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Port of Seattle

Seattle-Tacoma Airport Master Plan Update
Low Streamflow Analysis

Prepared for:
Port of Seattle
17900 International Boulevard, Suite 402
SeaTac, Washington 98188

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Bellevue, WA 98004

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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. 200th 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 12th Avenue So.	1949-1996	0.033	0.035
Walker Creek near mouth [1]	1949-1996	1.37	1.37
Des Moines Creek near So. 200th St.	1949-1996	1.08	1.64

[1] Included 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 12th Avenue So.	0.021	0.019	0.017	0.016
Des Moines Creek near So. 200th 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 12th Avenue So.	1949-1996	0.031	0.039
Des Moines Creek near So. 200th 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 12th Avenue So.	0.015	0.012	0.010	0.009
Des Moines Creek near So. 200th 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 recessional 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 evapotransporation. 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 Discharge[1]

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

[1] Miller Creek at SR 509

[2] Calculated 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 Discharge[1]

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

[1] Walker Creek near 12th Avenue South

[2] Calculated 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)

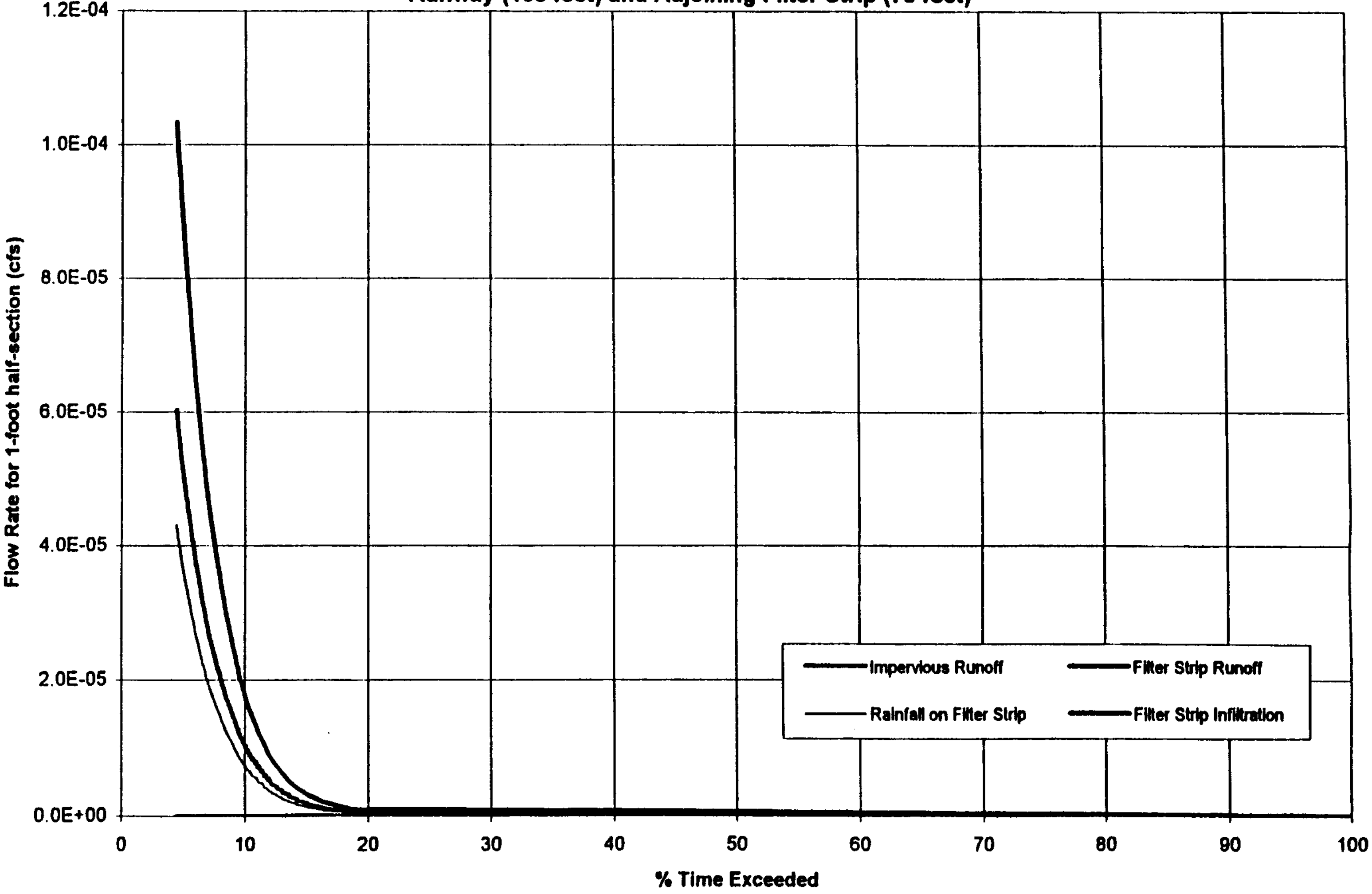


Figure 2. Annual Flow Duration Curves for a One-foot Wide Section of Taxiway (140 feet slope length) and Adjoining Filter Strip (75 feet)

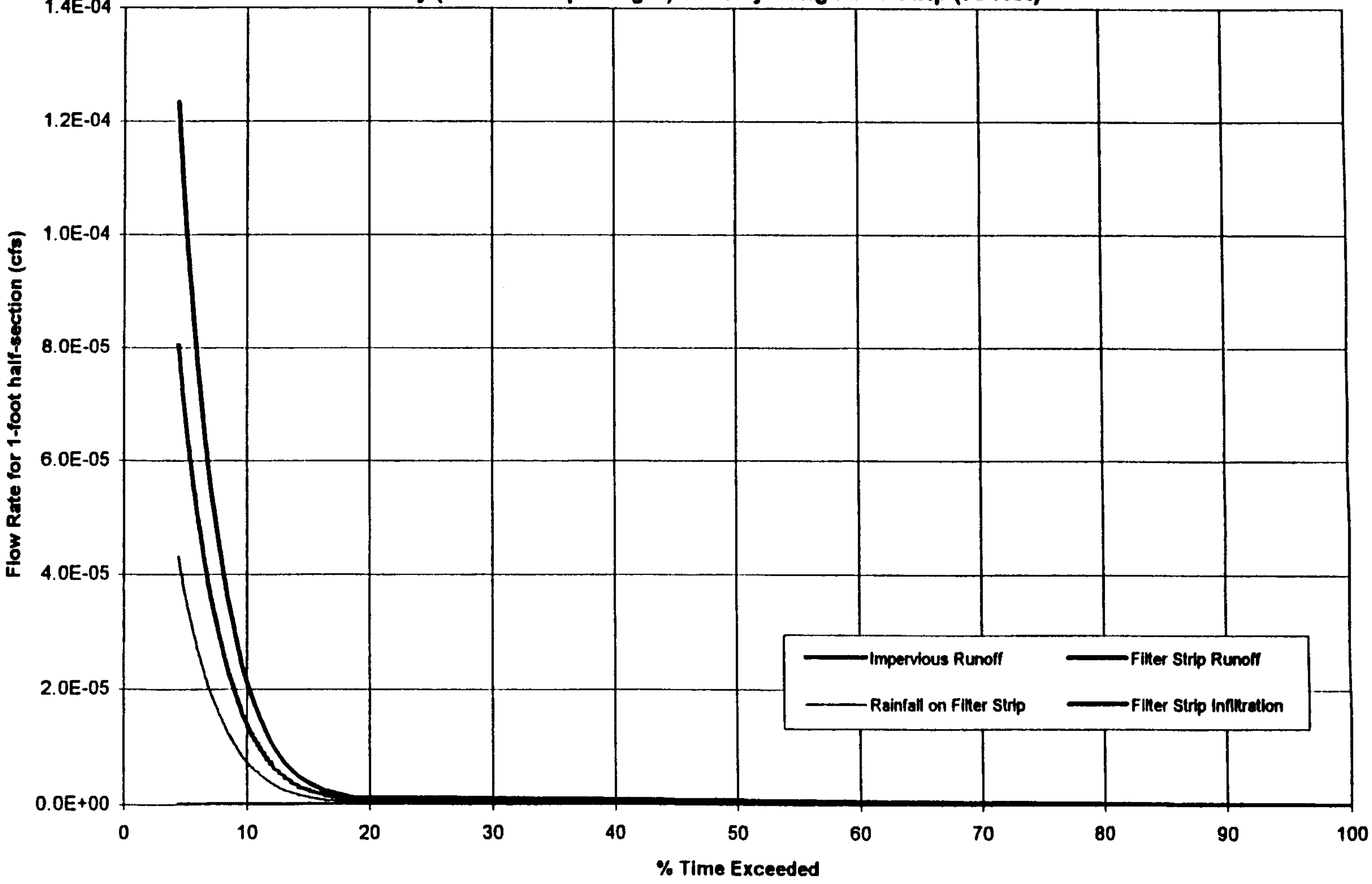
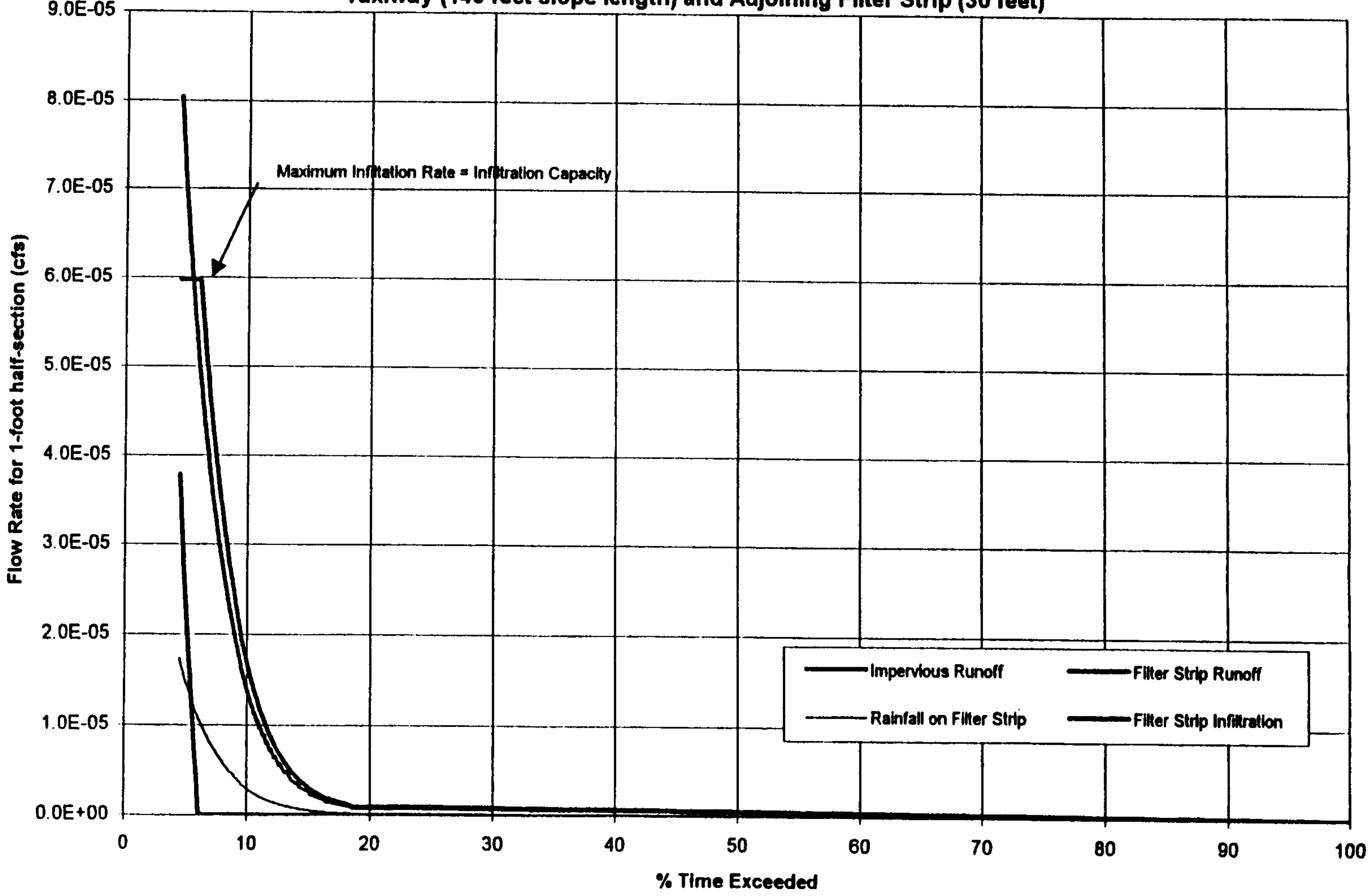


Figure 3. Annual Flow Duration Curves for a One-foot Wide Section of Connecting Taxiway (140 feet slope length) and Adjoining Filter Strip (30 feet)



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)

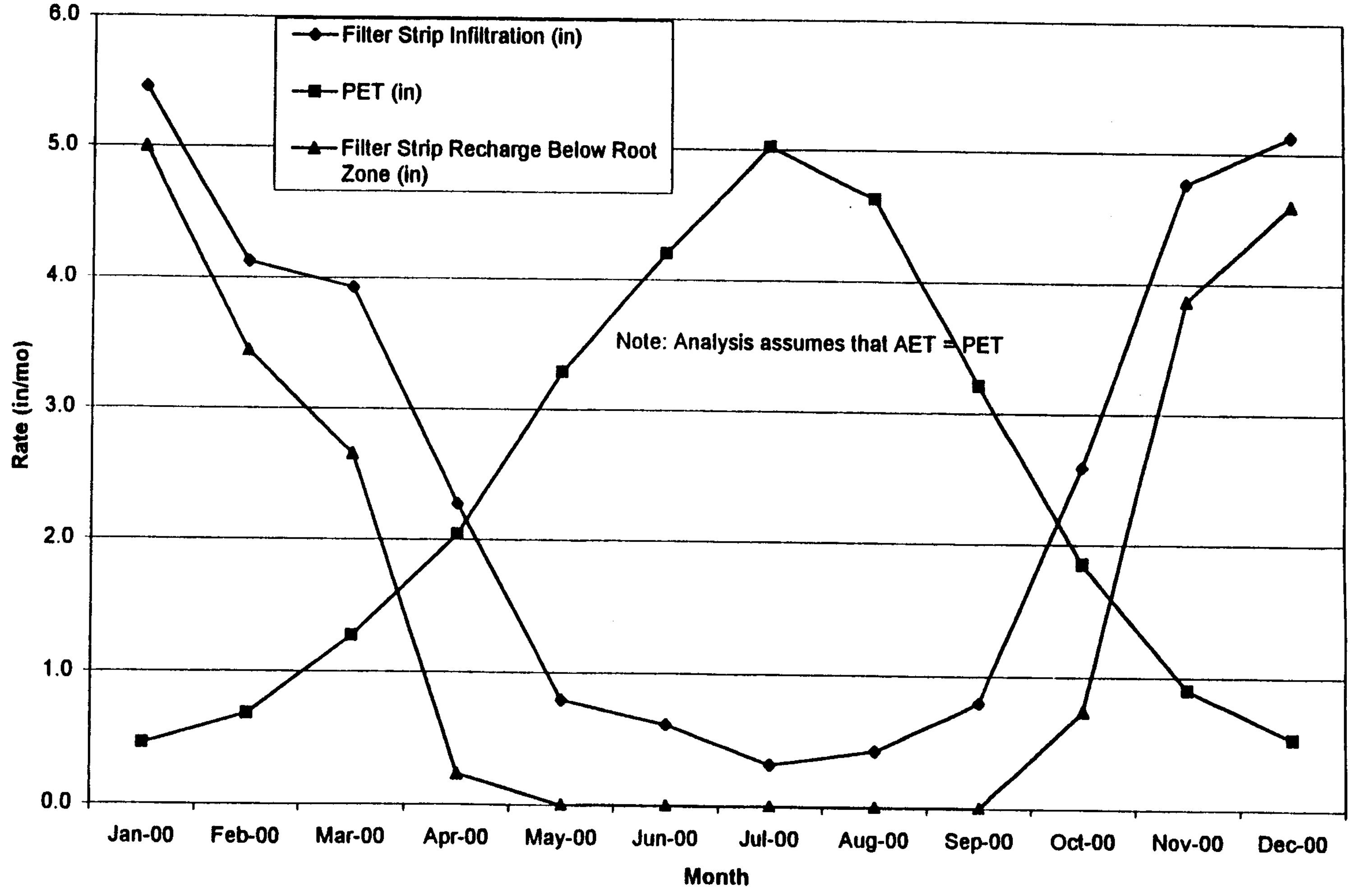


Figure 5. Predicted Infiltration, PET and Total Recharge on Taxiway Filter Strip (75 feet)

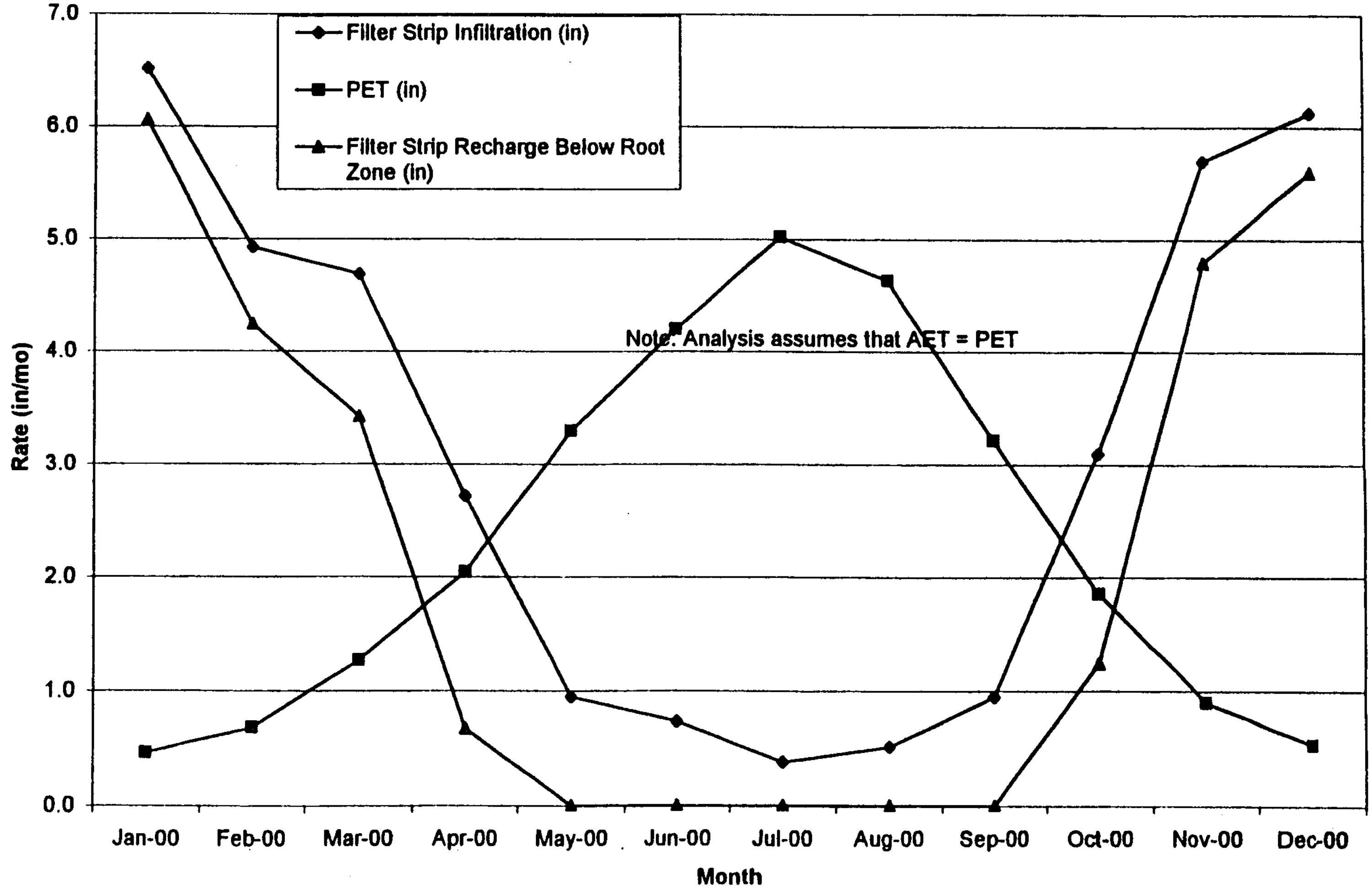


Figure 6. Predicted Infiltration, PET and Total Recharge on Connecting Taxiway Filter Strip (30 feet)

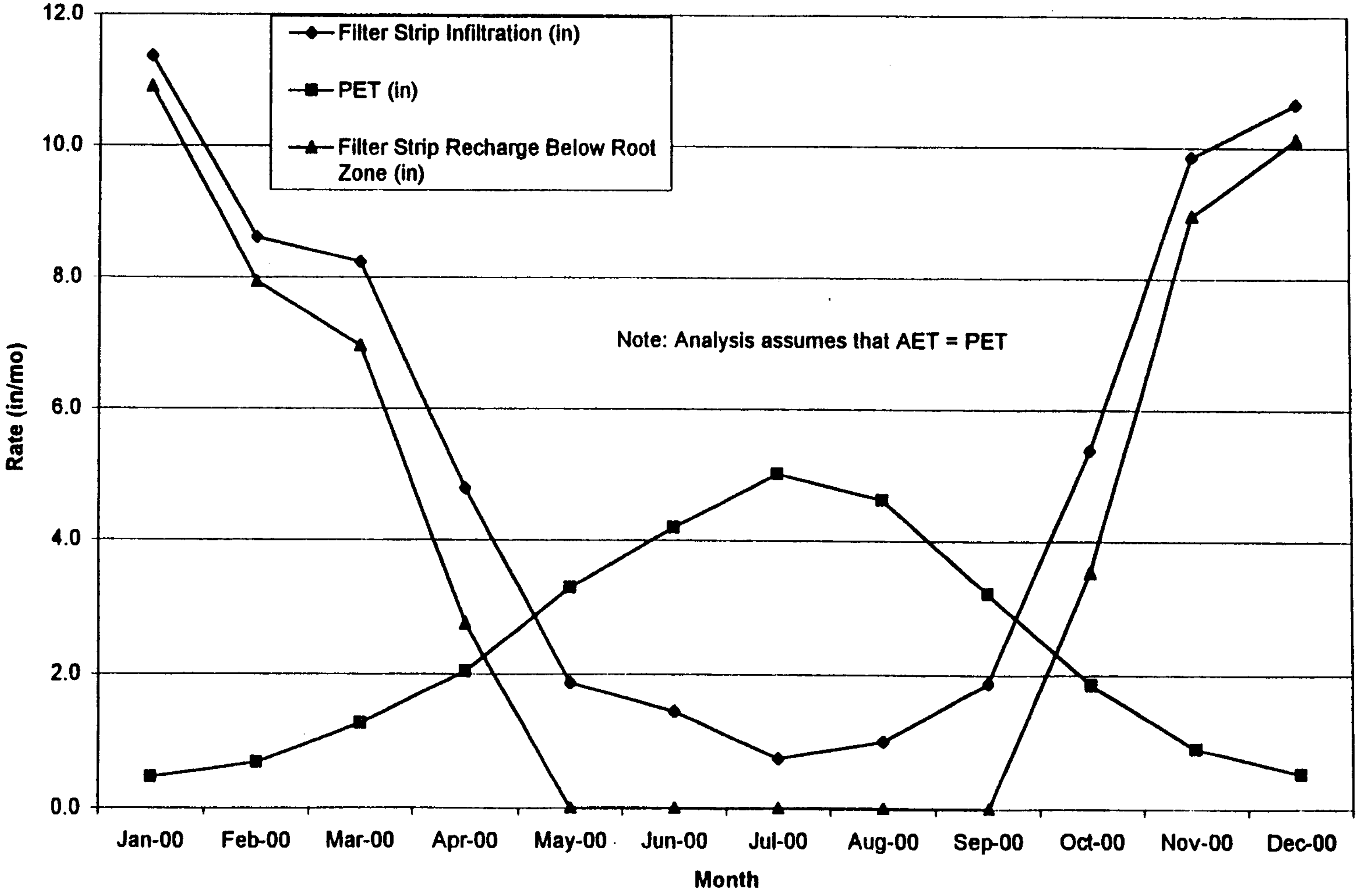


Table 9:
Miller Creek Reserved Stormwater Release Rate Determination

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**

[1] Miller Creek at SR 509

[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 and secondary impervious recharge.

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

Table 10:
Des Moines Creek Reserved Stormwater Release Rate Determination[1]

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**

[1] Des Moines Creek at South 200th Street

[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 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 cfs × 3600 seconds × 24 hours × 45 days /43,560 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

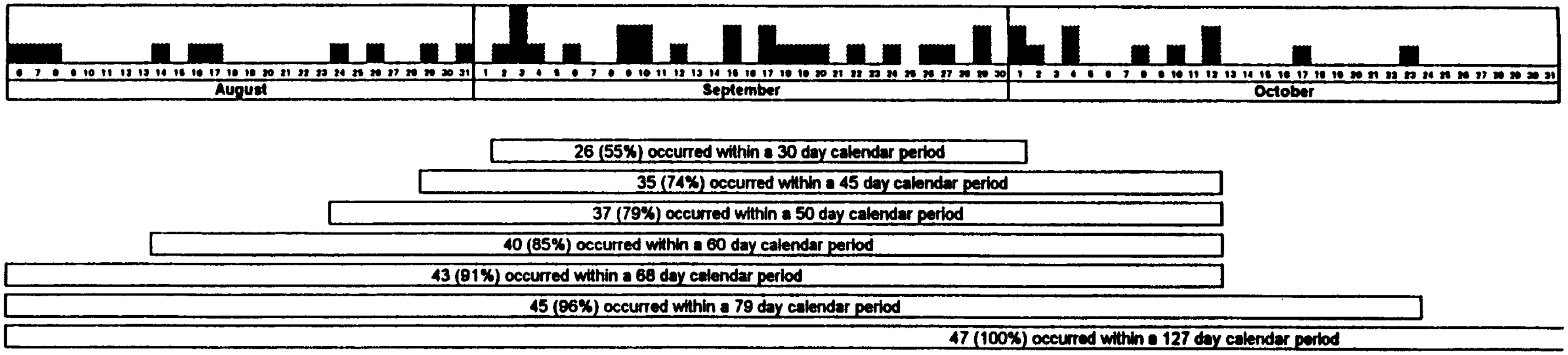


Figure 7: 7-Day Low Flow Occurrences in Miller Creek, 1949-1995

Derived from HSPF model results for proposed (2006) conditions

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

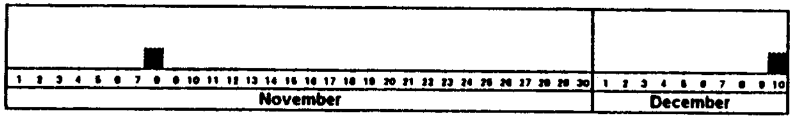
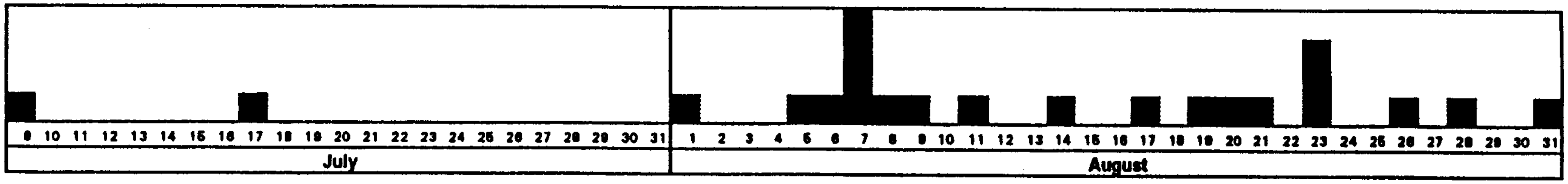


Figure 8: 7-Day Low Flow Occurrences in Des Moines Creek, 1949-1995

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

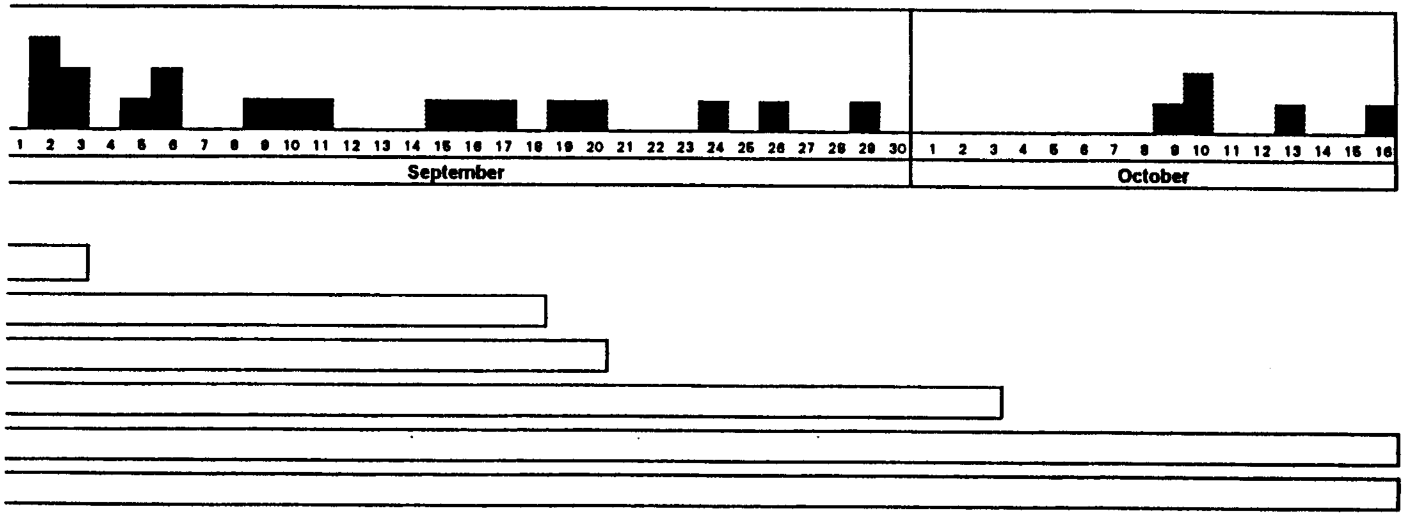
44 (94%) occurred within a 73 day calendar period

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



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 Effects[1]

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	0.065[4]	(0.04)	0.024[4]	0.10	0.79	-0-

[1] Miller Creek at SR 509

[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 12:
Summary of Walker Creek Streamflow Effects[1]

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] WalkerCreek 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 Effects[1]

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-

[1] Des Moines Creek at South 200th Street

[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 and secondary impervious recharge.

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APPENDIX A

Comparison of Pacific Groundwater and Hart Crowser Fill Modeling Approaches

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	Precipitation	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	Runoff	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	Plant ET	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	Recharge	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 articially "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 affects 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		Exerpted 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 groundater 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

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	**Aug**	**Sept**	
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	**Aug**	**Sept**	
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	6.56E-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	**Aug**	**Sept**	
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

APPENDIX C

FROM SMP (DECEMBER 2000)

APPENDIX G

TABLE OF CONTENTS

LIST OF TABLES

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 (Qi)	Quantity (Qa)	Acres	Parcel	Tax ID.	Site Address	First Name	Owner's Last Name
<u>RESIDENTIAL PROPERTIES</u>									
	121806 (Lora Lake)	—	—	—	050R	202304-9347	15016 Des Moines Memorial Dr.	William F.	Elsminger
	96247 (Miller Creek)	20 gpm	6.1 acft	1	143R	202304-9090	15818 Des Moines Memorial Dr.	David P. & Frances	Brale
	14424 (Miller Creek)	20 gpm	3 acft	1	214R	725120-0015	15914 Des Moines Memorial Dr.	Karla A.	Kamp, Martin D. Martinez & Theresa
	106684 (Miller Creek)	—	—	—	068R	369680-0015	15419 9th Place S.	Helen V.	Goodmansen
	115026 (Miller Creek)	—	—	—	185R	725120-0045	15823 9th Ave. S.	Carl M. & Nanny E.	Berry
	160107 (Miller Creek)	120 gpm	1 acft	0.6	087R	202304-9071	15454 Des Moines Memorial Dr.	Roy C.	Smith
	117634 (Miller Creek)	15 gpm	1.5 acft	0.75	142R	947530-0010-0100	15800 Des Moines Memorial Dr.		Wind of the Willows Condos
s1-20949c (Miller Creek)		0.01 cfs	1.0 acft		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.	Rholon
	42012 (Miller Creek)	20 gpm	1.0 acft	0.75	321R	384660-0115	16616 8th Ave. S.	Commander F.X.	Beaudin II
	41157 (Miller Creek)	—	—	—	298R	292304-9198	849 S. 164th St.	Lee & Bonnie J.	Warner
	112315 (Miller Creek)	10 gpm	2.0 acft	0.5	253R	384660-0060	632 S. 168th St.	Pegi	Kobela
	137915 (Miller Creek)	20 gpm	1.0 acft	0.75	246R	384660-0035	16483 8th Ave. S.	John & Joseph	Galando
	14425 (Miller Creek)	5 gpm	1.0 acft	1	182R	202304-9426	actual: 15836, closest: 15820 Des Moines Memorial Dr.	Paul R.	Ilies
s1-04903c (Miller Creek)		0.01 cfs	—	0.25	316R	384660-0125	raw land	Richard H./Bette M.	Roullard/Markley
s1-04904c (Miller Creek)		0.01 cfs	—	0.50 ac	244R	384660-0030	16609 8th Ave. S.	Earl D.	Randall & Vearl Sandback
s1-08355c (Miller Creek)		0.01 cfs	—	—	302R	292304-9270	16429 12th Ave. S.	Alfredo & Roberta	Lopez

Total water use: Assume 17 certificates/claims at minimum rate of 0.01 cfs each, assuming only 50% are continuously active.
$Q = 17 * 0.01\ \text{cfs} * 50\% = 0.09\ \text{cfs}$

Water Right Certificate	Water Right Claim	Rate (Qi)	Quantity (Qa)	Acres	Parcel	Tax ID.	Site Address	First Name	Owner's Last Name
<u>FARM PROPERTIES</u>									
	55350 (Miller Creek)	25 gpm (not used)	7 acft (not used)	3.5	083R	202304-9229	15416 Des Moines Memorial Dr.	attn: Ray Rosatto	RST Enterprises (Nick Raffo)
	none (city water)				055R	202304-9068	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	202304-9099	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)
$Q = 5.2\ \text{acres} * 0.008\ \text{cfs/acre} = 0.04\ \text{cfs}$

<u>**TOTAL WATER USE TO BE RELINQUISHED INSIDE ACQUISITION AREA = 0.13 CFS**</u>

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 Useage 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	Roullard	0	0.25			0.000	1940-60 Maximum, 1990's No Water Usage
050R	1	Eisiminger	0				0.000	None to very little
246R	1	Galando	0	0.75			0.000	Unknown - doesn't remember dad 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	Brate	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	Roullard	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		Goodmansen		?			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

APPENDIX D

HSPF Model Input and Results For Low Streamflow Conditions

Parametrix, Inc. *Consultants in Engineering and Environmental Sciences*
5808 Lake Washington Blvd. NE, Suite 200, Kirkland, WA 98033-7350
425-822-8880 • Fax: 425-889-8808

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.

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, <u>average annual baseflow from pervious land segments</u> 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 <u>August through September</u> 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.

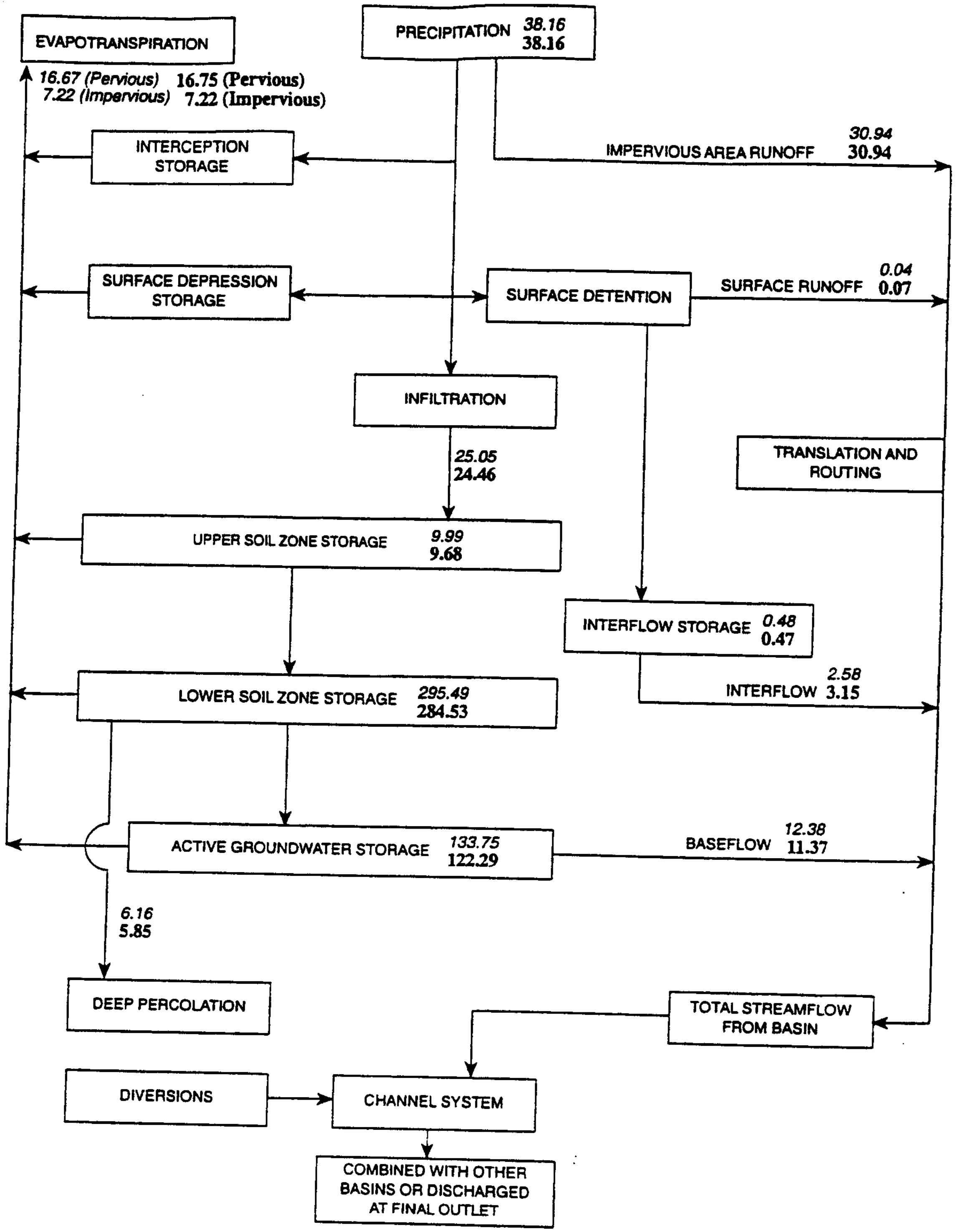
The average annual AGWO change from various pervious land segments in the Miller Creek watershed was calculated using the unit AGWO values obtained from the Hydrocomp analysis. This provided a second method for verifying the results of the HSPF model results. Table 5 indicates that in addition to the 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

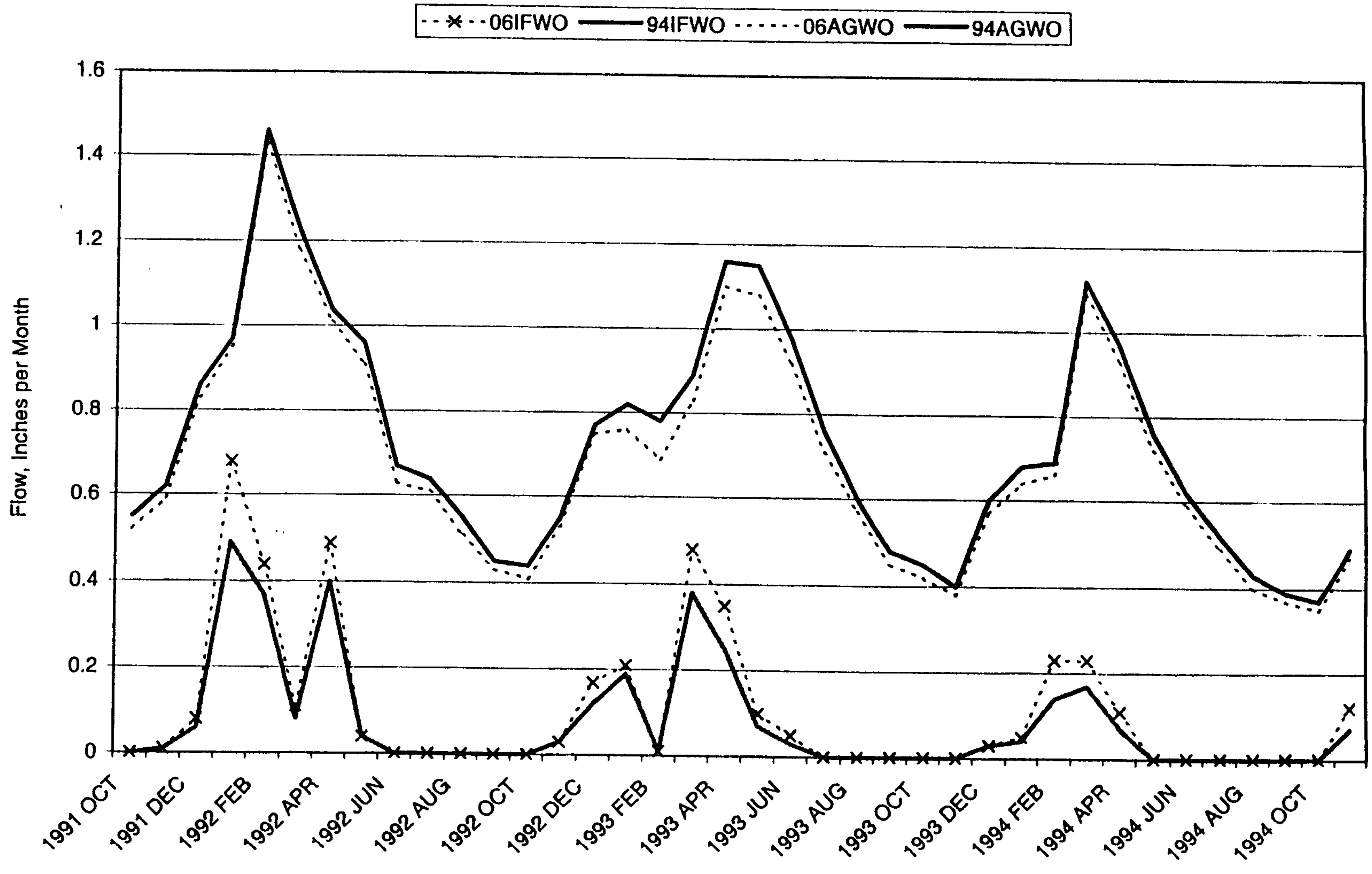


Figure 4. Miller Creek at SR509

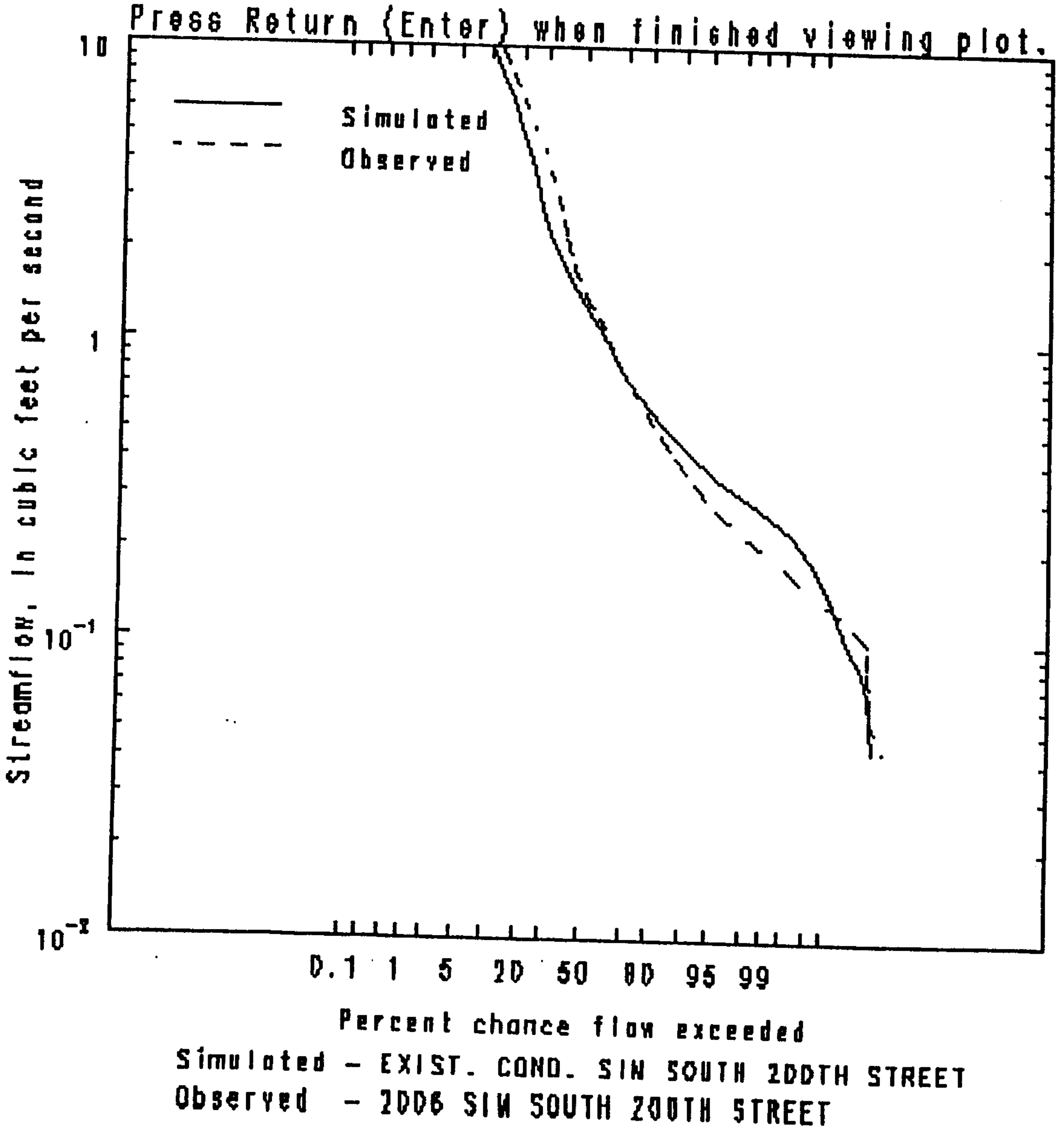

Press Return (Enter) when finished viewing plot.
Simulated
Observed
Streamflow, in cubic feet per second
10
1
10^{-1}
10^{-2}
0.1
1
5
20
50
80
95
99
Percent chance flow exceeded
Simulated - EXIST. COND. SIW SOUTH 200TH STREET
Observed - 2006 SIW SOUTH 200TH STREET

FIGURE 5

Figure 6. Flow Duration, All Seasons

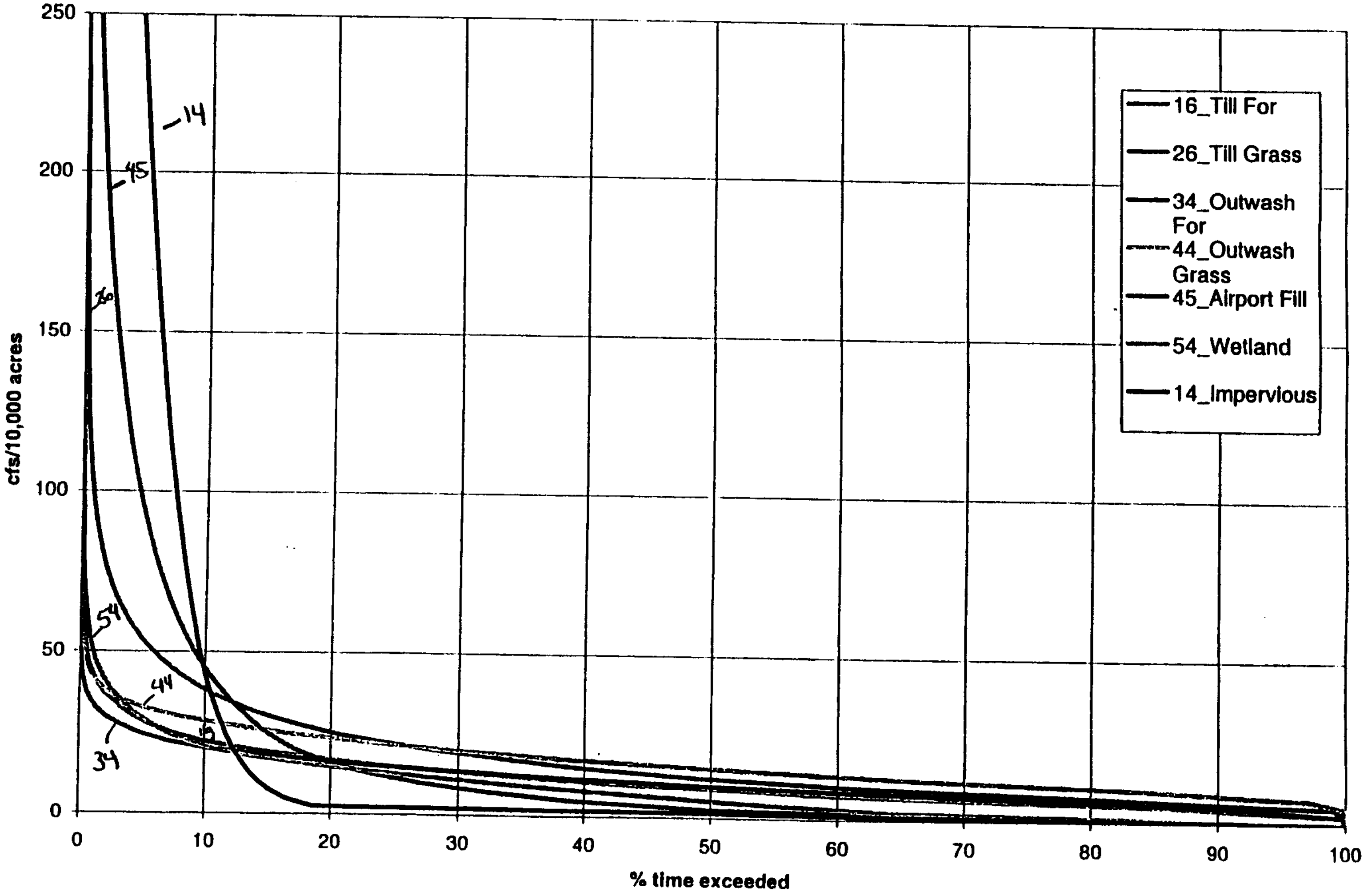


Figure 7. Flow Duration, August

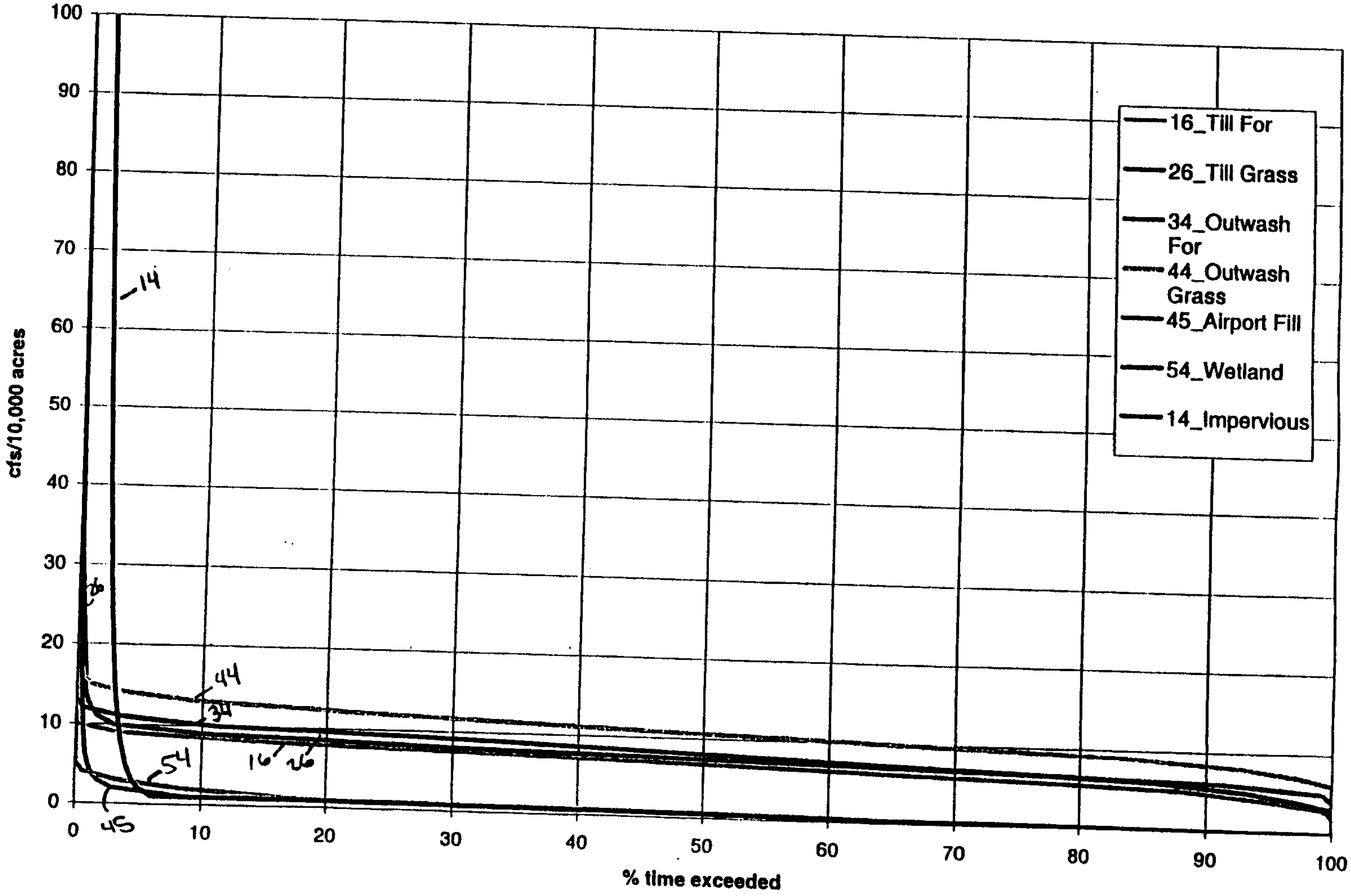


Figure 8. Flow Duration, September

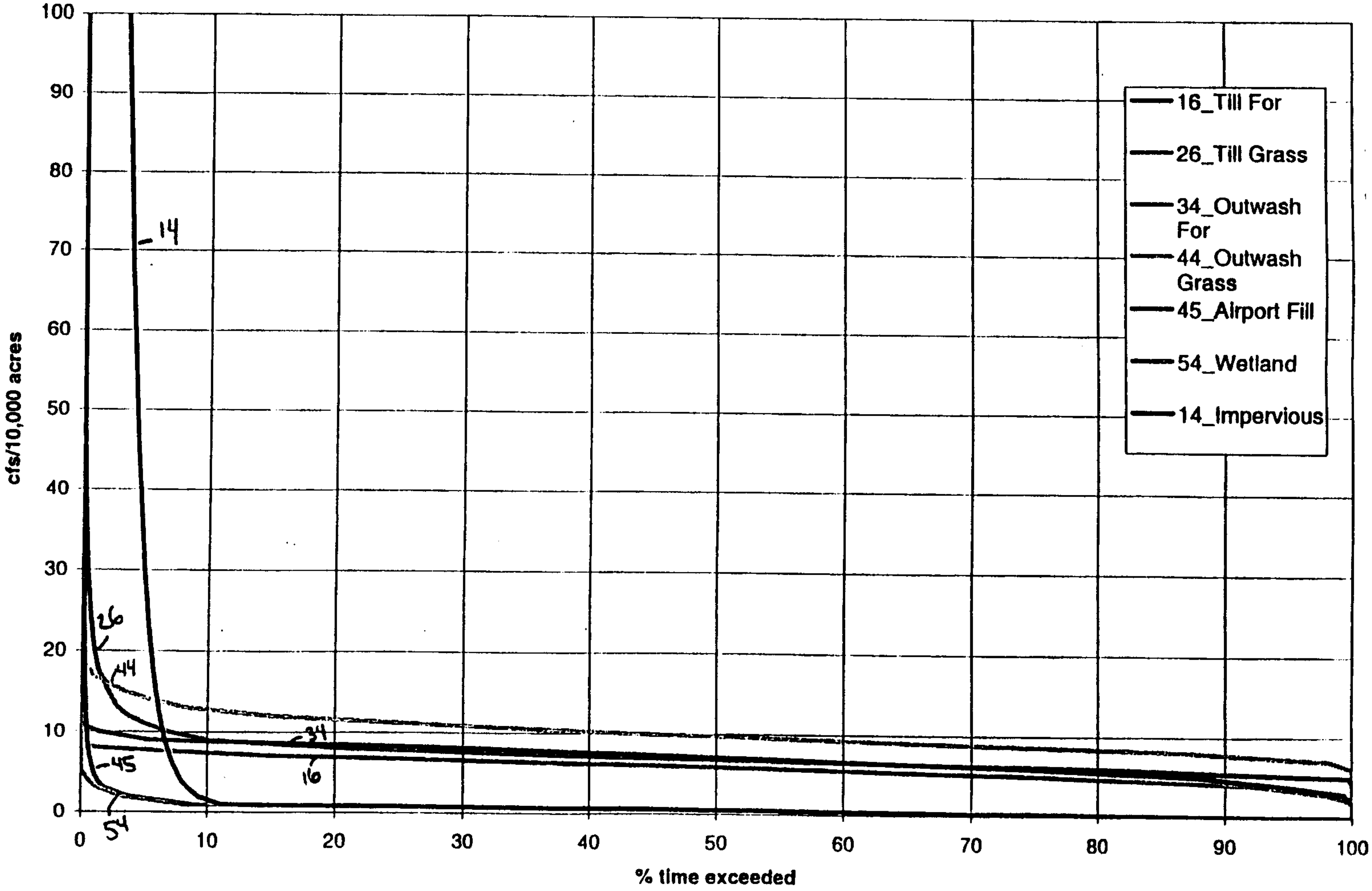


Table 1. Calibration values for selected HSPF parameters. (moderate slope)

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	
DEEPFR	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	Contributing Pervious	
AVG,cfs	1.386	1.250			1994 acres	2006 acres
AVG,inch			0.584	0.528	1668.42	1528.71
AVG,cfs			0.671	0.556		

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

Data-set	29	109	57	53
Data-set	FLOW CFS	FLOW CFS	AGWO INCHES	AGWO 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	Contributing Pervious area:	
AVG,cfs	0.034	0.035			1994 acres	2006 acres
AVG,inch			0.437	0.448	41.29	35.09
AVG,cfs			0.012	0.011		

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	Contributing Pervious	
AVG,cfs	1.364	1.399			1994 acres	2006 acres
AVG,inch			0.386	0.389	1323.27	1141.65
AVG,cfs			0.352	0.306		

Table 5. Area changes from 1994 base flow to 2006 - Miller/Walker Creeks (acres)

		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
	Lake						-0.03	-0.02							
	Mcrk-df														
16	Till forest													-8.77	-0.02
26	Till grass		-0.37	-0.03	-0.1			-0.06		2.03	1.17	-0.17	-7.04	-21.47	
34	Outwash forest				-3.07	-1.82	0.23							-8.78	0.02
44	Outwash grass	-0.01	0.41	-0.03	-1.21	-0.12	-2.96	2.72	0.54	1.25	0.2	0.01		7.6	
45	Fill			0.02	2.22	1.07	4.23		0.09						
54	Wetland				-0.11	-0.43	-2.74	-0.16	-0.09	-0.27	-0.02				
	Pervious	-0.01	0.04	-0.04	-2.27	-1.3	-1.24	2.5	0.54	3.01	1.35	-0.16	-7.04	-31.42	0
14	Impervious	0.01	-0.04	0.03	2.27	1.31	1.27	-2.48	-0.54	-3.02	-1.35	0.16	7.04	31.42	
	Fill	0.00	0.00	0.02	2.22	1.07	4.23	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00
	Other pervious	-0.01	0.04	-0.06	-4.49	-2.37	-5.47	2.50	0.45	3.01	1.35	-0.16	-7.04	-31.42	0.00
	Impervious	0.01	-0.04	0.03	2.27	1.31	1.27	-2.48	-0.54	-3.02	-1.35	0.16	7.04	31.42	0.00
		SDN-1	SDN1-LWR	SDN1-OFF	SDN-2X	SDN-3	SDN-3A	SDN-3X	SDN-4	SDN-4X	IWS-NCPS	IWS-NSMPS	SDW-1A	SDW-1B	SDW-2
	Lake														
	Mcrk-df														
16	Till forest							-0.65							
26	Till grass	-1.78		2.53	-0.74	-9.8	-5.07	-5.33	-8.73	-0.84	-2.15	-1.02	-19.82	-36.01	-10.96
34	Outwash forest						-9.12	-12.2		-1.22					
44	Outwash grass	-1	-0.19	-0.07	-2.18		-14.1	-5.01	-1.89	-9.41		-0.9	-24.2	-25.13	-0.81
45	Fill				0.98		22.12	23.77	0.99	8.31		0.01	32.44	46.26	6.7
54	Wetland						-0.19	-0.57					-2.96	-7.73	-1.13
	Pervious	-2.78	-0.19	2.46	-1.94	-9.8	-6.36	0.01	-9.63	-3.16	-2.15	-1.91	-14.54	-22.61	-6.2
14	Impervious	2.78	0.19	-2.46	1.94	9.8	6.35		9.64	3.16	2.15	1.91	14.54	22.61	6.2
	Fill	0.00	0.00	0.00	0.98	0.00	22.12	23.77	0.99	8.31	0.00	0.01	32.44	46.26	6.70
	Other pervious	-2.78	-0.19	2.46	-2.92	-9.80	-28.48	-23.76	-10.62	-11.47	-2.15	-1.92	-46.98	-68.87	-12.90
	Impervious	2.78	0.19	-2.46	1.94	9.80	6.35	0.00	9.64	3.16	2.15	1.91	14.54	22.61	6.20
	Total Fill Change		149.21												
	Total Pervious Change		-114.84												
	Total Impervious Change		114.89												

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
													0.00
16	Till forest		-0.07	-0.01						-2.76			-2.84
26	Till grass	-1.10		-0.11	-10.61	0.46	-21.22	-28.08	-2.37	2.82	-3.79	1.08	-62.92
34	Outwash forest								-0.14	-4.06			-4.20
44	Outwash grass			-0.04					-10.80	4.46			-6.38
45	Fill												0.00
54	Wetland	-0.09		-0.01									-0.10
	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
	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
		SDS-7	SASA	IWS-NSPS		IWS-SASA	Subtotal						
	sasa-df												
16	Till forest		-22.79			-36.57	-59.36						
26	Till grass	-32.57	-1.74	-0.01		-9.97	-44.29						
34	Outwash forest		-0.23			-0.24	-0.47						
44	Outwash grass	-0.66	-0.01			-3.58	-4.25						
45	Fill	5.48					5.48						
54	Wetland	-0.39	-0.54			-1.33	-2.26						
	Pervious	-28.14	-25.31	-0.01		-51.69	-105.15						
	Impervious	28.14	25.31	-0.04		51.78	105.19						
	Fill	5.48	0.00	0.00		0.00	5.48						
	Other pervious	-33.62	-25.31	-0.01		-51.69	-110.63						
	Impervious	28.14	25.31	-0.04		51.78	105.19						
	sasa-df	0.00	0.00	0.00		0.00	0.00						
	Total Pervious Change	-181.59											
	Total Impervious Change	173.83											
	SASA detention facility	7.77											

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

	IMPLND	PERLND	PERLND	PERLND	PERLND	PERLND	PERLND
Month	[illegible]	6	26	34	24	5	54
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

To convert from depth to flow
factor= 0.00012

Avg Ann AGWO (inches)		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
		Subbasin Area Changes In Acres													
9.788	16 Till forest													-8.77	-0.02
11.495	26 Till grass		-0.37	-0.03	-0.1			-0.06		2.03	1.17	-0.17	-7.04	-21.47	
10.134	Outwash 34 forest				-3.07	-1.82	0.23							-8.78	0.02
15.019	Outwash 44 grass	-0.01	0.41	-0.03	-1.21	-0.12	-2.96	2.72	0.54	1.25	0.2	0.01		7.6	
3.819	45 Fill			0.02	2.22	1.07	4.23		0.09						
6.189	54 Wetland				-0.11	-0.43	-2.74	-0.16	-0.09	-0.27	-0.02				
		Change in baseflow (cfs) as a result of change in pervious to new pervious or impervious area													
0	14 Imperviou	-0.00002	0.00022	-0.0001	-0.00686	-0.00311	-0.00919	0.00489	0.00104	0.00504	0.00191	-0.00024	-0.00931	-0.06165	-0.00005
													Total STIA	-0.07743	

Avg Ann AGWO (inches)		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
		Subbasin Area Changes In Acres													
9.788	16 Till forest							-0.65							
11.495	26 Till grass	-1.78		-2.53	-0.74	-9.8	-5.07	-5.33	-8.73	-0.84	-2.15	-1.02	-19.82	-36.01	-10.96
10.134	Outwash 34 forest						-9.12	-12.2		-1.22					
15.019	Outwash 44 grass	-1	-0.19	0.07	-2.18		-14.1	-5.01	-1.89	-9.41		-0.9	-24.2	-25.13	-0.81
3.819	45 Fill				0.98		22.12	23.77	0.99	8.31		0.01	32.44	46.26	6.7
6.189	54 Wetland						-0.19	-0.57					-2.96	-7.73	-1.13
		Change in baseflow (cfs) as a result of change in pervious to new pervious or impervious area													
0	14 Imperviou	-0.00408	-0.00033	0.00347	-0.00518	-0.01296	-0.05156		-0.01537	-0.02245	-0.00284	-0.00291	-0.0844	-0.11689	-0.01965
													Total SDS	-0.31551	-0.020

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

Total Miller -0.393
Total Walker -0.020

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PROJECT POS STORMWATER JOB NO ____
BY RD DATE 11/27/00 CHECKED ____ DATE ____ SHEET ____ OF ____

ATTACHMENT I

MILLER CK @ SR 509 - SUMMARY LOW FLOW STATISTICS

AVERAGE NUMBER DAYS	RETURN INTERVAL YEARS	CFS 1994	2006	DIFFERENCE (1994-2006)	(GPM)
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	0.490	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

Parametrix, Inc.

PROJECT POS STORMWATER JOB NO ______

BY JRD DATE 11/4/00 CHECKED ______ DATE ______ SHEET ____ OF ____

ATTACHMENT II

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

		CFS			GPM
AVERAGE NUMBER DAYS	RETURN INTERVAL YEARS	1994	2006	DIFFERENCE (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

PROJECT POS STORMWATER JOB NO ______
BY JRD DATE 11/22/00 CHECKED ______ DATE ______ SHEET ____ OF ____

ATTACHMENT III

DES MOINES CK @ S. 200TH ST. - LOW FLOW STATISTICS

		CFS			
AVERAGE NUMBER DAYS	RETURN INTERVAL YEARS	1994	2006	DIFFERENCE (1994-2006)	(GPM)
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

Parametrix, Inc. *Consultants in Engineering and Environmental Sciences*
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425-822-8880 • Fax: 425-889-8808

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

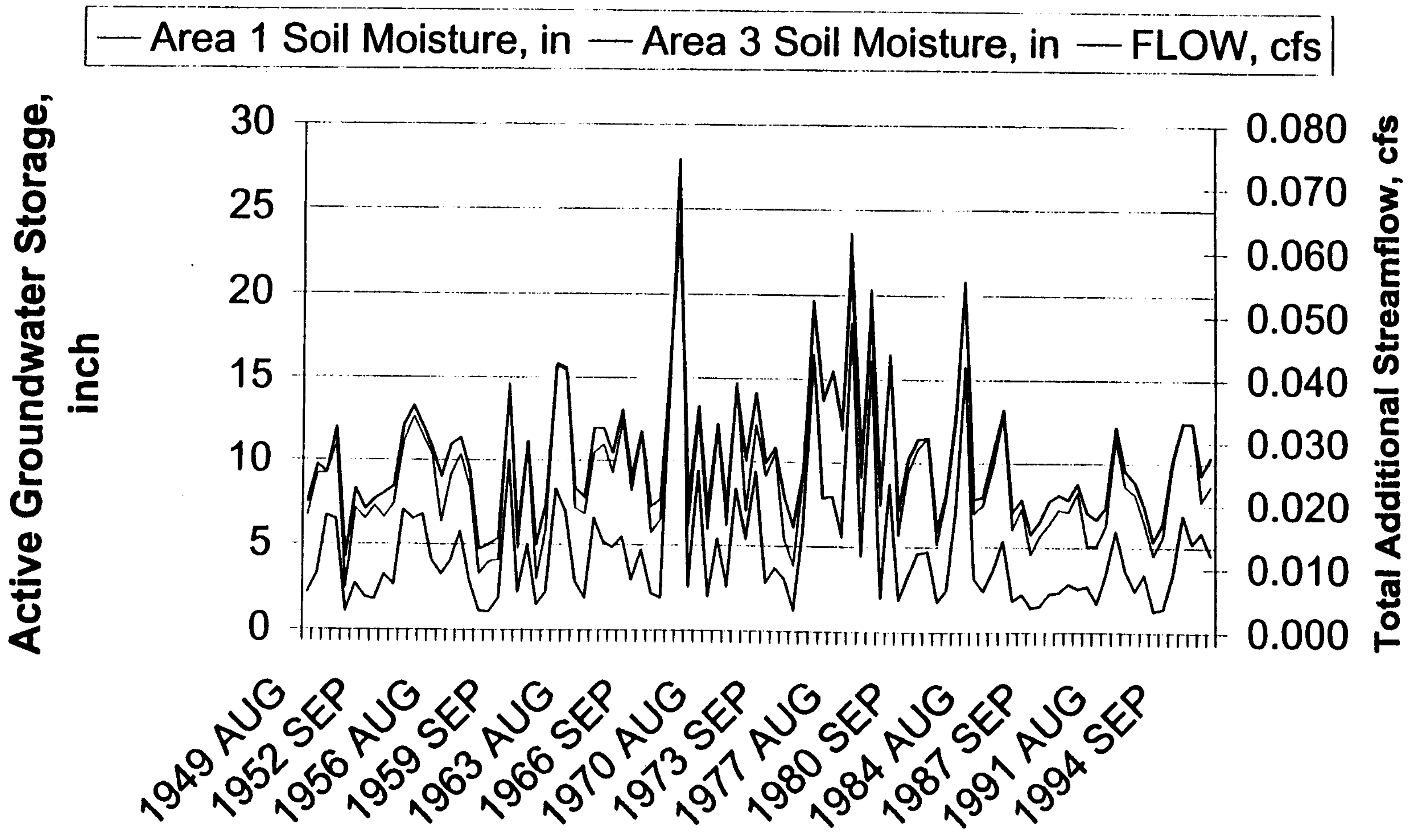

FIGURE 3.

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PROJECT POS STORMWATER JOB NO

BY dRD DATE 12/10/00 CHECKED DATE SHEET OF

ATTACHMENT I-REVISED

MILLER CK @ SR 509 - SUMMARY LOW FLOW STATISTICS

AVERAGE NUMBER DAYS	RETURN INTERVAL 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

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 Paramatrix

```
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 <--
```

```
    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 Engl Metr         ***
                           in  out               ***
  16    TFM- TILL FOR MOD     1   1   1   1  61   0
  26    TGM- TILL GR MOD     1   1   1   1  61   0
  34    OF - OUTWASH FOR      1   1   1   1  61   0
  44    OG - OUTWASH GR      1   1   1   1  61   0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
  45    AIRPORT FILL        1   1   1   1  61   0
  47    OG - INFILTRATION 1   1   1   1   1  61   0
  54    SA - WETLANDS       1   1   1   1  61   0
  57    OG - INFILTRATION 3   1   1   1   1  61   0
 END GEN-INFO
 ACTIVITY
  <PLS > ************* Active Sections *****************************
  #- # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC      ***
  14 200   0   0   1   0   0   0   0   0   0   0   0   0
 END ACTIVITY
 PRINT-INFO
  <PLS > ********************* Print-flags ************************* PIVL  PYR
  #- # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
  14 200   0   0   5   0   0   0   0   0   0   0   0   0   1   9
 END PRINT-INFO
 PWAT-PARM1
  <PLS > ***************** Flags ********************
  #- # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE              ***
  14 200   0   0   0   0   0   0   0   0   0
 END PWAT-PARM1
 PWAT-PARM2
  <PLS > ***
  #- # ***FOREST    LZSN   INFILT    LSUR    SLSUR    KVARY    AGWRC
  16            9.0000   0.3200   400.00   0.1000   0.5000   0.9960
  26            9.0000   0.1200   400.00   0.1000   0.5000   0.9960
  34           10.0000   2.0000   400.00   0.0500   0.3000   0.9960
  44           10.0000   0.8000   400.00   0.0500   0.3000   0.9960
  45            7.5000   0.0200   300.00   0.0700   0.0000   0.9000
  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   DEEPFR   BASETP   AGWETP
  16                 2.0000   2.0000    0.33     0.00     0.0
  26                 2.0000   2.0000    0.33      0.       0.
  34                 2.0000   2.0000    0.33     0.00     0.0
```

```
  44               2.0000  2.0000   0.33    0.     0.
  47               2.0000  2.0000   0.33    0.     0.
  45               2.0000  2.0000   0.33    0.     0.
  54               10.000  2.0000   0.33    0.     0.7
  57               2.0000  2.0000   0.33    0.     0.
 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 Engl Metr            ***
                          in  out                     ***
 14     IMPERVIOUS          1    1    1   60   0
 END GEN-INFO
 ACTIVITY
  <ILS > ************** Active Sections ****
  # - # ATMP SNOW IWAT  SLD  IWG IQAL  ***
 14       0   0   1   0   0   0
 END ACTIVITY
 PRINT-INFO
  <ILS > ******** Print-flags ******** PIVL  PYR
  # - # ATMP SNOW IWAT  SLD  IWG IQAL **********
 14       0   0   6   0   0   0   1   9
 END PRINT-INFO
 IWAT-PARM1
  <ILS >        Flags         ***                   ***
  # - # CSNO RTOP  VRS  VNN RTLI   ***                      ***
 14       0   0   0   0   0
 END IWAT-PARM1
 IWAT-PARM2
  <ILS >                                        ***
  # - #    LSUR    SLSUR    NSUR    RETSC                   ***
 14      100.00  0.0100  0.1000  0.1000
 END IWAT-PARM2
 IWAT-PARM3
  <ILS >                                        ***
  # - #   PETMAX   PETMIN                              ***
 14
 END IWAT-PARM3
 IWAT-STATE1
  <ILS >  IWATER state variables                          ***
  # - #     RETS     SURS                           ***
 14     1.0000E-3 1.0000E-3
END IWAT-STATE1
```

```
END IMPLND
                                              ***
EXT SOURCES
                                              ***
*** NOTE: The only RCHRES that precip and PET are applied to are lakes and ponds
*** FOLLOWING RCHRES ARE PONDS: 57, 247, 237
                                              ***
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #  #       <Name> # #  ***
*** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
WDM  1002 PREC    ENGLZERO  1.00      PERLND  14 200 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
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*** 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
***INFILTRATION FLOW
  ***  --> output SDW1A infiltration discharge to WDM dataset 3 <--
  ***  --> convert acft to in/ac, assuming reinfiltrate to 2 ac <--
COPY    47 OUTPUT MEAN   1 1  6        WDM     5 FLOW    ENGL     REPL
  ***  --> output SDW1B infiltration discharge to WDM dataset 4 <--
  ***  --> convert acft to in/ac, assuming reinfiltrate to 2 ac <--
COPY    57 OUTPUT MEAN   1 1  6        WDM     6 FLOW    ENGL     REPL
END EXT TARGETS

SCHEMATIC
<-Source->              <--Area-->   <-Target->  MBLK  ***
<Name>  #               <-factor->   <Name>  #  Tbl#  ***
 *** SUB-CATCHMENT 1 all agwo goes to sound
PERLND  16                  3.41    RCHRES  1    6
PERLND  26                232.36    RCHRES  1    6
PERLND  34                  3.07    RCHRES  1    6
PERLND  44                 38.03    RCHRES  1    6
PERLND  54                  3.87    RCHRES  1    6
IMPLND  14                 56.14    RCHRES  1    2
 *** SUB-CATCHMENT 2 10% of area GW goes to vaca 90% goes to sound
PERLND  16                  5.56    RCHRES  2    6
PERLND  26                200.05    RCHRES  2    6
PERLND  34                  0.46    RCHRES  2    6
PERLND  44                 38.71    RCHRES  2    6
PERLND  16                  0.56    RCHRES 135   7
PERLND  26                 20.00    RCHRES 135   7
PERLND  34                  0.05    RCHRES 135   7
PERLND  44                  3.87    RCHRES 135   7
IMPLND  14                 42.22    RCHRES  2    2
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 *** 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
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
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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
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 *** 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>  #   Tbl#  ***
 *** 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            ***
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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> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>       <-MEMBER->
<NAME>  # <NAME>   TEM STRG<-FACTOR->STRG <NAME>  #  # <-GRP> <NAME> # # ***
END NETWORK
                                              ***
RCHRES
 GEN-INFO
  RCHRES     Name      Nexits  Unit Systems  Printer            ***
  # -  #<-------------><---> User T-series  Engl Metr LKFG      ***
                          in  out                  ***
  1    Arbor Lake  M 1      2   1   1   1  62   0   0
  2    Arbor Ck -03710 M 2    1   1   1   1  62   0   0
  3    Arbor Ck   M 3      1   1   1   1  62   0   0
  4    Tub Lake   M 4      2   1   1   1  62   0   0
  5    Miller Ck SR518 M5     1   1   1   1  62   0   0
 10     Trib (0371G)   M 10    1   1   1   1  62   0   0
 11     M11 Ambaum Detention    1   1   1   1  62   0   0
 12     Trib(0354)  M 12     1   1   1   1  62   0   0
 13     Burien Lake M 13      2   1   1   1  62   0   0
 14     Trib (0353) M 14     1   1   1   1  62   0   0
 15     M/S U/S OF 17        1   1   1   1  62   0   0
 16     U/S OF 15 M/S        1   1   1   1  62   0   0
 17     GAGE               1   1   1   1  62   0   0
 23     BASIN M23           2   1   1   1  62   0   0
 24     BASIN M24           1   1   1   1  62   0   0
 33     detention m3        1   1   1   1  62   0   0
 34     LORA LAKE           2   1   1   1  62   0   0
 35     D/S OF VACA FARM       1   1   1   1  62   0   0
 37     sdn3ai vault        1   1   1   1  62   0   0
 38     MC basins           1   1   1   1  62   0   0
***  39    SDN3A/SDW1A POC       1   1   1   1  62   0   0
 43     sdn3 pond           1   1   1   1  62   0   0
***  44    sdn4 pond          1   1   1   1  62   0   0
 45     nepl poc          1   1   1   1  62   0   0
 46     cargo pond          1   1   1   1  62   0   0
```

```
 47   sdw1a infiltration   2   1   1   1  62   0   0
 50   sr 518             1   1   1   1  62   0   0
 51   SDN2X+SDN4X          1   1   1   1  62   0   0
 52   U/S OF LAKE REBA      1   1   1   1  62   0   0
 53   Reba outflow       1   1   1   1  62   0   0
 54   Miller RDF outflow   1   1   1   1  62   0   0
 57   sdw1b pond         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-nsmps          2   1   1   1  62   0   0
247   sdw1a pond g        2   1   1   1  62   0   0
257   sdw1b infiltration   2   1   1.  1  62   0   0
451   nepl VAULT           1   1   1   1  62   0   0
452   nepl VAULT           1   1   1   1  62   0   0
552   SDN1 POC              1   1   1   1  62   0   0
645   nepl POC           1   1   1   1  62   0   0
END GEN-INFO

ACTIVITY
 RCHRES *************** Active Sections *****************
 # - # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG              ***
 1 999  1   0   0   0   0   0   0   0   0   0
END ACTIVITY

PRINT-INFO
 RCHRES *************** Printout Flags ***************** PIVL  PYR
 # - # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
 1 999  5   0   0   0   0   0   0   0   0   0   1   9
END PRINT-INFO

HYDR-PARM1
 RCHRES  Flags for each HYDR Section                       ***
 # - #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
      FG FG FG FG  possible  exit *** possible  exit     possible  exit
       * * * *   * * * * *    * * * * *     ***

 1      0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
 2      0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
 3      0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
 4      0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
 5  12  0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
13      0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
14  22  0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
23      0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
24  33  0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
34      0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
35  46  0 1 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
47      0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
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    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
   3.500  1.3639  2.7685   387.38
   4.000  1.5266  3.4912   528.19
 END FTABLE  2

 FTABLE     3
ROWS COLS ***
 12   4
   DEPTH    AREA   VOLUME   OUTFLOW ***
   0.000  0.0000  0.0000     0.00
   0.100  0.9669  0.0483     0.13
   0.500  1.0637  0.4545     4.92
   1.000  1.1846  1.0165    17.12
   1.500  1.3055  1.6390    34.92
   2.000  1.4264  2.3220    57.95
   2.500  1.5473  3.0654    86.14
   3.000  1.6682  3.8693   119.53
   3.500  1.7891  4.7336   158.24
   4.000  1.9100  5.6584   202.41
   4.500  2.0294  6.6310   251.52
   5.000  2.1488  7.6624   306.28
END FTABLE  3

FTABLE     4
     *** REVISED 8/16/00 ADDED 2ND OUTFLOW
```

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

 FTABLE     5
ROWS COLS ***
 10   4
  DEPTH     AREA   VOLUME   OUTFLOW ***
  0.000   0.0000  0.0000    0.00
  0.100   0.1010  0.0051    0.03
  0.500   0.1754  0.0603    1.46
  1.000   0.2684  0.1713    6.16
  1:500   0.3614  0.3288    14.89
  2.000   0.4544  0.5327    28.48
  2.500   0.5474  0.7832    47.70
  3.000   0.6404  1.0801    73.29
  3.500   0.7334  1.4236   105.94
  4.000   0.8264  1.8136   146.33
END FTABLE  5

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

 POST AMBAUM DETENTION ***
 FTABLE    11
ROWS COLS ***
 12   4
  DEPTH     AREA   VOLUME   OUTFLOW ***
  0.000   0.0000  0.0000    0.00
  1.000   0.1000  0.2300    3.90
  2.000   0.2000  0.6000    6.30
  3.000   0.3000  0.9700    8.10
  4.000   0.4000  1.3400   11.10
  5.000   0.5000  1.8200   16.00
  6.000   0.6000  2.2700   19.10
  7.000   0.7000  2.8300   21.60
  8.000   0.8000  3.3700   30.80
  9.000   0.9000  4.0000   38.10
 10.000   1.0000  4.6500   74.10
 10.500   1.1000  5.2000  133.00
 11.000   1.1500  6.0000  500.00
 11.500   1.3000  11.000 1300.00
END FTABLE 11

FTABLE    12
ROWS COLS ***
 6   4
  DEPTH     AREA   VOLUME   OUTFLOW ***
  0.000   0.0000  0.0000    0.00
  0.100   0.6327  0.0316    0.15
```

```
  0.500  0.7960  0.3174    5.87
  1.000  1.0002  0.7664   21.53
  1.500  1.2043  1.3176   46.43
  2.000  1.4085  1.9708   81.20
  3.000  1.8168  3.5834  183.79
  4.000  2.2251  5.6044  336.22
  5.000  2.6335  8.0337  545.30
  6.000  3.0418 10.8713  817.51
 END FTABLE 12

 FTABLE    13
      *** REVISED 8/16/00 ADDED 2ND OUTFLOW
ROWS COLS ***
  7   5
  DEPTH     AREA   VOLUME   OUTFLOW OUTFLOW2***
  0.000  40.000  0.0000     0.00   0.00
  1.000  41.400  40.000     0.00   0.11
  1.500  42.000  60.000    10.00    0.11
  2.000  42.700  80.000    16.00    0.11
  2.500  43.300  100.00    20.00    0.11
  3.000  44.000  120.00    28.00    0.11
  5.000  45.000  210.00    45.00    0.11
 END FTABLE 13

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

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

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

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

 FTABLE    23
```

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

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

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

 FTABLE    34
ROWS COLS *** REVISED 11/19/97 BASED ON HEC-RAS MODEL
      *** REVISED 8/16/00 ADDED 2ND OUTFLOW
  6   5
   DEPTH     AREA   VOLUME   OUTFLOW OUTFLOW2***
    0.00    3.00    0.00     0.00   0.00
    3.00    3.05    9.08     0.00   0.11
    4.00    3.10   12.15     0.00   0.11
    5.00    3.15   15.28     0.00   0.11
    6.00    3.20   18.45     72.0   0.11
    7.00    3.25   21.68    225.0   0.11
 END FTABLE 34

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

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

 FTABLE    45
ROWS COLS ***
  4   4
   DEPTH    AREA   VOLUME  OUTFLOW ***
   0.000  0.0010  0.0000     0.00
   0.000  0.0100  0.0100    10.00
   0.100  0.1000  0.1000   100.00
   1.000  1.0000  1.0000  1000.00
  10.000 10.0000 10.0000 10000.00
 END FTABLE 45

 FTABLE   645
ROWS COLS ***
  4   4
   DEPTH    AREA   VOLUME  OUTFLOW ***
   0.000  0.0010  0.0000     0.00
   0.000  0.0100  0.0100    10.00
   0.100  0.1000  0.1000   100.00
   1.000  1.0000  1.0000  1000.00
  10.000 10.0000 10.0000 10000.00
 END FTABLE645

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

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

 FTABLE   552
ROWS COLS ***  SDN1 VAULT EFFECTIVE DEPTH=12 FT  RISER=24 INCHES
 15   4
   DEPTH    AREA   VOLUME  OUTFLOW ***
   0.000  0.4308  0.0000     0.00
   1.290  0.4308  0.6520    0.111
```

```
  2.130   0.4308   1.0760   0.143
  3.530   0.4308   1.7830   0.184
  4.640   0.4308   2.3430   0.211
  5.200   0.4308   2.6260   0.223
  6.320   0.4308   3.1920   0.246
  7.430   0.4308   3.7530   0.267
  8.200   0.4308   4.1410   0.280
  9.220   0.4308   4.6570   0.407
  10.190   0.4308   5.1460   0.567
  11.250   0.4308   5.6820   0.954
  12.100   0.4308   6.1110   2.130
  12.300   0.4308   6.2120   4.730
  13.700   0.4308   6.9190   21.360
 END FTABLE552

 FTABLE    53
OLD LAKE REBA                          ***
MAX DEPTH = 4.9 FEET                      ***
30" CMP, 40 CFS DISCHARGE AT MAX DEPTH    ***
ROWS COLS ***
  7   4
  DEPTH    AREA   VOLUME   OUTFLOW ***
  0.000   2.4000   0.0000    0.00
  1.000   2.5800   2.5000   18.00
  2.000   2.9400   5.3000   26.00
  3.000   3.4100   8.4000   31.00
  4.000   3.8800   12.100   36.00
  4.900   4.3000   15.800   40.00
  6.000   4.3000   15.810   500.00
 END FTABLE 53

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

 FTABLE    104
MILLER CREEK DETENTION FACILITY*** WITH ADD'L AREA 1+AREA 2 55.5 ACFT @ 10FT
GATE SETTING: 2.0 FEET*** EXISTING OUTLET NO LOW FLOW CONTROL
ROWS COLS ***
 17   4
  DEPTH    AREA   VOLUME   OUTFLOW ***
  0.000   0.0000   0.0000    0.00
  0.500   0.0100   0.0100    2.50
  1.500   0.0300   0.2800   14.29
  2.500   1.1100   1.3900   24.88
  3.500   2.6100   4.0000   34.51
  4.500   4.6100   9.1400   43.20
  5.500   7.1200   19.600   50.98
  6.000   8.3600   21.180   54.53
  6.500   11.870   30.060   57.87
  7.000   15.370   38.930   61.00
  7.500   18.870   47.800   63.91
  8.000   21.860   59.160   66.62
  8.500   24.850   70.510   69.12
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   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
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  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
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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
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   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     AREA   VOLUME    OUTFLOW                 ***
    (FT)  (ACRES) (ACRE-FT)  (FT3/S)                ***
    0.00   0.789   0.000   0.000
    0.16   0.789   0.126   0.056
    1.51   0.789   1.192   0.169
    3.28   0.789   2.588   0.249
    5.49   0.789   4.332   0.322
    7.26   0.789   5.729   0.370
   10.35   0.789   8.168   0.442
   12.12   0.789   9.564   0.478
   13.44   0.789  10.606   0.503
   14.33   0.789  11.308   0.520
   15.57   0.789  12.287   0.654
   16.72   0.789  13.194   0.828
   17.19   0.789  13.565   0.950
   17.63   0.789  13.913   1.030
   18.00   0.789  14.205   1.080
   19.00   0.789  14.994   1.960
   19.10   0.789  15.073   2.580
   19.40   0.789  15.309   6.930
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   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     1.063    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-
  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
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   12.000   0.5740   7.7130    0.978
   12.100   0.5740   7.7780    1.600
   12.300   0.5740   7.9060    4.200
   12.800   0.5740   8.2280   14.560
  END FTABLE 61

  PRE AMBAUM DETENTION ***
  FTABLE    111
 ROWS COLS ***
  15   4
    DEPTH     AREA    VOLUME   OUTFLOW ***
    0.000   0.0000   0.0000     0.00
    0.500   0.2160   0.0750     5.30
    1.000   0.2730   0.1990    21.10
    1.500   0.2890   0.3410    43.90
    2.000   0.2900   0.4830    68.80
    2.500   0.2910   0.6070    89.10
    3.000   0.2950   0.6820    90.00
    3.500   0.3000   2.1000   100.00
    4.000   0.3050   2.5000   105.00
    4.500   0.3100   3.0000   110.00
    5.000   0.3200   3.5000   120.00
    5.500   0.3300   4.0000   130.00
    6.000   0.3800   5.0530   166.48
    6.500   0.3980   5.9430   225.31
    7.000   0.4150   6.9040   320.10
 END FTABLE111

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

  FTABLE    240
*** NORTH SNOWMELT PUMP STATION (SDN-2) (INSTALLED IN LATE 1997/1998)
 ROWS COLS                                    ***
  14   5
   DEPTH     AREA    VOLUME     (IWS)     (SDS)              ***
    (FT)   (ACRES) (ACRE-FT)    (CFS)     (CFS)             ***
     0.0    0.002     0.00      0.00      0.00
    1.00    0.002   0.0023      0.00      0.00
    2.00    0.002   0.0046      1.67      0.00
    3.00    0.002   0.0069      1.67      0.00
    4.00    0.002   0.0092      1.67      0.00
    5.00    0.002   0.0115      1.67      0.00
    5.25    0.002   0.0121      1.67      1.53
    5.50    0.002   0.0126      1.67      6.06
    5.75    0.002   0.0132      1.67     12.65
    6.00    0.002   0.0138      1.67     19.83
    6.25    0.002   0.0144      1.67     25.66
    6.50    0.002   0.0149      1.67     25.70
    6.75    0.002   0.0155      1.67     26.70
    7.00    0.002   0.0161      1.67     50.00
 END FTABLE240

  FTABLE    242
*** NORTH CARGO PUMP STATION (SDN-2) (INSTALLED IN OCTOBER 1997)
 ROWS COLS                                    ***
  14   5
   DEPTH     AREA    VOLUME     (IWS)     (SDS)              ***
    (FT)   (ACRES) (ACRE-FT)    (CFS)     (CFS)             ***
     0.0    0.002     0.00      0.00      0.00
    1.00    0.002   0.0023      0.00      0.00
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    2.00   0.002   0.0046    6.13    0.00
    3.00   0.002   0.0069    6.13    0.00
    4.00   0.002   0.0092    6.13    0.00
    5.00   0.002   0.0115    6.13    0.00
    5.25   0.002   0.0121    6.13    0.28
    5.50   0.002   0.0126    6.13    1.16
    5.75   0.002   0.0132    6.13    2.53
    6.00   0.002   0.0138    6.13    4.23
    6.25   0.002   0.0144    6.13    6.05
    6.50   0.002   0.0149    6.13    7.72
    6.75   0.002   0.0155    6.13    8.50
    7.00   0.002   0.0161    6.13    20.0
  END FTABLE242

 END FTABLES

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

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

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

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

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

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

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

  MASS-LINK     10
 COPY      OUTPUT MEAN              COPY       INPUT  MEAN
  END MASS-LINK  10

  MASS-LINK     11
 RCHRES    ROFLOW                 COPY       INPUT  MEAN
  END MASS-LINK  11

  MASS-LINK     12
 COPY      OUTPUT MEAN              RCHRES      INFLOW IVOL
  END MASS-LINK  12

  MASS-LINK     14
 RCHRES    OFLOW  OVOL  1          COPY       INPUT  MEAN
  END MASS-LINK  14

  MASS-LINK     15
 RCHRES    OFLOW  OVOL  2          COPY       INPUT  MEAN
  END MASS-LINK  15

  MASS-LINK     21
```

```
PERLND    PWATER PERO      0.0833333    COPY         INPUT  MEAN
 END MASS-LINK  21

 MASS-LINK      22
IMPLND    IWATER SURO      0.0833333    COPY         INPUT  MEAN
 END MASS-LINK  22

 MASS-LINK      26
PERLND    PWATER SURO      0.0833333    COPY         INPUT  MEAN
PERLND    PWATER IFWO      0.0833333    COPY         INPUT  MEAN
 END MASS-LINK  26

 MASS-LINK      27
PERLND    PWATER AGWO      0.0833333    COPY         INPUT  MEAN
 END MASS-LINK  27

END MASS-LINK

COPY
 TIMESERIES
 Copy-opn                                   ***
  #- # NPT  NMN                               ***
  37  66      1
 END TIMESERIES
END COPY

END RUN
```

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
```

```
    COPY     66
    RCHRES    47
    COPY     62
    COPY     63
    RCHRES    34
    RCHRES   135
    RCHRES    57
    RCHRES   257
    COPY     64
    COPY     65
    RCHRES    35
***  --> output special perlnd outflow to check
    COPY     47
    COPY     55
***  --> output special perlnd 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 Engl Metr         ***
                           in  out                 ***
 16    TFM- TILL FOR MOD    1   1   1   1  61   0
 26    TGM- TILL GR MOD    1   1   1   1  61   0
 34    OF - OUTWASH FOR     1   1   1   1  61   0
 44    OG - OUTWASH GR     1   1   1   1  61   0
***PERLND FOR NEW AIRPORT FILL; NONE IN CALIBRATION
 45    AIRPORT FILL       1   1   1   1  61   0
 47    OG - INFILTRATION 1   1   1   1   1  61   0
 54    SA - WETLANDS       1   1   1   1  61   0
 57    OG - INFILTRATION 3   1   1   1   1  61   0
 END GEN-INFO
 ACTIVITY
  <PLS > ************* Active Sections *****************************
  # - # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC     ***
 14 200   0   0   1   0   0   0   0   0   0   0   0   0
 END ACTIVITY
 PRINT-INFO
  <PLS > ******************** Print-flags ************************ PIVL  PYR
  # - # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *********
 14 200   0   0   5   0   0   0   0   0   0   0   0   0   1   9
 END PRINT-INFO
 PWAT-PARM1
  <PLS > **************** Flags *******************
  # - # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE             ***
 14 200   0   0   0   0   0   0   0   0   0
 END PWAT-PARM1
 PWAT-PARM2
  <PLS > ***
  # - # ***FOREST    LZSN   INFILT    LSUR    SLSUR    KVARY    AGWRC
 16             9.0000  0.3200  400.00  0.1000  0.5000  0.9960
 26             9.0000  0.1200  400.00  0.1000  0.5000  0.9960
 34            10.0000  2.0000  400.00  0.0500  0.3000  0.9960
 44            10.0000  0.8000  400.00  0.0500  0.3000  0.9960
 45             7.5000  0.0200  300.00  0.0700  0.0000  0.9000
 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   DEEPFR   BASETP   AGWETP
 16                 2.0000   2.0000    0.33    0.00     0.0
 26                 2.0000   2.0000    0.33     0.      0.
 34                 2.0000   2.0000    0.33    0.00     0.0
 44                 2.0000   2.0000    0.33     0.      0.
 47                 2.0000   2.0000    0.33     0.      0.
 45                 2.0000   2.0000    0.33     0.      0.
 54                 10.000   2.0000    0.33     0.     0.7
 57                 2.0000   2.0000    0.33     0.      0.
 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 Engl Metr             ***
                          in  out                      ***
 14    IMPERVIOUS          1   1   1  60   0
 END GEN-INFO
 ACTIVITY
  <ILS > ************** Active Sections ****
  # - # ATMP SNOW IWAT  SLD  IWG IQAL  ***
 14       0   0   1   0   0   0
 END ACTIVITY
 PRINT-INFO
  <ILS > ******** Print-flags ******** PIVL  PYR
  # - # ATMP SNOW IWAT  SLD  IWG IQAL *********
 14       0   0   6   0   0   0   1   9
 END PRINT-INFO
 IWAT-PARM1
  <ILS >        Flags        ***              ***
  # - # CSNO RTOP  VRS  VNN RTLI  ***                   ***
 14       0   0   0   0   0
 END IWAT-PARM1
 IWAT-PARM2
  <ILS >                                     ***
  # - #     LSUR    SLSUR    NSUR    RETSC                    ***
 14       100.00   0.0100   0.1000   0.1000
 END IWAT-PARM2
 IWAT-PARM3
  <ILS >                                     ***
  # - #    PETMAX    PETMIN                          ***
 14
 END IWAT-PARM3
```

```
  IWAT-STATE1
    <ILS >  IWATER state variables                                ***
    # - #      RETS      SURS                                 ***
   14      1.0000E-3 1.0000E-3
  END IWAT-STATE1
 END IMPLND
                                                         ***
 EXT SOURCES
                                                         ***
 *** NOTE: The only RCHRES that precip and PET are applied to are lakes and ponds
 *** FOLLOWING RCHRES ARE PONDS: 57, 247, 237
                                                         ***
 <-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
 <Name>   # <Name> # tem strg<-factor->strg <Name>   #  #        <Name> # #  ***
 *** PRECIP/EVAP TO PERVIOUS/IMPERV SURFACES
 WDM   1002 PREC     ENGLZERO  1.00        PERLND  14 200 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 reinfiltration chamber for SDW1A
 WDM      5 FLOW     ENGLZERO  1.0        PERLND  47    EXTNL  AGWLI
   ***  --> lateral inflow from reinfiltration chamber for SDW1B
 WDM      6 FLOW     ENGLZERO  1.0        PERLND  57    EXTNL  AGWLI
 *** PRECIP/EVAP TO LAKES
 WDM   1002 PREC     ENGLZERO              RCHRES   1    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES   1    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES   4    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES   4    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES  11    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES  11    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES  13    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES  13    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES  23    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES  23    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES  34    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES  34    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES  53    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES  53    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES  54    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES  54    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES 237    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES 237    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES 247    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES 247    EXTNL  POTEV
 WDM   1002 PREC     ENGLZERO              RCHRES  57    EXTNL  PREC
 WDM      1 EVAP    ENGLZERO    0.8      RCHRES  57    EXTNL  POTEV
 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     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>  #  Tbl#  ***
 *** SUB-CATCHMENT 1 all agwo goes to sound
PERLND  16                  3.41    RCHRES  1     6
PERLND  26                232.36    RCHRES  1     6
PERLND  34                  3.07    RCHRES  1     6
PERLND  44                 38.03    RCHRES  1     6
PERLND  54                  3.87    RCHRES  1     6
IMPLND  14                 56.14    RCHRES  1     2
```

```
 *** SUB-CATCHMENT 2 10% of area GW goes to vaca 90% goes to sound
PERLND 16          5.56   RCHRES 2    6
PERLND 26        200.05   RCHRES 2    6
PERLND 34          0.46   RCHRES 2    6
PERLND 44         38.71   RCHRES 2    6
PERLND 16          0.56   RCHRES 135  7
PERLND 26         20.00   RCHRES 135  7
PERLND 34          0.05   RCHRES 135  7
PERLND 44          3.87   RCHRES 135  7
IMPLND 14         42.22   RCHRES 2    2
 *** SUB-CATCHMENT 23 New subbasin 15 % OF GW GOES TO VACCA 85% TO SOUND
PERLND 16          3.09   RCHRES 23   6
PERLND 26        156.15   RCHRES 23   6
PERLND 34          2.25   RCHRES 23   6
PERLND 44         45.84   RCHRES 23   6
PERLND 16          0.46   RCHRES 135  7
PERLND 26         23.42   RCHRES 135  7
PERLND 34          0.34   RCHRES 135  7
PERLND 44          6.88   RCHRES 135  7
IMPLND 14         58.44   RCHRES 23   2
 *** SUB-CATCHMENT 24 New subbasin 60 % OF GW GOES TO 11 40% TO SOUND
PERLND 26        135.43   RCHRES 24   6
PERLND 34          2.02   RCHRES 24   6
PERLND 44         69.29   RCHRES 24   6
PERLND 26         81.26   RCHRES 11   7
PERLND 34          1.21   RCHRES 11   7
PERLND 44         41.57   RCHRES 11   7
IMPLND 14         79.98   RCHRES 24   2
 *** SUB-CATCHMENT 3 agwo goes to vaca(135)
PERLND 16          8.26   RCHRES 3    6
PERLND 26        108.38   RCHRES 3    6
PERLND 34         16.02   RCHRES 3    6
PERLND 44        102.89   RCHRES 3    6
PERLND 54          0.04   RCHRES 3    6
PERLND 16          8.26   RCHRES 135  7
PERLND 26        108.38   RCHRES 135  7
PERLND 34         16.02   RCHRES 135  7
PERLND 44        102.89   RCHRES 135  7
PERLND 54          0.04   RCHRES 135  7
IMPLND 14         27.30   RCHRES 3    2
 *** SUB-CATCHMENT 4 10% of agwo goes to rchres 90% goes to sound
PERLND 16          2.95   RCHRES 4    6
PERLND 26         85.95   RCHRES 4    6
PERLND 34          3.75   RCHRES 4    6
PERLND 44         92.06   RCHRES 4    6
PERLND 16          0.30   RCHRES 4    7
PERLND 26          8.59   RCHRES 4    7
PERLND 34          0.38   RCHRES 4    7
PERLND 44          9.21   RCHRES 4    7
IMPLND 14         18.43   RCHRES 4    2
 *** SUB-CATCHMENT 4a 70% of agwo goes to rchres 30% goes to sound
PERLND 16          8.66   RCHRES 4    6
PERLND 26         61.64   RCHRES 4    6
PERLND 34         22.06   RCHRES 4    6
PERLND 44         78.09   RCHRES 4    6
PERLND 54         12.50   RCHRES 4    6
PERLND 16          6.06   RCHRES 4    7
PERLND 26         43.15   RCHRES 4    7
PERLND 34         15.44   RCHRES 4    7
PERLND 44         54.66   RCHRES 4    7
PERLND 54          8.75   RCHRES 4    7
IMPLND 14         29.14   RCHRES 4    2
 *** SUB-CATCHMENT 5
PERLND 26         10.29   RCHRES 5    1
PERLND 44         50.05   RCHRES 5    1
PERLND 54         10.74   RCHRES 5    1
IMPLND 14         16.31   RCHRES 5    2
 *** SUB-CATCHMENT 6
PERLND 16          1.42   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
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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 (acft/ac)
PERLND 47             1.00   COPY   47   21

 *** SUB-CATCHMENT MC-7
 ***  --> reduce by 2 acres to make special PERLND 57 for SDW1B
PERLND 26            11.26    COPY   55   21
 ***  --> reduce by 2 acres to make special PERLND 57 for SDW1B
***PERLND 44             31.80   COPY   55   21
 ***  --> add 2 acres from special PERLND 57 for SDW1B
PERLND 57             2.00   COPY   55 ·  21
 ***  --> output outflow from special PERLND 57 (acft/ac)
PERLND 57             1.00   COPY   57   21
PERLND 44            29.80    COPY   55   21
PERLND 54             3.20   COPY   55   21
IMPLND 14             0.03   COPY   55   22

***note: SDN AGWO TO VACCA FARMS (135)NOT TO PONDS

 *** SUB-CATCHMENT SDN-1
PERLND 26             1.97   RCHRES 552    6
PERLND 44             1.29   RCHRES 552    6
PERLND 54             0.20   RCHRES 552    6
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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
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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>  #   Tbl#  ***
 *** 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> SSYSSGAP<--MULT-->TRAN <-TARGET VOLS>      <-MEMBER->
<NAME>  # <NAME>   TEM STRG<-FACTOR->STRG <NAME>  #  # <-GRP> <NAME> # # ***
END NETWORK
                                              ***
RCHRES
 GEN-INFO
  RCHRES      Name      Nexits  Unit Systems  Printer          ***
  # - #<---------------><---> User T-series  Engl Metr LKFG      ***
                        in  out                ***
  1    Arbor Lake  M 1    2   1    1    1   62   0   0
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  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-nsmps           2   1   1   1  62   0   0
247     sdw1a pond g          2   1   1   1  62   0   0
257     sdw1b infiltration    2   1   1   1  62   0   0
451     nepl VAULT            1   1   1   1  62   0   0
452     nepl VAULT            1   1   1   1  62   0   0
552     SDN1 POC               1   1   1   1  62   0   0
645     nepl POC            1   1   1   1  62   0   0
END GEN-INFO

ACTIVITY
 RCHRES *************** Active Sections *****************
 # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG           ***
 1 999   1   0   0   0   0   0   0   0   0   0
END ACTIVITY

PRINT-INFO
 RCHRES *************** Printout Flags ****************** PIVL  PYR
 # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB *********
 1 999   5   0   0   0   0   0   0   0   0   0   1   9
END PRINT-INFO

HYDR-PARM1
 RCHRES  Flags for each HYDR Section                        ***
 # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
         FG FG FG FG  possible  exit *** possible  exit     possible  exit
         * * * *   * * * * *    * * * * *      ***

1       0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
2       0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
3       0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
4       0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
5  12   0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
13      0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
14  22  0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
23      0 1 0 0   4 5 0 0 0    0 0 0 0 0    2 2 2 2 2
24  33  0 0 0 0   4 0 0 0 0    0 0 0 0 0    2 2 2 2 2
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34      0 1 0 0   4 5 0 0 0     0 0 0 0 0     2 2 2 2 2
35  46  0 1 0 0   4 0 0 0 0     0 0 0 0 0     2 2 2 2 2
47      0 1 0 0   4 5 0 0 0     0 0 0 0 0     2 2 2 2 2
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     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
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```
   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
```

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  3.500  1.3639  2.7685  387.38
  4.000  1.5266  3.4912  528.19
 END FTABLE  2

 FTABLE    3
ROWS COLS ***
 12   4
  DEPTH    AREA   VOLUME  OUTFLOW ***
  0.000  0.0000  0.0000    0.00
  0.100  0.9669  0.0483    0.13
  0.500  1.0637  0.4545    4.92
  1.000  1.1846  1.0165   17.12
  1.500  1.3055  1.6390   34.92
  2.000  1.4264  2.3220   57.95
  2.500  1.5473  3.0654   86.14
  3.000  1.6682  3.8693  119.53
  3.500  1.7891  4.7336  158.24
  4.000  1.9100  5.6584  202.41
  4.500  2.0294  6.6310  251.52
  5.000  2.1488  7.6624  306.28
 END FTABLE  3

 FTABLE    4
      *** REVISED 8/16/00 ADDED 2ND OUTFLOW
ROWS COLS ***
  7   5
  DEPTH    AREA   VOLUME   OUTFLOW OUTFLOW2***
   0.00   3.00    0.00     0.00    0.00
   2.50   4.50    9.38     0.00    0.11
   3.00   6.00   12.00     6.00    0.11
   4.00  10.00   20.00    13.00    0.11
   5.00  15.00   32.50    20.00    0.11
   6.00  20.00   50.00    26.00    0.11
   7.00  25.00   72.50   168.00    0.11
 END FTABLE  4

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

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

 POST AMBAUM DETENTION ***
 FTABLE    11
ROWS COLS ***
```

```
    12   4
     DEPTH     AREA    VOLUME   OUTFLOW ***
     0.000   0.0000   0.0000      0.00
     1.000   0.1000   0.2300      3.90
     2.000   0.2000   0.6000      6.30
     3.000   0.3000   0.9700      8.10
     4.000   0.4000   1.3400     11.10
     5.000   0.5000   1.8200     16.00
     6.000   0.6000   2.2700     19.10
     7.000   0.7000   2.8300     21.60
     8.000   0.8000   3.3700     30.80
     9.000   0.9000   4.0000     38.10
    10.000   1.0000   4.6500     74.10
    10.500   1.1000   5.2000    133.00
    11.000   1.1500   6.0000    500.00
    11.500   1.3000   11.000   1300.00
  END FTABLE 11

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

  FTABLE    13
        *** REVISED 8/16/00 ADDED 2ND OUTFLOW
 ROWS COLS ***
    7   5
     DEPTH     AREA    VOLUME   OUTFLOW OUTFLOW2***
     0.000   40.000   0.0000     0.00   0.00
     1.000   41.400   40.000     0.00   0.11
     1.500   42.000   60.000    10.00   0.11
     2.000   42.700   80.000    16.00   0.11
     2.500   43.300   100.00    20.00   0.11
     3.000   44.000   120.00    28.00   0.11
     5.000   45.000   210.00    45.00   0.11
  END FTABLE 13

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

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

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 END FTABLE 15

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

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

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

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

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

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 FTABLE    34
ROWS COLS *** REVISED 11/19/97 BASED ON HEC-RAS MODEL
      *** REVISED 8/16/00 ADDED 2ND OUTFLOW
  6   5
  DEPTH    AREA   VOLUME   OUTFLOW OUTFLOW2***
   0.00    3.00   0.00     0.00   0.00
   3.00    3.05   9.08     0.00   0.11
   4.00    3.10   12.15    0.00   0.11
   5.00    3.15   15.28    0.00   0.11
   6.00    3.20   18.45    72.0   0.11
   7.00    3.25   21.68    225.0  0.11
 END FTABLE 34

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


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

 FTABLE    45
ROWS COLS ***
  4   4
  DEPTH    AREA   VOLUME   OUTFLOW ***
  0.000  0.0010  0.0000    0.00
  0.000  0.0100  0.0100   10.00
  0.100  0.1000  0.1000  100.00
  1.000  1.0000  1.0000  1000.00
 10.000 10.0000  10.0000 10000.00
 END FTABLE 45

 FTABLE   645
ROWS COLS ***
  4   4
  DEPTH    AREA   VOLUME   OUTFLOW ***
  0.000  0.0010  0.0000    0.00
  0.000  0.0100  0.0100   10.00
  0.100  0.1000  0.1000  100.00
  1.000  1.0000  1.0000  1000.00
 10.000 10.0000  10.0000 10000.00
 END FTABLE645

 FTABLE    50
ROWS COLS ***
 10   4
  DEPTH    AREA   VOLUME   OUTFLOW ***
   0.00   1.00    0.00     0.00
   0.50   1.10    0.53     5.00
   1.00   1.20    1.10    15.00
   1.50   1.30    1.73    25.00
   2.00   1.40    2.40    35.00
   2.50   1.50    3.13    52.00
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   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
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  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
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   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
```

```
   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     AREA    VOLUME    OUTFLOW                     ***
   (FT)  (ACRES) (ACRE-FT)  (FT3/S)                 ***
   0.00    0.789    0.000    0.000
   0.16    0.789    0.126    0.056
   1.51    0.789    1.192    0.169
   3.28    0.789    2.588    0.249
   5.49    0.789    4.332    0.322
   7.26    0.789    5.729    0.370
  10.35    0.789    8.168    0.442
  12.12    0.789    9.564    0.478
  13.44    0.789   10.606    0.503
  14.33    0.789   11.308    0.520
  15.57    0.789   12.287    0.654
  16.72    0.789   13.194    0.828
  17.19    0.789   13.565    0.950
  17.63    0.789   13.913    1.030
  18.00    0.789   14.205    1.080
  19.00    0.789   14.994    1.960
  19.10    0.789   15.073    2.580
  19.40    0.789   15.309    6.930
  19.60    0.789   15.467   11.080
  20.00    0.789   15.783   17.190
 END FTABLE 51

*** SDW-1B:3RD RUNWAY CENTRAL SOUTH POND D TO MILLER CREEK (LEVEL 2): ***
 FTABLE    57
ROWS COLS ***     EFFECTIVE DEPTH = 13.0 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    1.063   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     (IWS)    (SDS)                  ***
   (FT)  (ACRES) (ACRE-FT)   (CFS)    (CFS)                  ***
```

```
    0.0   0.002   0.00   0.00   0.00
    1.00  0.002  0.0023   0.00   0.00
    2.00  0.002  0.0046   1.67   0.00
    3.00  0.002  0.0069   1.67   0.00
    4.00  0.002  0.0092   1.67   0.00
    5.00  0.002  0.0115   1.67   0.00
    5.25  0.002  0.0121   1.67   1.53
    5.50  0.002  0.0126   1.67   6.06
    5.75  0.002  0.0132   1.67  12.65
    6.00  0.002  0.0138   1.67  19.83
    6.25  0.002  0.0144   1.67  25.66
    6.50  0.002  0.0149   1.67  25.70
    6.75  0.002  0.0155   1.67  26.70
    7.00  0.002  0.0161   1.67  50.00
  END FTABLE240

  FTABLE   242
*** NORTH CARGO PUMP STATION (SDN-2) (INSTALLED IN OCTOBER 1997)
 ROWS COLS                                        ***
  14   5
   DEPTH    AREA   VOLUME    (IWS)    (SDS)                ***
   (FT)  (ACRES) (ACRE-FT)   (CFS)   (CFS)                 ***
    0.0   0.002   0.00   0.00   0.00
    1.00  0.002  0.0023   0.00   0.00
    2.00  0.002  0.0046   6.13   0.00
    3.00  0.002  0.0069   6.13   0.00
    4.00  0.002  0.0092   6.13   0.00
    5.00  0.002. 0.0115   6.13   0.00
    5.25  0.002  0.0121   6.13   0.28
    5.50  0.002  0.0126   6.13   1.16
    5.75  0.002  0.0132   6.13   2.53
    6.00  0.002  0.0138   6.13   4.23
    6.25  0.002  0.0144   6.13   6.05
    6.50  0.002  0.0149   6.13   7.72
    6.75  0.002  0.0155   6.13   8.50
    7.00  0.002  0.0161   6.13   20.0
  END FTABLE242

END FTABLES

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

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

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

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

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

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

  MASS-LINK     7
```

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

 MASS-LINK     10
COPY     OUTPUT MEAN              COPY       INPUT  MEAN
 END MASS-LINK  10

 MASS-LINK     11
RCHRES   ROFLOW                   COPY       INPUT  MEAN
 END MASS-LINK  11

 MASS-LINK     12
COPY     OUTPUT MEAN              RCHRES     INFLOW IVOL
 END MASS-LINK  12

 MASS-LINK     14
RCHRES   OFLOW  OVOL  1           COPY       INPUT  MEAN
 END MASS-LINK  14

 MASS-LINK     15
RCHRES   OFLOW  OVOL  2           COPY       INPUT  MEAN
 END MASS-LINK  15

 MASS-LINK     21
PERLND   PWATER PERO     0.0833333   COPY       INPUT  MEAN
 END MASS-LINK  21

 MASS-LINK     22
IMPLND   IWATER SURO     0.0833333   COPY       INPUT  MEAN
 END MASS-LINK  22

 MASS-LINK     26
PERLND   PWATER SURO     0.0833333   COPY       INPUT  MEAN
PERLND   PWATER IFWO     0.0833333   COPY       INPUT  MEAN
 END MASS-LINK  26

 MASS-LINK     27
PERLND   PWATER AGWO     0.0833333   COPY       INPUT  MEAN
 END MASS-LINK  27

END MASS-LINK

COPY
 TIMESERIES
 Copy-opn                         ***
  #-  # NPT  NMN                   ***
  37  66      1
 END TIMESERIES
END COPY

END RUN
```