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HSPF Hydrologic Analysis of the Big Lake Watershed

Prepared in Conjunction with Montgomery Water Group

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The engineering analyses and technical material presented in this report were prepared under the supervision and direction of the undersigned professional engineer.

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EXECUTIVE SUMMARY

A hydrologic analysis of the Big Lake watershed was performed using the US EPA Hydrological Simulation Program Fortran[1] (HSPF) as part of the Big Lake Drainage Management Plan. The purpose of the analysis was to quantify the Big Lake inflow and water surface elevation under existing and future build-out land use.

Flood frequency analyses were performed on streamflow at several locations along Lake Creek, the principal tributary to Big Lake, and on Big Lake water surface elevation and discharge. Results of the analysis showed only slight differences between the runoff response from the watershed under existing and future build-out conditions. This was due to the current rural nature of the watershed and the designation of the majority of the watershed as forest practices under future conditions, which will maintain the current rural state of the watershed in the future.

The relatively small increase in development together with an assumed 50% clear cut in the forest production areas resulted in a minor increase in Big Lake peak inflow and water surface elevation. The future 100-year peak inflow was predicted to increase by approximately 4-percent (709 cfs to 740 cfs) and the 100-year water surface elevation was predicted to increase by less than 0.1 feet relative to existing land use conditions (89.91 feet to 89.95 feet NAVD88).

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HSPF Hydrologic Analysis of the Big Lake Watershed

INTRODUCTION

This report presents findings of a hydrologic analysis of the Big Lake watershed using the Hydrological Simulation Program-Fortran[1] (HSPF) model. The purpose of the analysis was to quantify the effects of land use changes on basin runoff and lake water levels as part of the Big Lake Drainage Master Plan. The report documents the HSPF model development and the results of the hydrologic analysis.

HSPF MODEL DEVELOPMENT

Subbasin Definitions

The Big Lake watershed is located approximately 3 miles southeast of Mount Vernon in Skagit County. Big Lake receives runoff from Lake Creek, which enters the lake from the south, and several small unnamed tributaries surrounding the lake. The HSPF model analysis included the area upstream of the outlet to Big Lake, a tributary area of approximately 18.6 square miles. The watershed ranges in elevation from 86 feet at the Big Lake outlet to 1,700 feet on Devils Mountain along the western watershed boundary.

HSPF is a conceptual, continuous, hydrologic model where surface, shallow subsurface (interflow), and groundwater flows can be simulated, lagged, and combined as discharge into a stream network. In application, the watershed to be modeled is divided into a number of subbasins that are connected by channel reaches. Subbasin delineations are based on topography, hydrologic characteristics, the channel network, and locations where computed streamflows are desired. For purposes of hydrologic analysis, the Big Lake watershed was partitioned as shown in Figure 1.

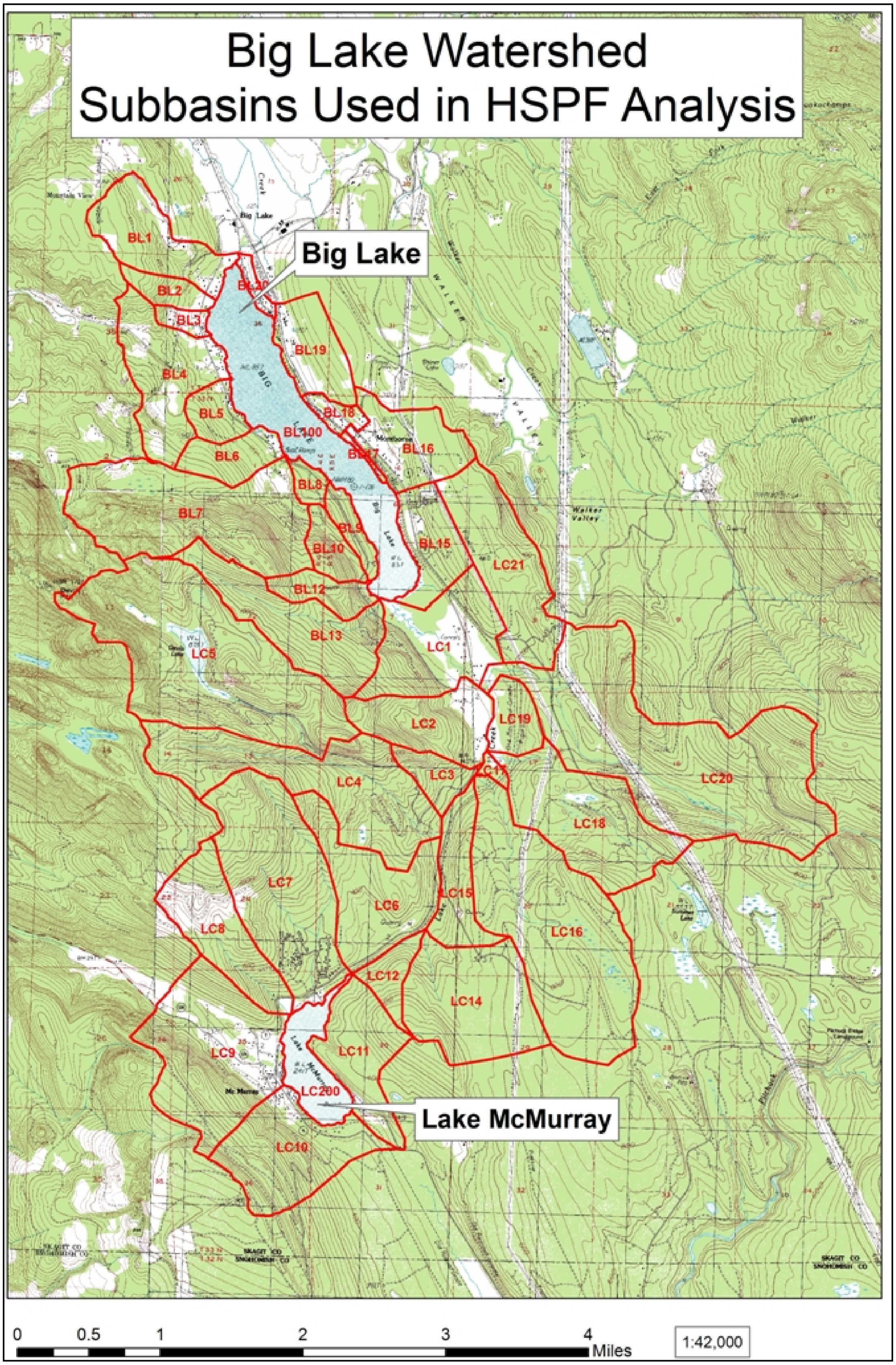

Figure 1 – Big Lake Subbasin Delineation for Hydrologic Modeling

Geology

The geology of the watershed was based on 1:100,000 scale mapping by the Washington State Department of Natural Resources[2]. For hydrologic modeling purposes, each geologic association was assigned to one of three categories; bedrock/till, outwash, or wetland as shown in Figure 2.

The soils in the majority of the watershed are underlain by glacial till or bedrock. The majority of infiltrated moisture in these areas moves laterally along the bedrock or till surface and reaches the stream as interflow. The rate of interflow is proportional to the slope of the bedrock and is much slower than the rate of surface overland flow.

Small pockets of alluvium, defined as outwash for hydrologic modeling purposes, are present near Lake McMurray and near the northern end of Big Lake. Soils formed in these areas consist of sand and gravels that have high infiltration rates. The majority of rainfall in these areas is infiltrated and does not contribute to storm flow.

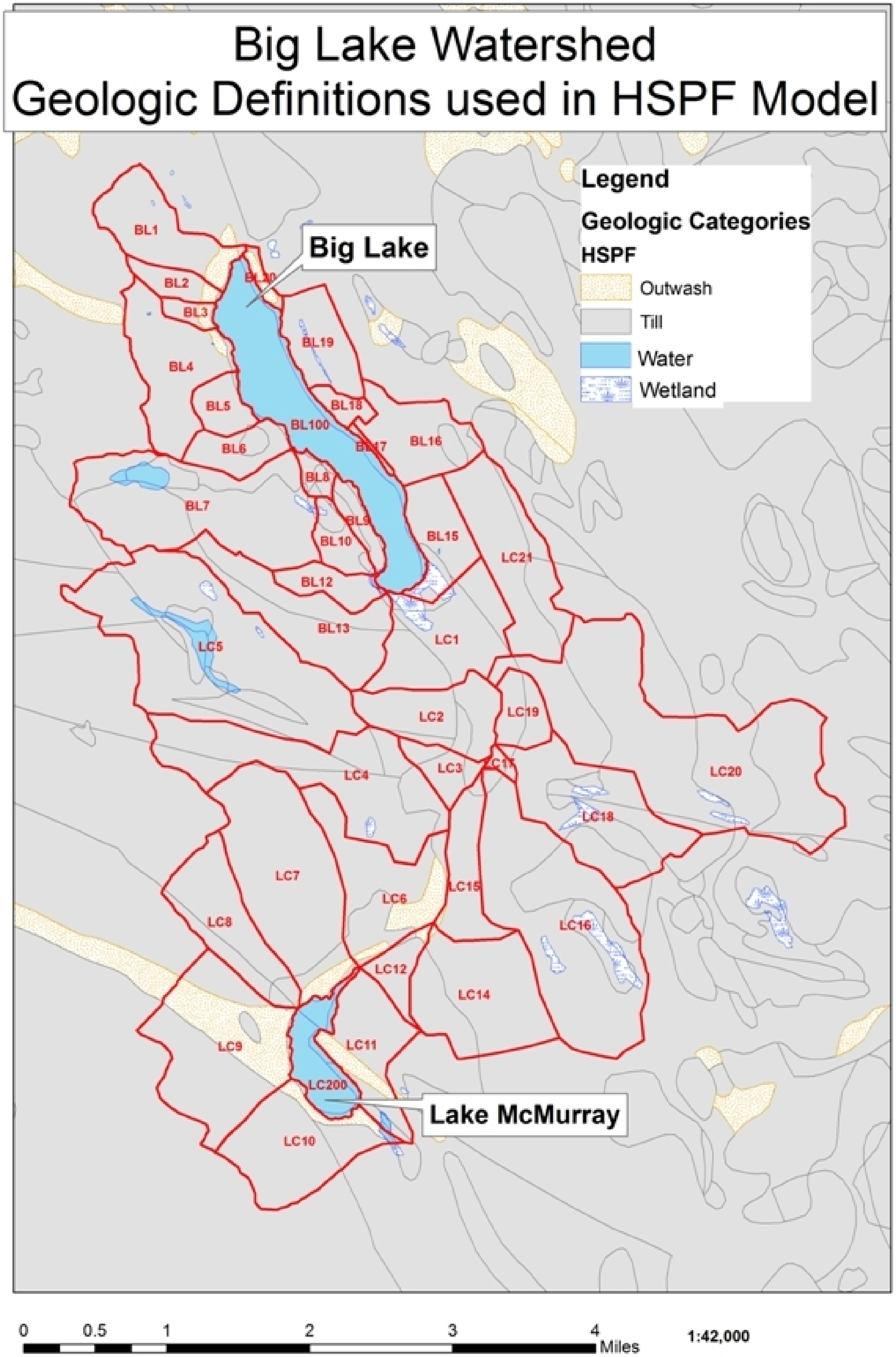

Figure 2 – Big Lake Watershed Geologic Map

Land Cover

Two land use scenarios were analyzed with the HSPF model; existing (Figure 3) and build-out according to the current Skagit County Comprehensive Land Use plan (Figure 4). Existing land use was derived by analysis of aerial photographs of the watershed. Six land cover classes were considered in analyzing the watershed hydrology; forest, clear-cut, pasture, grass, wetland, and impervious. Land cover was determined by converting the mapped land use to effective impervious and pervious land cover according to the factors in Tables 2a and 2b.

Table 2a – Effective Impervious and Pervious Cover Factors Used for Existing Land Use

Land Use Description	Effective Impervious Percent	Pervious Cover Type
Commercial (C)	85%	Grass
Clear Cut (CLR)	0%	Clear Cut
Forest (F)	0%	Forest
Grass (G)	0%	Grass
High Density (HD)	23%	Grass
Medium Density (MD)	10%	Grass
Pasture (P)	0%	Pasture
Rural Forest (RF)	4%	Forest
Rural Grass (RG)	4%	Pasture
Wetland (WL)	0%	Wetland

Table 2b – Effective Impervious and Pervious Cover Factors Used for Future Land Use

Land Use Description	Effective Impervious Percent	Pervious Cover Type
Agricultural (A)	0%	Pasture
Industrial Forest (IF)	0%	50% Forest 50% Clear Cut
Rural Business (RB)	48%	Grass
Rural Reserve (RRV)	4%	Pasture
Rural Resource (RR)	4%	Pasture
Rural Village Commercial (RVC)	85%	Grass
Rural Village Residential (RV)	10%	Grass
Secondary Forest (SF)	0%	50% Forest 50% Clear Cut
Urban Development District (Mount Vernon, UGA)	10%	Grass
Wetland (WL)	0%	Wetland

The dominant land use in the watershed is forestry with residential development along the shore of Big Lake and Lake McMurray. Forest practice areas were assumed to be 50-percent clear cut under future land use. Because the comprehensive plan designates the majority of the watershed as forest practices, there is relatively little difference between existing and future land use (Tables 3a and 3b).

Table 3a – Watershed Land Use Summary Tributary to Big Lake Outlet (Expressed as Total Acreage in Watershed)

	Land Use (acres)	
Land Cover	**Existing**	**Future**
Forest	6128	3449
Clear Cut	3144	3447
Pasture	1248	2920
Grass	353	948
Wetland/Lake	938	939
Effective Impervious	113	222
Total	**11925**	**11925**

Table 3b – Watershed Land Use Summary Tributary to Big Lake Outlet (Expressed as Percentage of Total)

	Land Use (Percentage)	
Land Cover	**Existing**	**Future**
Forest	51%	29%
Clear Cut	26%	29%
Pasture	10%	24%
Grass	3%	8%
Wetland/Lake	8%	8%
Effective Impervious	1%	2%
Total	**100%**	**100%**

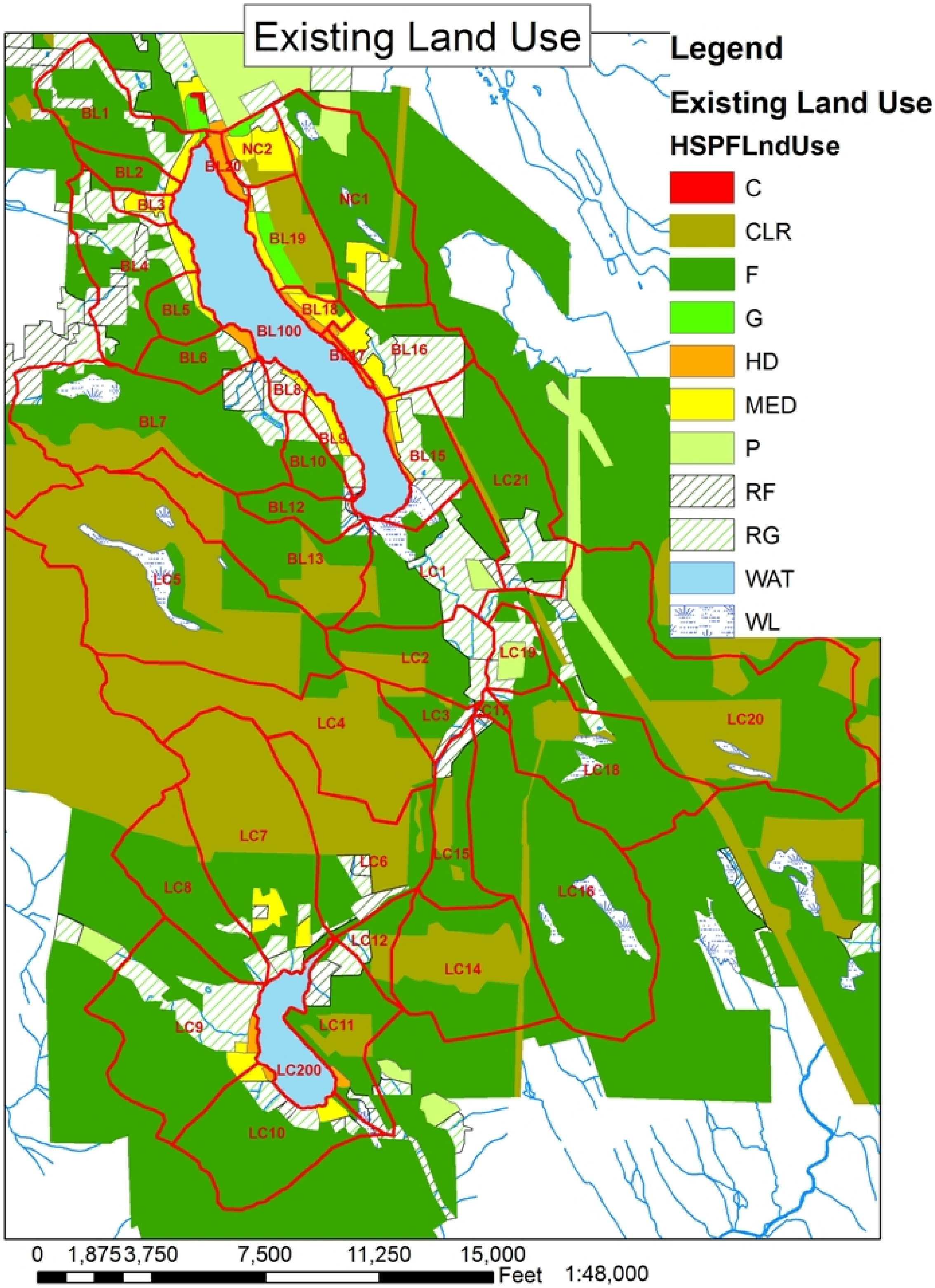

Figure 3 – Big Lake Existing Land Use Map

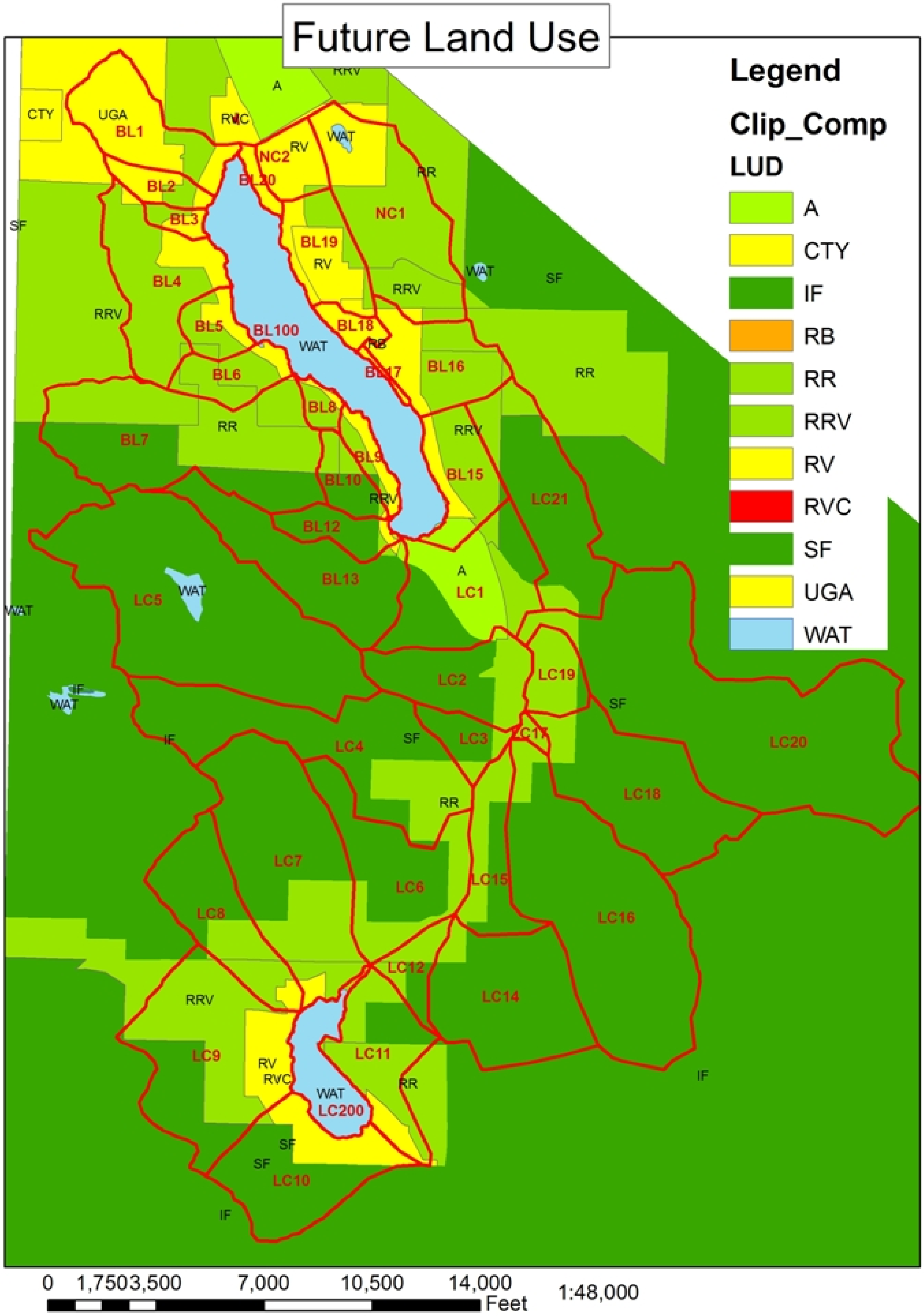

Figure 4 – Big Lake Future Land Use Map, Based on Skagit County Comprehensive Plan (Note: Wetland Areas not Shown, but were included in Analysis)

On-Site Detention Assumed for Future Land Use Scenario

On-site detention facilities were simulated for the future land use scenario by including ponds in each subbasin that represented the cumulative effects of all of the future stormwater ponds in that subbasin. The ponds were designed using predeveloped land cover of pasture or forest depending on the dominant land cover in the subbasin under existing conditions. Ponds were sized for soil types of glacial till and outwash, resulting in up to four ponds per subbasin depending on the geologic and land use composition of the subbasin.

Ponds were sized according to the 2005 Ecology Stormwater Management Manual[3] *flow duration* standard. The *flow duration* detention standard specified in the Ecology Manual requires that the post-development runoff rate and duration be maintained to predeveloped levels from ½ of the predeveloped 2-year to the 50-year recurrence interval. The Ecology Manual requires the assumption of forest cover as the predeveloped condition regardless of the existing land cover on the site. For this analysis, on-site detention ponds were designed assuming existing conditions (forest or pasture) based on the dominant land cover in the subbasin under existing conditions.

Stream Definition/ Channel Routing

Runoff computed by the HSPF model is routed through the stream system using a Kinematic Wave hydrologic routing algorithm. The principal input for this routine is a stage-storage-discharge rating table, called an *FTABLE*. FTABLES were computed using open channel hydraulic calculations[4] with a representative cross section for each subbasin.

Big Lake discharges to a low-gradient, open channel, with a log weir located approximately 500 feet downstream of the lake. A hydraulic analysis performed as part of the Big Lake Drainage Management Plan using the Corps of Engineers HEC-RAS[5] open channel hydraulics model was used to establish the stage-storage-discharge rating table for Big Lake. This approach accurately accounted for the losses in the channel between the lake and the control weir.

Precipitation and Evaporation Timeseries Input

Successful application of continuous hydrologic modeling is dependent upon having a high-quality, long-term, precipitation time-series that is representative of the watershed under study. A precipitation time-series with a long record length is needed for several reasons. Estimation of unusually dry periods or rare flood events is always of interest in hydrologic modeling. The long record provides a diversity of wet and dry years, storm temporal patterns, multi-day sequences of storms, and seasonality of occurrence of storm events that are possible.

Long-term precipitation timeseries have been developed by MGS Engineering Consultants for WSDOT for use in continuous hydrologic modeling in western Washington and were used in as input to the HSPF model for this analysis. The extended timeseries, which are 158 years in length, were developed by combining and scaling records from distant precipitation stations in a manner that the statistics of the scaled timeseries possess the regional statistics at the target site. Details on the precipitation and evaporation timeseries development can be found in the report; *Extended Precipitation Time-Series for Continuous Hydrological Model in Western Washington*, MGS Engineering Consultants, Inc., 2002[6,7].

Mean annual precipitation in the Big Lake watershed varies from 40 to 56 inches with a watershed average of 48 inches. The watershed was divided into two zones of mean annual precipitation (44 and 50 inches) with each subbasin assigned to one of the zones as indicated in Figure 5. Extended precipitation and evaporation timeseries developed for each zone were used as input to the model for hydrologic analyses. This approach preserved the 48 inch watershed average mean annual precipitation.

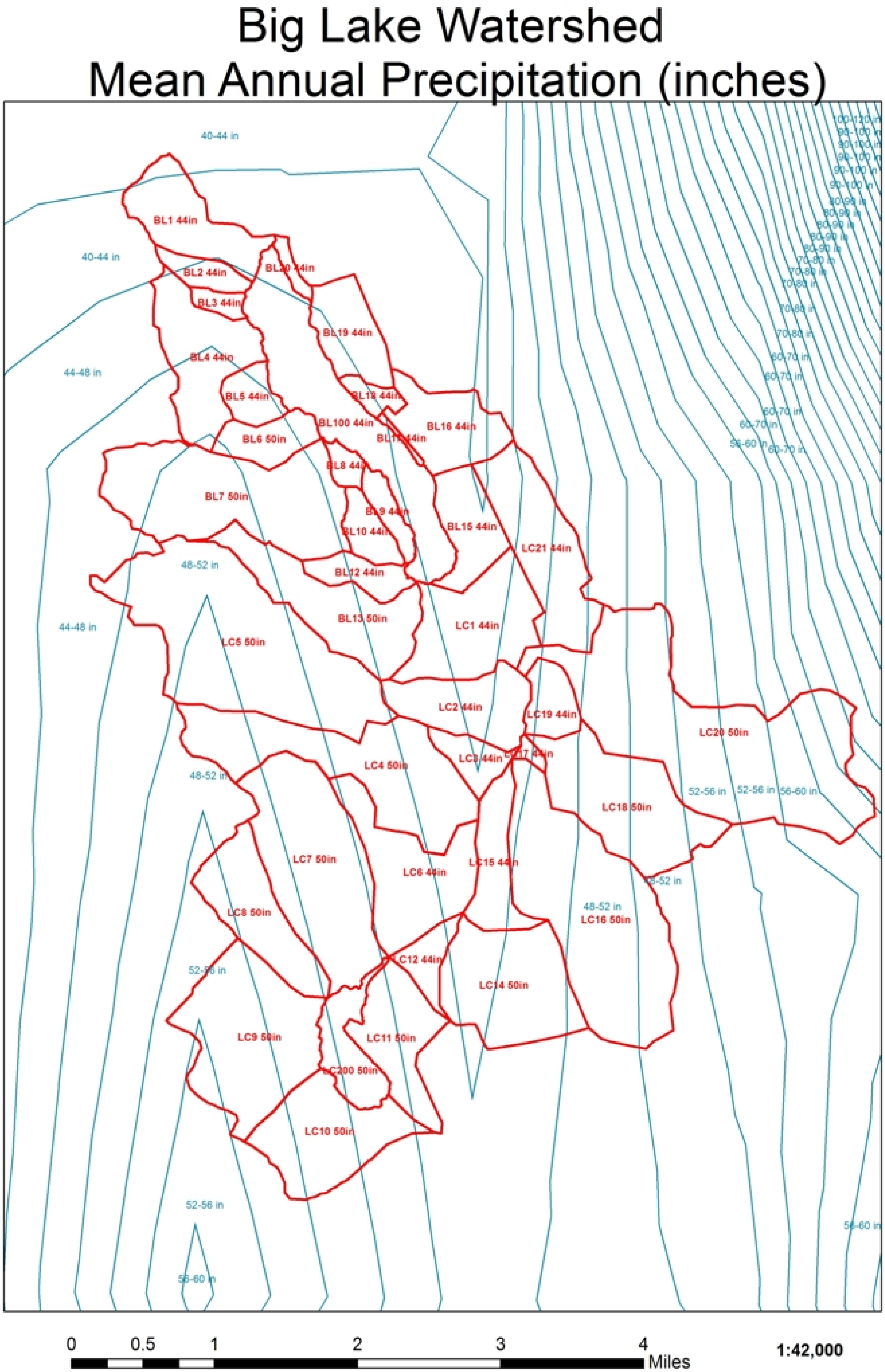

Figure 5 – Big Lake Watershed Mean Annual Precipitation Map (PRISM[8]) and Precipitation Zone (44 or 50 in) Assigned to Each Subbasin for Hydrologic Modeling

Model Calibration/Validation

There were no streamflow or lake water surface elevation data available for calibration of the watershed model. Therefore, HSPF parameters developed by the USGS[9,10] for use in ungaged watersheds in western Washington were adopted for use in this study.

To verify the validity of flood discharge rates computed by the model, simulated flood magnitude-frequency estimates were compared with values obtained from USGS regional regression equations[11]. The USGS regression equations used in the comparison were developed from streamflow records with climatic conditions similar to the Big Lake area.

Figure 6 shows a comparison between simulated inflow to Big Lake and values obtained using the USGS regression equations. The simulated flood-frequency points plotted slightly below the mean USGS regression line but well within the 1 standard deviation bounds on the regression. The hydrologic response from the Big Lake watershed would be expected to be lower than the mean regression line because of the rural nature of the watershed and the flood attenuation provided by Lake McMurray. Based on this comparison, the simulated peak discharge rates compare favorably with discharge rates predicted by the USGS equations.

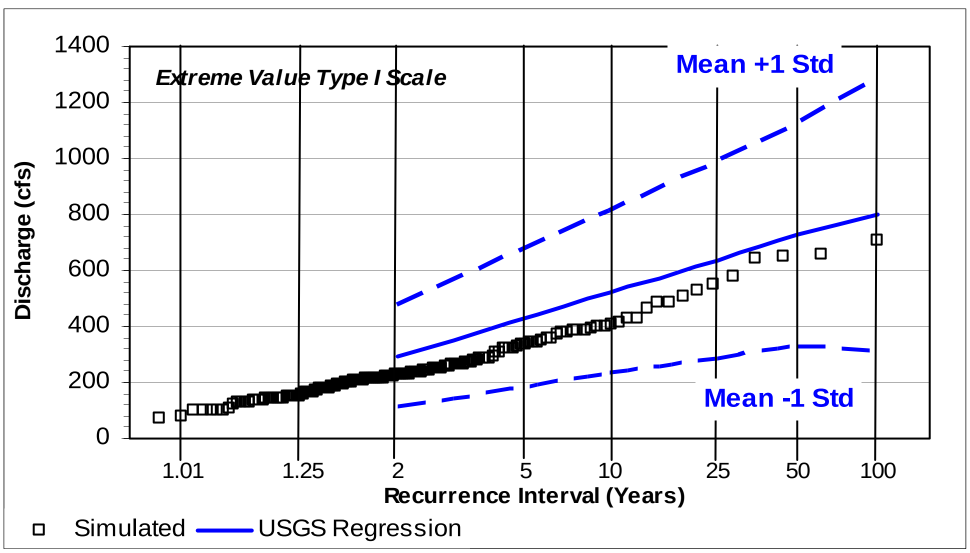

Figure 6 – Comparison of Lake Creek Discharge to Big Lake Flood Magnitude-Frequency Relationships HSPF and USGS Regression Equations

ANALYSIS RESULTS

Changes in Flood Frequency with Land Use

The HSPF model was used to characterize runoff in the Big Lake watershed for two land use conditions; existing and future build-out under the current Skagit County Comprehensive Land Use Plan. The dominant land use in the watershed is forest practices. Areas designated as forest practice under the comprehensive plan were assumed to be 50-percent clear-cut under future land use. Given the rural land use designation for the majority of the watershed, there is relatively little difference between existing and build-out land use (Tables 3a and 3b).

The relatively small change in development and clearing in the watershed between existing and build-out conditions resulted in minor changes in the peak inflow to Big Lake (Figure 7a). The Big Lake 100-year water surface elevation was predicted to increase by less than 0.1 feet relative to existing conditions (Figure 7b). Flood-frequency results for existing and build-out land use are summarized in Tables 4a and 4b.

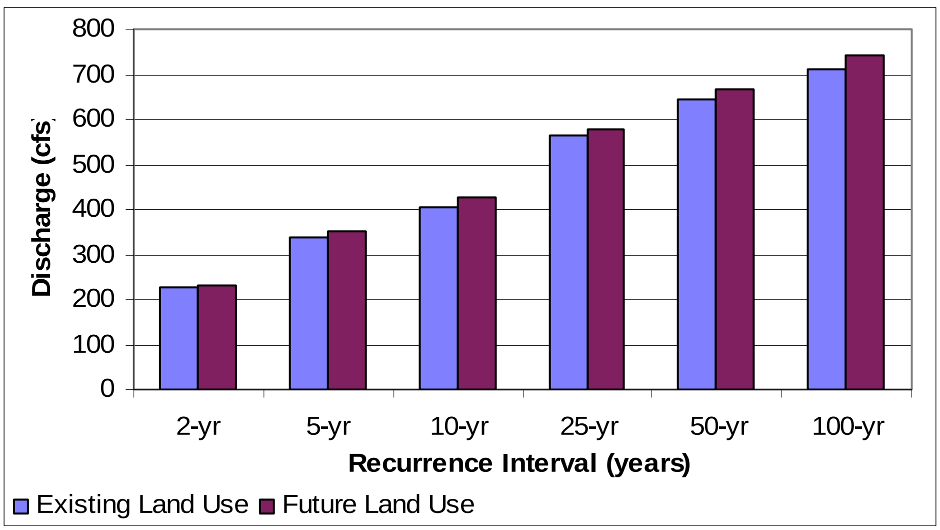

Figure 7a – Comparison of Lake Creek Discharge to Big Lake under Existing and Build-out Land Use

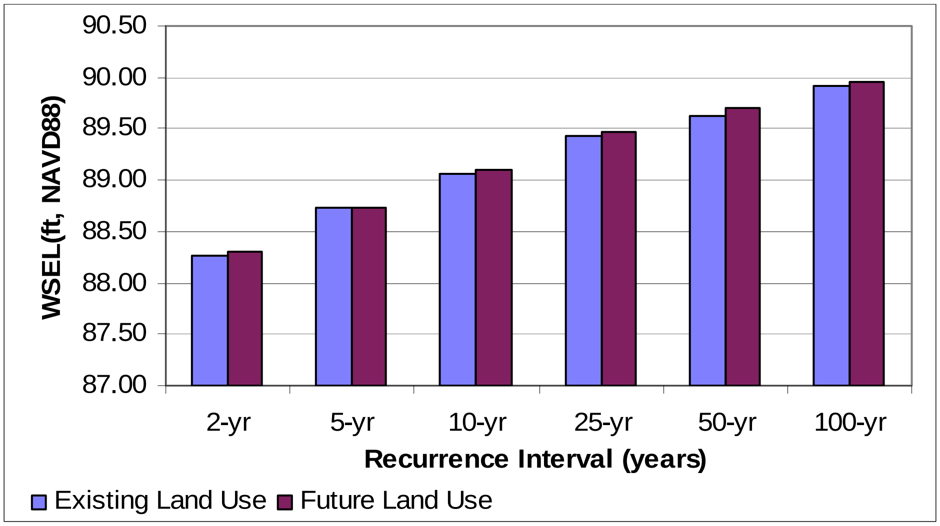

Figure 7b – Comparison of Big Lake Water Surface Elevation under Existing and Build-out Land Use

Table 4a – Big Lake Watershed Flood Peak Magnitude-Frequency Existing Land Use						
Location	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
Lake McMurray Discharge (cfs)	38	54	66	79	88	102
Subbasin LC6 Discharge (cfs)	59	86	104	129	136	153
Subbasin LC3 Discharge (cfs)	107	160	188	243	252	284
Subbasin LC2 Discharge (cfs)	164	242	292	407	441	466
Subbasin LC1 Discharge (cfs)	226	338	405	563	646	709
Big Lake Discharge (cfs)	197	278	348	425	472	546
Big Lake WSEL (ft)	88.27	88.72	89.07	89.43	89.62	89.91

Table 4b – Big Lake Watershed Flood Peak Magnitude-Frequency Future Land Use						
Location	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
Lake Mc Murray Discharge (cfs)	41	56	71	87	98	110
Subbasin LC6 Discharge (cfs)	61	90	112	139	145	160
Subbasin LC3 Discharge (cfs)	111	171	199	257	272	302
Subbasin LC2 Discharge (cfs)	170	261	313	423	471	488
Subbasin LC1 Discharge (cfs)	233	352	425	578	668	740
Big Lake Discharge (cfs)	202	280	353	434	493	554
Big Lake WSEL (ft)	88.30	88.73	89.10	89.46	89.71	89.95

Duration Analysis
Duration statistics were computed for Big Lake inflow and water surface elevation under existing and proposed outlet conditions (Tables 5 and 6). While the peak statistics presented in the previous section characterize the hydrologic response during floods, flow duration statistics summarize the response over the entire range of flow magnitudes (low flows to floods). A flow-duration analysis tracks the fraction of time that a given flow rate is equaled or exceeded during a particular time period (monthly or annual). For example, the 50% flow duration exceedance for the month of November is 19 cfs (Table 5a). In other words, 50% of the time, the inflow to Big Lake from Lake Creek equals or exceeds this value.

The Results of the duration analysis showed only minor changes in the simulated runoff response due to the slight differences in land use between existing and future conditions. Figure 8 shows the variation of Big Lake water surface throughout the year for typical conditions (50% exceedance) and high runoff conditions (10% exceedance). The lake typically reaches maximum elevation during the month of February in response to winter runoff and recedes to a minimum in August during the drier months.

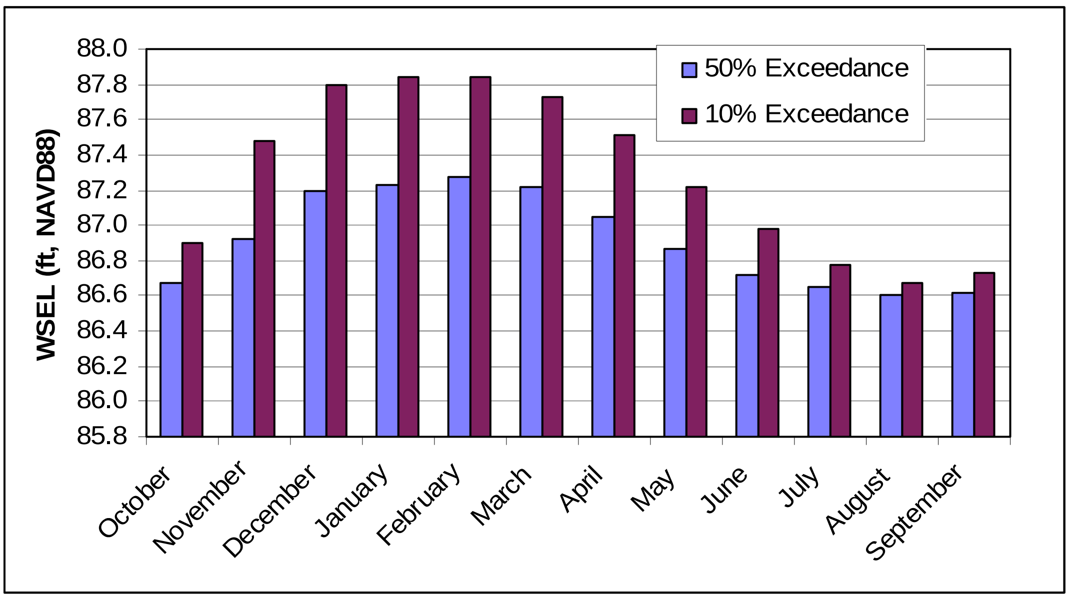

Figure 8 - Existing Land Use, Big Lake Water Surface Elevation Seasonal Distribution Typical (50% Exceedance) and Wet Year (10% Exceedance) Conditions

Table 5a – Existing Land Use, Lake Creek Inflow (Subbasin LC1) to Big Lake Duration Statistics

	Percentage of Simulation Time Discharge is Equaled or Exceeded (cfs)			
Month	**90%**	**50%**	**20%**	**10%**
October	4.6	7.4	12	17
November	6.9	19	43	65
December	15	35	68	94
January	18	39	74	100
February	19	41	76	104
March	18	36	67	91
April	15	26	45	65
May	11	16	25	38
June	8.5	12	16	21
July	6.3	8.8	11	13
August	4.7	6.6	8.1	9.1
September	4.4	6.3	7.9	9.6
Annual	**6.1**	**16**	**41**	**65**

Table 5b – Future Land Use, Lake Creek Inflow (Subbasin LC1) to Big Lake Duration Statistics

	Percentage of Simulation Time Discharge is Equaled or Exceeded (cfs)			
Month	**90%**	**50%**	**20%**	**10%**
October	4.6	7.8	13	20
November	7.3	21	46	69
December	15	36	70	97
January	18	39	75	102
February	19	41	77	105
March	18	36	68	92
April	15	25	46	66
May	11	16	25	38
June	8.4	12	16	21
July	6.2	8.6	11	13
August	4.5	6.5	8.0	9.0
September	4.3	6.2	8.1	10.2
Annual	**6.0**	**16**	**42**	**66**

Table 6a – Existing Land Use, Big Lake Water Surface Elevation Duration Statistics

	Percentage of Simulation Time Elevation is Equaled or Exceeded (ft, NAVD88)			
Month	**90%**	**50%**	**20%**	**10%**
October	86.5	86.7	86.8	86.9
November	86.7	86.9	87.3	87.5
December	86.8	87.2	87.6	87.8
January	86.9	87.2	87.6	87.8
February	86.9	87.3	87.6	87.8
March	86.9	87.2	87.5	87.7
April	86.8	87.1	87.3	87.5
May	86.7	86.9	87.0	87.2
June	86.6	86.7	86.9	87.0
July	86.6	86.6	86.7	86.8
August	86.4	86.6	86.6	86.7
September	86.4	86.6	86.7	86.7
Annual	**86.6**	**86.9**	**87.3**	**87.5**

Table 6b – Future Land Use, Big Lake Water Surface Elevation Duration Statistics

	Percentage of Simulation Time Elevation is Equaled or Exceeded (ft, NAVD88)			
Month	**90%**	**50%**	**20%**	**10%**
October	86.5	86.7	86.8	87.0
November	86.7	87.0	87.3	87.5
December	86.8	87.2	87.6	87.8
January	86.9	87.2	87.6	87.9
February	86.9	87.3	87.6	87.9
March	86.9	87.2	87.5	87.7
April	86.8	87.0	87.3	87.5
May	86.6	86.8	87.0	87.2
June	86.6	86.7	86.9	87.0
July	86.4	86.6	86.7	86.8
August	86.3	86.6	86.6	86.7
September	86.4	86.6	86.7	86.7
Annual	**86.6**	**86.9**	**87.3**	**87.5**

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APPENDIX – LAND USE SUMMARY BY SUBBASIN

Big Lake Watershed, Existing land use
Computed using data from Tab LUExistDatabase
PERLND Areas (acres)

Subbasin	Impervious	TILL Forest TF	TILL Clear TC	Till Pasture TP	TILL Grass TG	Outwash Forest OF	Outwash Clear OC	Outwash Pasture OP	Outwash Grass OG	Wetland WT	Water WAT	Total (acres)
BL1	4.784	170.569	2.394	45.873	4.917	5.085	0.000	8.938	10.683	0.276	0.000	253.5
BL10	0.758	66.700	0.000	16.638	0.000	0.000	0.000	0.000	0.000	2.615	0.000	86.7
BL100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**540.396**	540.4
BL12	0.441	92.030	0.000	2.144	0.000	0.000	0.000	0.000	0.000	1.409	0.000	96.0
BL13	0.279	179.798	185.083	0.003	0.000	0.000	0.000	0.000	0.000	0.331	0.000	365.5
BL15	6.967	71.039	4.344	62.907	17.104	0.000	0.000	0.000	0.000	20.255	0.000	182.6
BL16	9.718	75.687	0.009	106.517	41.221	0.000	0.000	0.000	0.000	0.000	0.000	233.2
BL17	2.220	0.000	0.000	0.000	7.791	0.000	0.000	0.000	0.000	0.000	0.000	10.0
BL18	5.521	3.355	0.354	0.000	35.471	0.000	0.000	0.000	0.000	0.000	0.000	44.7
BL19	3.241	9.694	105.386	10.442	53.767	0.000	0.000	0.000	0.000	3.226	0.000	185.8
BL2	0.818	59.360	0.000	1.671	1.498	0.196	0.000	4.550	3.532	0.000	0.000	71.6
BL20	5.865	0.000	0.000	1.498	5.407	0.000	0.000	0.109	14.525	0.000	0.000	27.4
BL3	2.539	0.843	0.000	12.684	11.290	0.000	0.000	4.683	5.052	0.000	0.000	37.1
BL4	8.652	191.939	0.000	107.231	9.507	0.109	0.000	1.151	6.481	0.330	0.000	325.4
BL5	1.415	66.773	0.000	8.431	9.575	0.000	0.000	0.000	0.000	0.000	0.000	86.2
BL6	3.475	94.950	0.000	13.971	9.496	0.000	0.000	0.000	0.000	0.000	0.000	121.9
BL7	4.329	458.207	115.604	36.998	0.000	0.000	0.000	0.000	0.000	35.634	0.000	650.8
BL8	1.954	8.199	0.000	24.555	5.301	0.000	0.000	0.000	0.000	0.000	0.000	40.0
BL9	3.746	5.076	0.000	34.507	20.135	0.000	0.000	0.000	0.000	0.406	0.000	63.9
LC1	4.848	192.449	24.856	121.162	0.000	0.000	0.000	0.000	0.000	26.783	0.000	370.1
LC10	4.970	290.409	0.532	27.470	6.483	6.895	0.000	12.694	15.286	3.857	0.000	368.6
LC11	3.743	142.025	39.951	23.679	4.417	30.924	13.197	0.769	0.000	4.560	0.000	263.3
LC12	0.711	37.549	24.970	17.070	0.000	5.323	0.000	0.000	0.000	0.000	0.000	85.6
LC14	0.000	248.176	184.169	0.000	0.000	2.141	0.000	0.000	0.000	0.000	0.000	434.5
LC15	0.870	143.152	34.157	0.000	0.000	3.506	0.000	0.000	0.000	0.000	0.000	181.7
LC16	0.336	763.314	21.027	1.084	0.000	0.000	0.000	0.000	0.000	45.829	0.000	831.6
LC17	0.198	14.274	0.000	3.256	0.000	0.000	0.000	0.000	0.000	0.000	0.000	17.7
LC18	0.675	364.154	52.824	16.206	0.000	0.000	0.000	0.000	0.000	21.603	0.000	455.5
LC19	1.784	37.168	0.000	67.230	0.000	0.000	0.000	0.000	0.000	0.000	0.000	106.2
LC2	2.651	133.562	53.330	62.416	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.0
LC20	2.083	734.093	309.911	75.891	0.000	0.000	0.000	0.000	0.000	10.715	0.000	1132.7
LC200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**161.351**	161.4
LC21	4.364	260.074	19.745	97.934	0.000	0.000	0.000	0.000	0.000	0.000	0.000	382.1
LC3	0.615	67.581	21.959	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	90.2
LC4	0.057	41.870	542.785	0.000	0.000	0.000	0.000	0.000	0.000	4.132	0.000	588.8
LC5	0.000	137.098	744.564	0.000	0.000	0.000	0.000	0.000	0.000	6.622	**48.040**	936.3
LC6	1.856	94.002	190.224	11.671	0.000	41.240	28.251	2.791	0.000	0.000	0.000	370.0
LC7	5.551	165.240	368.938	22.522	28.979	7.565	0.000	17.509	2.633	0.000	0.000	618.9
LC8	0.895	215.201	54.548	20.303	0.000	0.176	0.000	1.187	0.000	0.000	0.000	292.3
LC9	9.681	347.673	1.325	13.244	4.317	41.581	0.000	126.518	18.428	0.000	0.000	562.8

PERLND Areas (acres) FUTURE LAND USE

Subbasin	Impervious	TILL Forest TF	TILL Clear TC	Till Pasture TP	TILL Grass TG	Outwash Forest OF	Outwash Clear OC	Outwash Pasture OP	Outwash Grass OG	Wetland WT	Water WAT	Total (acres)
BL1	23.153	0.000	0.000	28.798	177.316	0.000	0.000	5.950	18.027	0.276	0.000	253.5
BL10	1.343	25.420	25.420	31.725	0.189	0.000	0.000	0.000	0.000	2.615	0.000	86.7
BL100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**540.362**	540.4
BL12	0.696	42.450	42.241	4.341	4.888	0.000	0.000	0.000	0.000	1.409	0.000	96.0
BL13	0.282	178.618	178.618	6.058	1.587	0.000	0.000	0.000	0.000	0.331	0.000	365.5
BL15	8.049	1.812	1.812	119.609	30.946	0.000	0.000	0.000	0.000	20.255	0.000	182.5
BL16	14.283	0.000	0.000	144.894	73.975	0.000	0.000	0.000	0.000	0.000	0.000	233.2
BL17	1.001	0.000	0.000	0.000	9.009	0.000	0.000	0.000	0.000	0.000	0.000	10.0
BL18	4.670	0.000	0.000	0.000	40.066	0.000	0.000	0.000	0.000	0.000	0.000	44.7
BL19	15.145	0.000	0.000	49.694	117.670	0.000	0.000	0.000	0.000	3.226	0.000	185.7
BL2	6.002	0.000	0.000	16.502	41.019	0.000	0.000	2.071	6.033	0.000	0.000	71.6
BL20	2.740	0.000	0.000	0.000	7.575	0.000	0.000	0.000	17.089	0.000	0.000	27.4
BL3	2.775	0.000	0.000	14.368	10.462	0.000	0.000	0.691	8.795	0.000	0.000	37.1
BL4	16.749	0.000	0.000	251.547	48.957	0.000	0.000	0.370	7.311	0.330	0.000	325.3
BL5	5.333	0.000	0.000	52.588	28.273	0.000	0.000	0.000	0.000	0.000	0.000	86.2
BL6	5.890	0.000	0.000	100.781	15.221	0.000	0.000	0.000	0.000	0.000	0.000	121.9
BL7	13.580	138.515	138.515	323.691	0.836	0.000	0.000	0.000	0.000	35.634	0.000	650.8
BL8	2.012	0.000	0.000	31.830	6.168	0.000	0.000	0.000	0.000	0.000	0.000	40.0
BL9	4.606	1.237	1.237	23.880	32.502	0.000	0.000	0.000	0.000	0.406	0.000	63.9
LC1	2.445	80.900	80.900	179.070	0.000	0.000	0.000	0.000	0.000	26.783	0.000	370.1
LC10	11.131	125.721	124.926	3.556	65.488	0.000	0.000	0.000	33.357	3.857	0.000	368.0
LC11	9.904	28.114	28.114	123.065	26.430	0.000	0.000	42.430	0.646	4.560	0.000	263.3
LC12	2.148	15.957	15.957	46.451	0.000	0.000	0.000	5.110	0.000	0.000	0.000	85.6
LC14	0.915	205.800	205.800	19.914	0.000	0.000	0.000	2.055	0.000	0.000	0.000	434.5
LC15	3.874	42.277	42.277	89.617	0.000	0.000	0.000	3.366	0.000	0.000	0.000	181.4
LC16	1.438	374.329	374.329	34.514	0.000	0.000	0.000	0.000	0.000	45.829	0.000	830.4
LC17	0.697	0.000	0.000	16.728	0.000	0.000	0.000	0.000	0.000	0.000	0.000	17.4
LC18	1.540	197.692	197.692	36.970	0.000	0.000	0.000	0.000	0.000	21.603	0.000	455.5
LC19	3.827	5.255	5.255	91.845	0.000	0.000	0.000	0.000	0.000	0.000	0.000	106.2
LC2	2.960	86.831	86.831	75.336	0.000	0.000	0.000	0.000	0.000	0.000	0.000	252.0
LC20	1.308	544.640	544.640	31.389	0.000	0.000	0.000	0.000	0.000	10.715	0.000	1132.7
LC200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**161.351**	161.4
LC21	3.539	146.840	146.840	84.937	0.000	0.000	0.000	0.000	0.000	0.000	0.000	382.2
LC3	0.941	33.312	33.312	22.595	0.000	0.000	0.000	0.000	0.000	0.000	0.000	90.2
LC4	5.409	224.729	224.729	129.818	0.000	0.000	0.000	0.000	0.000	4.132	0.000	588.8
LC5	0.000	440.835	440.828	0.000	0.000	0.000	0.000	0.000	0.000	6.622	**48.040**	936.3
LC6	4.845	109.525	109.525	74.989	0.000	14.895	14.895	41.284	0.000	0.000	0.000	370.0
LC7	9.065	207.496	206.665	164.875	4.167	0.000	0.000	17.832	8.905	0.000	0.000	619.0
LC8	5.696	86.092	86.092	100.444	12.664	0.000	0.000	0.388	0.827	0.000	0.000	292.2
LC9	21.529	87.921	87.921	166.493	16.069	0.541	0.541	105.014	75.412	0.000	0.000	561.4