10-YR	0.019	0.012	0.007	3.1
	20-YR	0.018	0.011	0.007	3.1
90-DAY	2-YR	0.028	0.024	0.004	1.8
	5-YR	0.024	0.020	0.004	1.8
	10-YR	0.023	0.018	0.005	2.2
	20-YR	0.022	0.017	0.005	2.2

ATTACHMENT III
DES NOWES CK @ S. 200TH ST. - LOW FLOW STATISTICS

AVERAGE NUMBER DAYS	RETURN INTERVAL YEARS	CFS		DIFFERENCE (1994-2006) (GPM)	
		1994	2006		
1-DAY	2-YR	0.337	0.247	0.090	40.4
	5-YR	0.269	0.194	0.075	33.7
	10-YR	0.234	0.168	0.066	29.6
	20-YR	0.205	0.148	0.057	25.6
7-DAY	2-YR	0.348	0.257	0.091	40.8
	5-YR	0.277	0.201	0.076	34.1
	10-YR	0.240	0.174	0.066	29.6
	20-YR	0.211	0.153	0.058	26.0
30-DAY	2-YR	0.411	0.327	0.084	37.7
	5-YR	0.321	0.241	0.080	35.9
	10-YR	0.282	0.208	0.070	33.2
	20-YR	0.254	0.185	0.069	31.0
90-DAY	2-YR	0.768	0.725	0.043	19.3
	5-YR	0.575	0.517	0.058	26.0
	10-YR	0.502	0.438	0.064	28.7
	20-YR	0.452	0.385	0.067	30.1



MEMORANDUM

Date: **December 11, 2000**
To: **Rick Schaefer, Earth Tech**
From: **Jim Dexter**
Subject: **Revisions to HSPF Low Flow Analysis**
cc: **Paul Fendt**
Norm Crawford

Project Number: **556-2912-001-1-28**
Project Name: **POS STORMWATER**

Revisions to HSPF Model. In response to a request from the Port of Seattle's Third Runway project management, we have revised the HSPF model to consider the effect of infiltration facilities upon low flows in Miller Creek. Two infiltration areas, described in greater detail in Hart Crowser's report entitled, "Feasibility of Stormwater Infiltration, Third Runway Project" (Hart Crowser, 12/1/00) were included in the model.

Figures 1 and 2 show schematic diagrams of how water was routed in the model. The relative elevation of the infiltration areas to the proposed detention pond locations determines the nature of the flow control. Flow into the infiltration facility is expected to be controlled by either a flow control structure, that may also serve as an energy dissipator, or a pump if the pond is lower in elevation than the infiltration area.

The HSPF FTABLES for each detention location were modified to include a second outlet for flow to the infiltration facility. In addition, a new vault was proposed in subbasin SDW1A to store impervious area runoff at the top of the embankment and route the water directly into the infiltration area 1. Each infiltration area was modeled as a tank as requested by King County during planning meetings. The design and outflow relationships are based on King County's Surface Water Design Manual.

The second outlet release from each infiltration area was routed to the active groundwater storage in a special pervious land segment created in the model for the infiltration facility. The procedure we created to do this required two model runs. The first run performed the time series simulation based on the selected detention facility size and discharge characteristics. The infiltration area flow was written to the external data (WDM) file in units of inches of water. The second run was performed for the entire time series, however, the file was modified to read the external infiltration load and apply it to the infiltration area as an input (active groundwater lateral inflow) to active groundwater storage. The pervious land segments describing the infiltration areas were assigned

Miller Creek Infiltration Areas

— Area 1 Soil Moisture, in — Area 3 Soil Moisture, in — FLOW, cfs

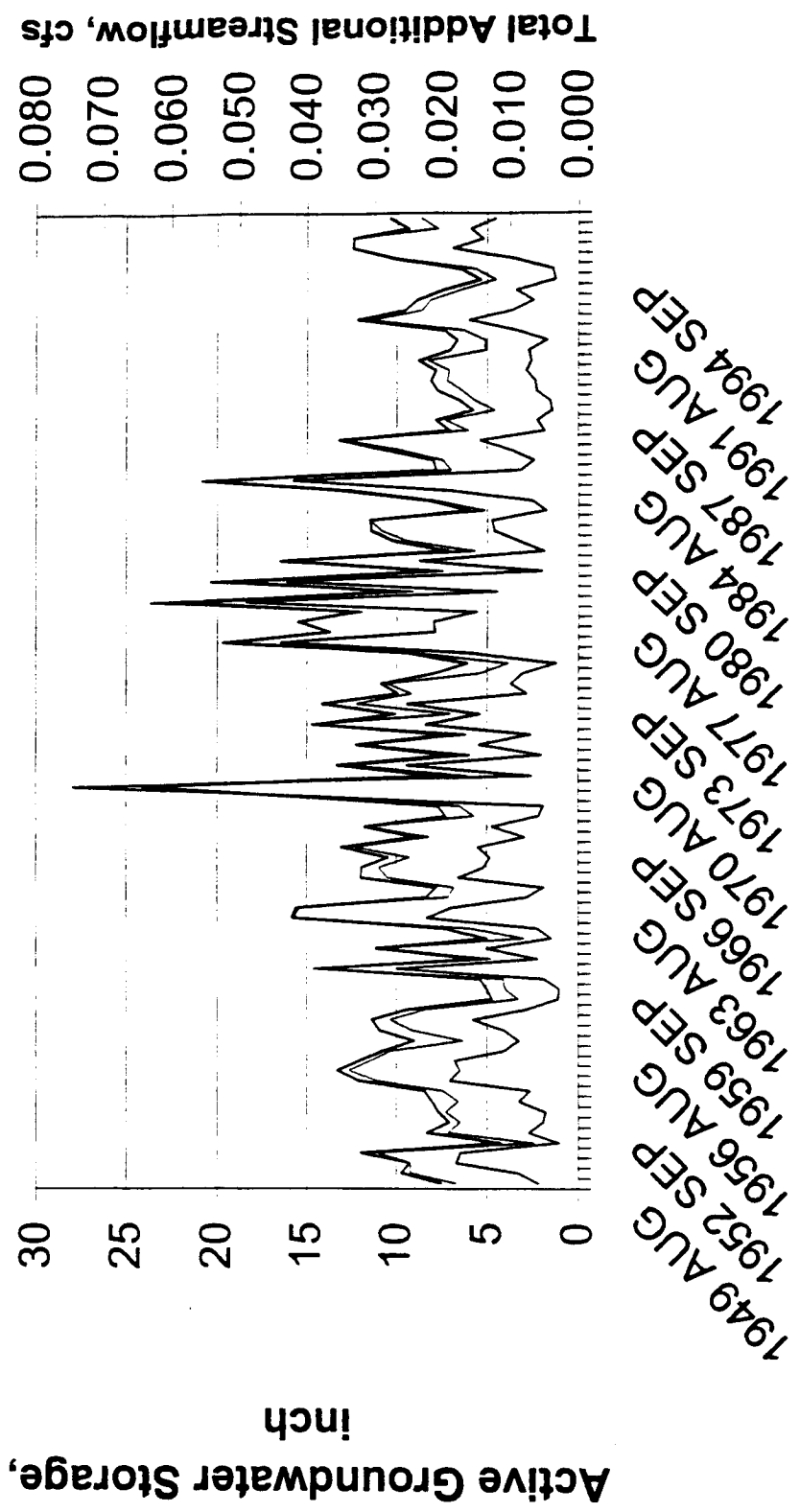


FIGURE 3.

ATTACHMENT I - REVISED

MILLER CK @ SR 509 - SUMMARY LOW FLOW STATISTICS

AVERAGE RETURN NUMBER DAYS	INTERNAL YEARS	CFS		
		1994	2006	DIFFERENCE
1-DAY	2-YR	0.774	0.624	0.150
	5-YR	0.668	0.525	0.143
	10-YR	0.615	0.474	0.141
	20-YR	0.573	0.431	0.142
7-DAY	2-YR	0.791	0.638	0.153
	5-YR	0.684	0.536	0.148
	10-YR	0.630	0.483	0.147
	20-YR	0.587	0.440	0.147
30-DAY	2-YR	0.879	0.713	0.166
	5-YR	0.753	0.592	0.161
	10-YR	0.693	0.536	0.157
	20-YR	0.647	0.495	0.152
90-DAY	2-YR	1.127	0.995	0.132
	5-YR	0.953	0.804	0.149
	10-YR	0.883	0.727	0.156
	20-YR	0.835	0.673	0.162

Parametrix, Inc.

PROJECT _____

JOB NO _____

BY _____

DATE _____

CHECKED _____

DATE _____

SHEET _____

OF _____

AVERAGE NUMBER DAYS	RETURN INTERVAL YEARS	1994	2006	DIFFERENCE
183	2-YR	1.745	1.691	0.054
	5-YR	1.446	1.355	0.091
	10-YR	1.311	1.204	0.107
	20-YR	1.209	1.091	0.118

Refer to 12.11.00 memo
by Parametrix

RUN
GLOBAL
*** SEATAC AIRPORT HSPF BASIN MODEL OF MILLER CREEK
*** FILE: MC22WDM.INP - 2006 future condition

*** BASED ON MILL64.INP FILE FROM AQUA TERRA
*** MC22WDM:
*** ADDED PERLND 47,57,
*** ADDED GROUND WATER INFILTRATION TO WDM FOR USE WITH MCAGWO.INP
MILLER CREEK BASIN HSPF MODEL
*** START 1994 1 1 0 0 END 1996 8 30 24 0
START 1948 10 1 0 0 END 1997 1 31 24 0
RUN INTERP OUTPUT LEVEL 6
RESUME 0 RUN 1
END GLOBAL

FILES
<type> <fun>***<-----fname----->
MESSU 24 C:\hspf\miller\MILL.MES
WDM 25 C:\hspf\miller\MCPOND22.WDM
61 C:\hspf\miller\PER.L61
62 C:\hspf\miller\RCH.L62
END FILES

OPN SEQUENCE
INGRP INDELT 01:00
PERLND 16
PERLND 26
PERLND 34
PERLND 44
PERLND 45
PERLND 47 ***
PERLND 54
PERLND 57 ***
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
RCHRES 45
RCHRES 645
RCHRES 46
RCHRES 552
RCHRES 52
RCHRES 53
RCHRES 54
RCHRES 37
RCHRES 237
COPY 37
RCHRES 147
RCHRES 247
COPY 66
RCHRES 47
COPY 62
COPY 63
*** --> output SDW1A infiltration discharge to WDM dataset 3 in in/ac <--

AR 044038

```

COPY      47
RCHRES   34
RCHRES   135
RCHRES   57
RCHRES   257
COPY     64
COPY     65
*** -> output SDW1B infiltration discharge to WDM dataset 4 in in/ac <-
COPY     57
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 Engrl 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  61  0
54  SA - WETLANDS    1  1  1  1  61  0
57  OG - INFILTRATION 3  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 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 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 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 0.9000
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
END PWAT-PARM2
PWAT-PARM3
<PLS > ***
# - # *** PETMAX PETMIN INFEXP INFILD DEEPRF 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          10.0000 2.0000 0.33 0. 0.7
57          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

```

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

```

END PWAT-STATE1

END PERLND

IMPLND

GEN-INFO

```

<ILS > Name Unit-systems Printer ***
#- # User t-series Engr 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

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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 vois> <-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	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

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 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	113	FLOW	ENGL	REPL
COPY	55	OUTPUT	MEAN	1 1 12.1	WDM	118	FLOW	ENGL	REPL
RCHRES	54	HYDR	RO	1 1	WDM	114	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 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
RCHRES	147	HYDR	RO	1 1	WDM	109	FLOW	ENGL	REPL

*** write RCHRES 57 outlet 1 and 2 to WDM 107 and 108 like so:

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

```

*** write RCHRES 37 vault to WDM 111
RCHRES 37 HYDR RO 11 WDM 111 FLOW ENGL REPL
RCHRES 237 HYDR RO 11 WDM 122 FLOW ENGL REPL
RCHRES 43 HYDR RO 11 WDM 103 FLOW ENGL REPL
COPY 44 OUTPUT MEAN 11 12.1 WDM 104 FLOW ENGL REPL
RCHRES 51 HYDR RO 11 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 11 12.1 WDM 125 FLOW ENGL REPL
COPY 45 OUTPUT MEAN 11 12.1 WDM 199 FLOW ENGL REPL
***INFILTRATION FLOW
*** --> output SDW1A infiltration discharge to WDM dataset 3 <--
*** --> convert acft to in/ac, assuming infiltrate to 2 ac <--
COPY 47 OUTPUT MEAN 11 6 WDM 5 FLOW ENGL REPL
*** --> output SDW1B infiltration discharge to WDM dataset 4 <--
*** --> convert acft to in/ac, assuming infiltrate to 2 ac <--
COPY 57 OUTPUT MEAN 11 6 WDM 6 FLOW ENGL REPL
END EXT TARGETS

```

```

SCHEMATIC
<-Source->      <-Area-->  <-Target->  MBLK ***
<-Name> #      <-factor->  <-Name> #  Tb# ***
*** 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 80 % 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	RCHRES 645	6
PERLND 26	20.38	RCHRES 645	6
PERLND 34	13.44	RCHRES 645	6
PERLND 44	11.79	RCHRES 645	6
PERLND 54	0.82	RCHRES 645	6
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	RCHRES 645	2

*** 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
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

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PERLND 44	8.19	RCHRES 52	1
PERLND 45	0.02	RCHRES 52	1
PERLND 54	0.27	RCHRES 52	1
IMPLND 14	0.12	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			
PERLND 44	14.10	RCHRES 35	1
PERLND 45	0.09	RCHRES 35	1
PERLND 54	0.90	RCHRES 35	1
IMPLND 14	0.26	RCHRES 35	2
*** SUB-CATCHMENT MC-7			
PERLND 26	11.26	COPY 55	21
PERLND 44	31.80	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	3.65	COPY 61	26

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PERLND 45	0.98	COPY 61	26
PERLND 26	0.63	RCHRES 135	7
PERLND 44	3.65	RCHRES 135	7
PERLND 45	0.98	RCHRES 135	7
IMPLND 14	2.22	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
PERLND 45	23.77	RCHRES 43	6
PERLND 26	1.61	RCHRES 135	7
PERLND 45	23.77	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)

IMPLND 14	5.87	RCHRES 37	2
-----------	------	-----------	---

*** SUB-CATCHMENT SDN3AO (TO POND)

PERLND 26	0.08	RCHRES 237	6
PERLND 44	0.03	RCHRES 237	6
PERLND 45	22.12	RCHRES 237	6
PERLND 26	0.08	RCHRES 135	7
PERLND 44	0.03	RCHRES 135	7
PERLND 45	22.12	RCHRES 135	7
IMPLND 14	2.35	RCHRES 237	2

*** SUB-CATCHMENT SDW1O (TO POND)
 PERLND 26 4.28 RCHRES 247 6
 PERLND 44 0.69 RCHRES 247 6
 PERLND 45 32.44 RCHRES 247 6
 PERLND 26 4.28 RCHRES 135 7
 PERLND 44 0.69 RCHRES 135 7
 PERLND 45 32.44 RCHRES 135 7
 IMPLND 14 1.64 RCHRES 247 2

*** SUB-CATCHMENT SDN1AI (TO VAULT)
 IMPLND 14 13.78 RCHRES 147 2

*** SUB-CATCHMENT SDW1B (TO POND)
 *** AGWO TO 35, AS 57 IS D/S OF VACCA FARMS (135)
 PERLND 26 21.25 RCHRES 57 6
 PERLND 44 2.39 RCHRES 57 6
 PERLND 45 46.26 RCHRES 57 6
 PERLND 26 21.25 RCHRES 35 7
 PERLND 44 2.39 RCHRES 35 7
 PERLND 45 46.26 RCHRES 35 7
 IMPLND 14 26.95 RCHRES 57 2

*** 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
 RCHRES 451 COPY 45 11
 RCHRES 452 COPY 45 11
 COPY 45 RCHRES 45 12
 RCHRES 45 RCHRES 645 3
 RCHRES 645 RCHRES 53 3
 RCHRES 46 RCHRES 53 3

*** NEW STREAM REACH 52 TO LAKE REBA 53 TO RDF 54
 RCHRES 552 RCHRES 52 3
 RCHRES 52 RCHRES 53 3
 RCHRES 53 RCHRES 54 3
 RCHRES 50 RCHRES 54 3

*** RDF 54 TO 35
 RCHRES 54 RCHRES 135 3
 <-Source-> <-Area-> <-Target-> MBLK ***
 <Name> # <-factor-> <Name> # Tb# ***

*** PONDS TO 34
 RCHRES 37 COPY 37 11
 RCHRES 237 COPY 37 11
 COPY 37 RCHRES 135 12
 SDW1AI VAULT FLOW TO INFILTRATION 1 ***
 RCHRES 147 RCHRES 47 3
 STORMWATER Q 1ST EXIT AT POND G ***
 RCHRES 247 RCHRES 135 4
 RCHRES 247 COPY 66 14
 2ND EXIT TO INFILTRATION TANK-MILLER CREEK ***
 RCHRES 247 RCHRES 47 5
 STORMWATER Q 1ST EXIT AT INFILTRATION TANK 1 ***

```

RCHRES 47          RCHRES 135  4
2ND EXIT TO SOIL & ULTIMATELY MILLER CREEK      ***
RCHRES 47          RCHRES 135  5
COPY BLOCK FOR OUTPUT PURPOSES                  ***
RCHRES 47          COPY 62  14
RCHRES 47          COPY 63  15
*** --> output SDW1A infiltration discharge to WDM dataset 5 <--
RCHRES 47          COPY 47  15
RCHRES 34          RCHRES 135  4
RCHRES 34          RCHRES 135  5
RCHRES 135        RCHRES 35  3
RCHRES 10          RCHRES 16  3
*** PONDS TO 35
STORM Q 1ST EXIT OF POND D TO MILLER CREEK      ***
RCHRES 57          RCHRES 35  4
INFILTRATION Q 2ND EXIT OF POND D TO SOIL AND ULTIMATELY MILLER CK ***
RCHRES 57          RCHRES 257  5
COPY BLOCK FOR OUTPUT PURPOSES                  ***
RCHRES 57          COPY 64  14
RCHRES 57          COPY 65  15
*** --> output SDW1B infiltration discharge to WDM dataset 6 <--
RCHRES 57          COPY 57  15
RCHRES 257        RCHRES 35  4
RCHRES 257        RCHRES 35  5
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> SSSYSSGAP<--MULT-->TRAN <-TARGET VOLTS> <-MEMBER->
<NAME> # <NAME> TEM STRG<-FACTOR->STRG <NAME> # # <-GRP> <NAME> ## ***
END NETWORK

```

```

RCHRES
GEN-INFO
RCHRES  Name      Nexits Unit Systems Printer      ***
# - #<-----><--> User T-senes Engr 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 2 1 1 1 62 0 0
135 VACA FARMS 1 1 1 1 62 0 0
147 sdw1a vault 1 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-nsmpe 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 nepi VAULT 1 1 1 1 62 0 0
452 nepi VAULT 1 1 1 1 62 0 0
552 SDN1 POC 1 1 1 1 62 0 0
645 nepi 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 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 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 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 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
50 54 0 1 0 0 4 0 0 0 0 0 0 0 0 2 2 2 2 2
57 0 1 0 0 4 5 0 0 0 0 0 0 0 0 2 2 2 2 2
100 237 0 1 1 0 4 0 0 0 0 0 0 0 0 2 2 2 2 2
240 300 0 1 1 0 4 5 0 0 0 0 0 0 0 2 2 2 2 2
301 999 0 1 0 0 4 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	0.863		0.3
37	37	0.010	0.0	0.3
38	38	0.010		0.3
43	43	0.010		0.3
45	45	0.010	0.0	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	0.0	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
645	645	0.010		0.0

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

#	ac-ft	COLIND	OUTDGT
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	
45	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	5.0
237	0.00	4.0	
147	0.00	4.0	

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
 645 0.0 4.0
 END HYDR-INIT
 END RCHRES

FTABLES
 ***UPPER BASIN

FTABLE 1
 *** REVISED 8/16/00 ADDED 2ND OUTFLOW
 ROWS COLS ***

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 ***

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 ***

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	306.26

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	0.8887	1.8116	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

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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	1.4626	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
5.00	0.50	1.91	0.00	305.00
11.00	0.79	5.79	0.00	311.00
15.00	1.13	9.64	0.50	315.00
19.00	1.72	15.34	0.50	319.00
29.00	2.86	38.25	0.50	329.00
39.00	4.40	74.55	0.50	339.00
50.00	6.22	132.98	0.50	350.00
60.00	10.00	1212.98	0.50	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

AR 044054

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

AR 044055

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	5.8820	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	6.861	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
16 4

DEPTH	AREA	VOLUME	INFILTRQ ***
0.000	0.459	0.000	0.00
0.010	0.459	0.005	0.150
1.000	0.459	0.459	0.150
2.000	0.459	0.918	0.150
4.000	0.459	1.837	0.150
6.000	0.459	2.755	0.150

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8.000	0.459	3.614	0.150
10.000	0.459	4.592	0.150
14.000	0.459	6.429	0.150
15.000	0.459	6.888	0.150
16.000	0.459	7.347	0.150
16.750	0.459	7.692	0.201
16.900	0.459	7.760	0.246
17.000	0.459	7.806	0.283
17.100	0.459	7.852	0.900
17.300	0.459	7.944	3.480
18.000	0.459	8.265	15.410

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
 20 4

DEPTH (FT)	AREA (ACRES)	VOLUME (ACRE-FT)	FLOW (FT3/S)	***
0.00	1.288	0.00	0.00	***
0.13	1.288	0.167	0.061	***
1.38	1.288	1.777	0.199	***
3.35	1.288	4.314	0.310	***
5.31	1.288	6.839	0.391	***
8.00	1.288	10.367	0.481	***
8.84	1.288	11.385	0.504	***
10.01	1.288	13.394	0.547	***
12.00	1.288	15.455	0.587	***
12.11	1.288	15.596	0.607	***
14.08	1.288	18.133	0.710	***
14.86	1.288	19.138	0.740	***
16.04	1.288	20.658	0.782	***
18.00	1.288	23.182	0.845	***
18.32	1.288	23.594	1.110	***
18.80	1.288	24.212	1.330	***
20.00	1.288	25.758	1.640	***
20.10	1.288	25.886	2.270	***
20.50	1.288	26.402	8.620	***
20.80	1.288	26.788	15.320	***

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 = 12.0 FT
 *** BASED ON INFILTRATION OUTLET CAPACITY OF 0.2 CFS

17 5
 DEPTH AREA VOLUME STORMQ INFILTRQ ***
 (FT) (ACRES) (ACRE-FT) (FT3/S) (CFS) ***
 0.00 0.000 0.000 0.000 0.00
 1.00 0.897 0.872 0.153 0.20
 2.00 0.943 1.791 0.220 0.20
 3.00 0.990 2.755 0.271 0.20
 4.00 1.038 3.765 0.313 0.20
 5.00 3.499 7.232 0.351 0.20
 6.00 3.591 10.745 0.382 0.20
 7.00 3.684 14.350 0.410 0.20
 8.00 3.778 18.046 0.440 0.20
 9.00 3.872 21.835 0.470 0.20
 10.00 3.996 25.692 0.492 0.20
 11.00 4.123 29.710 0.520 0.20
 12.00 4.206 33.774 0.846 0.20
 12.50 4.249 35.840 1.083 0.20
 13.00 4.291 37.907 1.280 0.20
 13.50 4.340 41.328 8.230 0.20
 14.00 4.390 44.827 15.230 0.20
 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

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 0.017
 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 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 81

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> #<factor->***
 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 06 1

END TIMESERIES

END COPY

END RUN

AR 044064

Refer to 12.11.00
memo by
Parametrix

```
RUN
GLOBAL
*** SEATAC AIRPORT HSPF BASIN MODEL OF MILLER CREEK
*** FILE: MC22AGW.INP - 2006 future condition
***
*** BASED ON MILL64.INP FILE FROM AQUA TERRA
*** PARALLEL NEPL VAULTS
*** TWO OUTLETS ADDED TO SDW1A
*** REVISED SDW1A AND SDW1B OUTLETS TO PROVIDE INFILTRATION DISCHARGES
*** MC22AGW:
*** REVISED PERLND 47 AND 57 TO ROUTE REINFILTRATION AS AGWLI TO MILLER CK
MILLER CREEK BASIN HSPF MODEL
*** START 1994 1 1 0 0 END 1996 8 30 24 0
START 1948 10 1 0 0 END 1997 1 31 24 0
RUN INTERP OUTPUT LEVEL 6
RESUME 0 RUN 1
END GLOBAL
```

```
FILES
<type> <fun>***<-----fname----->
MESSU 24 C:\hspf\miller\MILL.MES
WDM 25 C:\hspf\miller\MCPOND22.WDM
61 C:\hspf\miller\PER.L61
62 C:\hspf\miller\RCH.L62
END FILES
```

```
OPN SEQUENCE
INGRP INDELT 01:00
PERLND 16
PERLND 26
PERLND 34
PERLND 44
PERLND 45
*** -> special PERLND for infiltration:
*** -> SDW 1A:
PERLND 47
PERLND 54
*** -> SDW 1B:
PERLND 57
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
RCHRES 45
RCHRES 645
RCHRES 46
RCHRES 552
RCHRES 52
RCHRES 53
RCHRES 54
RCHRES 37
RCHRES 237
COPY 37
RCHRES 147
RCHRES 247
```

AR 044065

COPY 66
 RCHRES 47
 COPY 62
 COPY 63
 RCHRES 34
 RCHRES 135
 RCHRES 57
 RCHRES 257
 COPY 64
 COPY 65
 RCHRES 35
 *** -> output special perind outflow to check
 COPY 47
 COPY 55
 *** -> output special perind outflow to check
 COPY 57
 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 Engr 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 61 0
 54 SA - WETLANDS 1 1 1 1 61 0
 57 OG - INFILTRATION 3 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 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 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 0.9000
 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

END PWAT-PARM2

PWAT-PARM3

AR 044066

```

<PLS >***
#- #*** PETMAX  PETMIN  INFEXP  INFILD  DEEPPR  BASETP  AGWETP
16          2.0000  2.0000  0.33   0.00   0.00   0.00
26          2.0000  2.0000  0.33   0.    0.    0.
34          2.0000  2.0000  0.33   0.00   0.00
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.

```

```

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

```

```

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

```

```

END PWAT-STATE1
END PERLND

```

```

IMPLND

```

```

GEN-INFO
<ILS > Name Unit-systems Printer ***
#- # User t-series Engr 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 14 200 EXTNL PREC
WDM 1002 PREC ENGLZERO 1.00 IMPLND 14 EXTNL PREC
WDM 1 EVAP ENGLZERO 0.8 PERLND 14 200 EXTNL PETINP
WDM 1 EVAP ENGLZERO 0.8 IMPLND 14 EXTNL PETINP
*** -> lateral inflow from infiltration chamber for SDW1A
WDM 5 FLOW ENGLZERO 1.0 PERLND 47 EXTNL AGWLI
*** -> lateral inflow from infiltration 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
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 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 11 WDM 113 FLOW ENGL REPL
COPY 55 OUTPUT MEAN 1 1 12.1 WDM 118 FLOW ENGL REPL
RCHRES 54 HYDR RO 11 WDM 114 FLOW ENGL REPL
*** DETENTION POND FLOWS
COPY 61 OUTPUT MEAN 1 1 12.1 WDM 101 FLOW ENGL REPL
RCHRES 552 HYDR RO 11 WDM 102 FLOW ENGL REPL
RCHRES 451 HYDR RO 11 WDM 105 FLOW ENGL REPL
RCHRES 452 HYDR RO 11 WDM 119 FLOW ENGL REPL
RCHRES 46 HYDR RO 11 WDM 106 FLOW ENGL REPL
*** write RCHRES 47 outlet 1 and 2 to WDM 107 and 108 like so:
COPY 62 OUTPUT MEAN 1 1 12.1 WDM 107 FLOW ENGL REPL

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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
 RCHRES 147 HYDR RO 1 1 WDM 109 FLOW ENGL REPL
 *** write RCHRES 57 outlet 1 and 2 to WDM 107 and 108 like so:
 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
 *** 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
 *** 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> #	Tb#	***
*** 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	RCHRES 645	6
PERLND 26	20.38	RCHRES 645	6

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PERLND 34	13.44	RCHRES 645	6
PERLND 44	11.79	RCHRES 645	6
PERLND 54	0.82	RCHRES 645	6
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	RCHRES 645	2
*** 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
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

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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	8.19	RCHRES 52	1
PERLND 45	0.02	RCHRES 52	1
PERLND 54	0.27	RCHRES 52	1
IMPLND 14	0.12	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 (act/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 (act/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

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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	3.65	COPY 61	26
PERLND 45	0.98	COPY 61	26
PERLND 26	0.63	RCHRES 135	7
PERLND 44	3.65	RCHRES 135	7
PERLND 45	0.98	RCHRES 135	7
IMPLND 14	2.22	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
PERLND 45	23.77	RCHRES 43	6
PERLND 26	1.61	RCHRES 135	7
PERLND 45	23.77	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)

IMPLND 14 5.87 RCHRES 37 2

*** SUB-CATCHMENT SDN3AO (TO POND)

PERLND 26 0.08 RCHRES 237 6
PERLND 44 0.03 RCHRES 237 6
PERLND 45 22.12 RCHRES 237 6
PERLND 26 0.08 RCHRES 135 7
PERLND 44 0.03 RCHRES 135 7
PERLND 45 22.12 RCHRES 135 7
IMPLND 14 2.35 RCHRES 237 2

*** SUB-CATCHMENT SDW1O (TO POND)

PERLND 26 4.28 RCHRES 247 6
PERLND 44 0.69 RCHRES 247 6
PERLND 45 32.44 RCHRES 247 6
PERLND 26 4.28 RCHRES 135 7
PERLND 44 0.69 RCHRES 135 7
PERLND 45 32.44 RCHRES 135 7
IMPLND 14 1.64 RCHRES 247 2

*** SUB-CATCHMENT SDN1AI (TO VAULT)

IMPLND 14 13.78 RCHRES 147 2

*** SUB-CATCHMENT SDW1B (TO POND)

*** AGWO TO 35, AS 57 IS D/S OF VACCA FARMS (135)
PERLND 26 21.25 RCHRES 57 6
PERLND 44 2.39 RCHRES 57 6
PERLND 45 46.26 RCHRES 57 6
PERLND 26 21.25 RCHRES 35 7
PERLND 44 2.39 RCHRES 35 7
PERLND 45 46.26 RCHRES 35 7
IMPLND 14 26.95 RCHRES 57 2

*** 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

RCHRES 451 COPY 45 11
RCHRES 452 COPY 45 11
COPY 45 RCHRES 45 12

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RCHRES 45          RCHRES 645  3
RCHRES 645        RCHRES 53   3
RCHRES 46          RCHRES 53   3
*** NEW STREAM REACH 52 TO LAKE REBA 53 TO RDF 54
RCHRES 552        RCHRES 52   3
RCHRES 52         RCHRES 53   3
RCHRES 53         RCHRES 54   3
RCHRES 50         RCHRES 54   3
*** RDF 54 TO 35
RCHRES 54          RCHRES 135  3
<-Source->         <-Area-->  <-Target-> MBLK ***
<Name> #          <-factor-> <Name> # Tb# ***
*** PONDS TO 34
RCHRES 37          COPY 37   11
RCHRES 237         COPY 37   11
COPY 37           RCHRES 135  12
SDW1AI VAULT FLOW TO INFILTRATION 1 ***
RCHRES 147        RCHRES 47   3 ***
STORMWATER Q 1ST EXIT AT POND G ***
RCHRES 247        RCHRES 135  4
RCHRES 247        COPY 66   14
2ND EXIT TO INFILTRATION TANK-MILLER CREEK ***
RCHRES 247        RCHRES 47   5
STORMWATER Q 1ST EXIT AT INFILTRATION TANK 1 ***
RCHRES 47         RCHRES 135  4 ***
2ND EXIT TO SOIL & ULTIMATELY MILLER CREEK ***
*** -> 2nd exit reintroduced as AGWLI
***2ND EXIT TO SOIL & ULTIMATELY MILLER CREEK ***
***RCHRES 47      RCHRES 135  5 ***
COPY BLOCK FOR OUTPUT PURPOSES ***
RCHRES 47         COPY 62   14
RCHRES 47         COPY 63   15
RCHRES 34         RCHRES 135  4
RCHRES 34         RCHRES 135  5
RCHRES 135        RCHRES 35   3
RCHRES 10         RCHRES 16   3
*** PONDS TO 35
STORM Q 1ST EXIT OF POND D TO MILLER CREEK ***
RCHRES 57         RCHRES 35   4
INFILTRATION Q 2ND EXIT OF POND D TO SOIL AND ULTIMATELY MILLER CK ***
*** -> 2nd exit reintroduced as AGWLI
***INFILTRATION Q 2ND EXIT OF POND D TO SOIL AND ULTIMATELY MILLER CK ***
***RCHRES 57     RCHRES 257  5 ***
COPY BLOCK FOR OUTPUT PURPOSES ***
RCHRES 57         COPY 64   14
RCHRES 57         COPY 65   15
RCHRES 257        RCHRES 35   4
RCHRES 257        RCHRES 35   5
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> SSSYSSGAP<--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 Engr Metr LKFG ***
      in out      ***
1 Arbor Lake M1  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 nepi 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 2 1 1 1 62 0 0
135 VACA FARMS 1 1 1 1 62 0 0
147 sdw1a vault 1 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-namps 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 nepi VAULT 1 1 1 1 62 0 0
452 nepi VAULT 1 1 1 1 62 0 0
552 SDN1 POC 1 1 1 1 62 0 0
645 nepi 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 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 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 0 2 2 2 2 2
50 54 0 1 0 0 4 0 0 0 0 0 0 0 0 0 2 2 2 2 2
57 0 1 0 0 4 5 0 0 0 0 0 0 0 0 0 2 2 2 2 2
100 237 0 1 1 0 4 0 0 0 0 0 0 0 0 0 2 2 2 2 2
240 300 0 1 1 0 4 5 0 0 0 0 0 0 0 0 2 2 2 2 2
301 999 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
-----
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
45 45 0.010 0.0 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 0.0 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
645 645 0.010 0.0
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
 45 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 5.0
 237 0.00 4.0
 147 0.00 4.0
 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
 645 0.0 4.0
 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

AR 044078

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 0.8000 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

AR 044080

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
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

AR 044081

FTABLE 34
 ROWS COLS *** REVISED 11/19/97 BASED ON HEC-RAS MODEL
 *** REVISED 8/16/00 ADDED 2ND OUTFLOW

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

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 ***

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 ***

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 ***

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 ***

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

AR 044082

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 ***

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 ***

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

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

16	4			
DEPTH	AREA	VOLUME	INFILTRQ	***
0.000	0.459	0.000	0.00	
0.010	0.459	0.005	0.150	
1.000	0.459	0.459	0.150	
2.000	0.459	0.918	0.150	
4.000	0.459	1.837	0.150	
6.000	0.459	2.755	0.150	
8.000	0.459	3.614	0.150	
10.000	0.459	4.592	0.150	
14.000	0.459	6.429	0.150	
15.000	0.459	6.888	0.150	
16.000	0.459	7.347	0.150	
16.750	0.459	7.692	0.201	
16.900	0.459	7.760	0.246	
17.000	0.459	7.806	0.283	
17.100	0.459	7.852	0.900	
17.300	0.459	7.944	3.480	
18.000	0.459	8.265	15.410	

END FTABLE147

*** SDW-1A: 3RD RUNWAY NORTH POND G TO MILLER CREEK (LEVEL 2): ***

FTABLE 247
 *** PROJECT SDW1A EFFECTIVE DEPTH=11.0 FT RISER DIA 24 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	

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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= 9.5 FT 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

20	4				
DEPTH	AREA	VOLUME	FLOW		***
(FT)	(ACRES)	(ACRE-FT)	(FT3/S)		***
0.00	1.288	0.00	0.00		
0.13	1.288	0.167	0.061		
1.38	1.288	1.777	0.199		
3.35	1.288	4.314	0.310		
5.31	1.288	6.839	0.391		
8.00	1.288	10.367	0.481		
8.84	1.288	11.385	0.504		
10.01	1.288	13.394	0.547		
12.00	1.288	15.455	0.587		
12.11	1.288	15.596	0.607		
14.08	1.288	18.133	0.710		
14.86	1.288	19.138	0.740		
16.04	1.288	20.658	0.782		
18.00	1.288	23.182	0.845		
18.32	1.288	23.594	1.110		
18.80	1.288	24.212	1.330		
20.00	1.288	25.758	1.640		
20.10	1.288	25.886	2.270		
20.50	1.288	26.402	8.620		
20.80	1.288	26.788	15.320		

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 = 13.0 FT
 *** BASED ON INFILTRATION OUTLET CAPACITY OF 0.2 CFS

17 5

DEPTH (FT)	AREA (ACRES)	VOLUME (ACRE-FT)	STORMQ (FT3/S)	INFILTRQ (CFS)	***
0.00	0.000	0.000	0.000	0.00	
1.00	0.897	0.872	0.153	0.20	
2.00	0.943	1.791	0.220	0.20	
3.00	0.990	2.755	0.271	0.20	
4.00	1.038	3.765	0.313	0.20	
5.00	3.499	7.232	0.351	0.20	
6.00	3.591	10.745	0.382	0.20	
7.00	3.684	14.350	0.410	0.20	
8.00	3.778	18.046	0.440	0.20	
9.00	3.872	21.835	0.470	0.20	
10.00	3.996	25.692	0.492	0.20	
11.00	4.123	29.710	0.520	0.20	
12.00	4.206	33.774	0.846	0.20	
12.50	4.249	35.840	1.063	0.20	
13.00	4.291	37.907	1.280	0.20	
13.50	4.340	41.328	8.230	0.20	
14.00	4.390	44.827	15.230	0.20	

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

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	0.017	
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 61

ROWS COLS ***

*** SDN-2X: DETAIN OVERFLOW FROM NCPS AND NSMPS- NOT USED

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	(MVS)	(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	0.0128	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

DEPTH (FT)	AREA (ACRES)	VOLUME (ACRE-FT)	(WS) (CFS)	(SDS) (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	0.0128	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

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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

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