31. SURFACE WATER HYDROLOGY

31.1 Introduction

Chapter 31 of the environmental baseline document presents the findings of the baseline surface water hydrology studies for the Cook Inlet drainages study area. These studies consisted of a field component to characterize stream channels crossing the linear study area and to collect spot measurements of instantaneous discharge (streamflow), a basin-analysis component to characterize physical and climatic aspects for the drainage basins of the studied streams, and a regional analysis component to estimate high and low flow statistics for each stream based on published guidelines and regression analyses.

The Cook Inlet drainages study area encompasses two surface water gaging stations, one on Williams Creek near the head of Iliamna Bay and one on Y Valley Creek near the mouth of Iniskin Bay (Figure 31-1). Williams Creek flows eastward from the drainage boundary between Bristol Bay and Cook Inlet and flows into Iliamna Bay at Williamsport. The Y Valley is located on the peninsula between Iliamna Bay and Iniskin Bay, and Y Valley Creek flows southward into Cook Inlet near the headland between the two bays.

Drainage basin characteristics—including drainage area, lake and pond area, mean basin elevation, mean annual precipitation, and mean minimum January temperature—were compiled for each of these two creeks. Instantaneous discharge measurements were collected monthly in the Y Valley Creek from August 2004 through October 2005, while monthly discharge measurements were measured in Williams Creek from July 2005 through October 2005.

The U.S. Geological Survey (USGS) provides regional regression equations for estimating low-duration, high-duration, and peak flow statistics based on basin characteristics (Wiley and Curran, 2003; Curran et al., 2003). These equations were used to estimate flow statistics in Williams Creek and Y Valley Creek. Low-duration flows are flows that are exceeded much of the time; the USGS equations provide results for flows that are predicted to be exceeded 50 percent to 98 percent of the time. High-duration flows are flows that are exceeded relatively infrequently; the USGS equations provide results for flows that are predicted to be exceeded 1 percent to 15 percent of the time. Peak flows are extreme high flows that are predicted to be exceeded only once, on average, within specified return periods expressed in years.

31.2 Results and Discussion

Drainage basin characteristics for Williams Creek and Y Valley Creek are summarized in Table 31-1.

The instantaneous discharge measurements collected in the Y Valley and Williams creeks are in general agreement with regional low-duration and high-duration flow estimates. The low-

duration flow statistics for July, August, and September, estimated based on the USGS regression equations in Wiley and Curran (2003), are presented in Table 31-2.

No field data on peak flows were collected to compare to the peak flow estimates from USGS regression equations, as is commonly the case in remote areas. Table 31-3 shows the estimated peak flow values for each creek for recurrence intervals of 2 through 500 years based on the USGS regression equations in Curran et al. (2003). Two sets of estimates are presented because the study area lies near the boundary of two USGS streamflow regions with differing equations for estimating peak flows. It is difficult to determine which region is more representative of the study area, so both sets of results were considered.

31.3 References

Curran, J.H., D.F. Meyer, and G.D. Tasker. 2003. Estimating the Magnitude and Frequency of Peak Streamflows for Ungaged Sites on Streams in Alaska and Conterminous Basins. U.S. Geological Survey Water Resources Investigations Report 03-4188.

Wiley, J.B., and J.H. Curran. 2003. Estimating Annual High-Flow Statistics and Monthly and Seasonal Low-Flow Statistics for Ungaged Sites on Streams in Alaska and Conterminous Basins in Canada. Water Resources Investigations Report 03-4114. U.S. Geological Survey.

TABLE 31-1
Drainage Basin Characteristics, Cook Inlet Drainages Study Area

			Drainage Basin Characteristics					
Station	Stream	Period of Record	Basin Area (mi^2)	Lake & Pond Area (mi^2)	Lake & Pond Area (%)	Mean Basin Elev. (ft)	Mean Annual Precipitation (in)	Mean Minimum January Temp. (°F)
GS-21	Y Valley Creek	2004-05	12.39	0	0.0	1165	70	12
GS-22	Williams Creek	2004-05	4.60	0	0.0	1775	70	11

in = inches
°F = degrees Fahrenheit
ft = feet
mi^2 = square miles

TABLE 31-2
Estimated Monthly Low-duration Flows [a] at Gage Stations in the Cook Inlet Drainages Study Area

JULY		Low-duration Flows Estimated from Regression Equations for July (cfs)							
Station	**Stream**	**98%**	**95%**	**90%**	**85%**	**80%**	**70%**	**60%**	**50%**
GS-21	Creek in Y Valley	25.5	30.0	35.0	39.2	42.7	49.0	55.6	62.4
GS-22	Williams Creek	11.1	12.9	15.4	17.2	18.9	21.8	24.8	27.9
AUGUST		**Low-duration Flows Estimated from Regression Equations for August (cfs)**							
Station	**Stream**	**98%**	**95%**	**90%**	**85%**	**80%**	**70%**	**60%**	**50%**
GS-21	Creek in Y Valley	18.4	21.8	25.2	28.1	30.7	36.2	41.7	48.1
GS-22	Williams Creek	7.4	8.8	10.2	11.4	12.5	14.8	17.1	19.7
SEPTEMBER		**Low-duration Flows Estimated from Regression Equations for September (cfs)**							
Station	**Stream**	**98%**	**95%**	**90%**	**85%**	**80%**	**70%**	**60%**	**50%**
GS-21	Creek in Y Valley	16.4	19.9	24.6	28.1	31.4	37.8	44.8	53.2
GS-22	Williams Creek	5.4	6.5	8.2	9.4	10.5	12.8	15.3	18.3

Notes:
a. Based on U.S. Geological Survey Region 3 and 4 regression equations.
cfs = cubic feet per second

TABLE 31-3
Estimated Peak Flows [a] at Gage Stations in the Cook Inlet Drainages Study Area

REGION 3		Peak Flows Estimated from Regression Equations for Region 3 (cfs)							
Station	**Stream**	**Q_2**	**Q_5**	**Q_{10}**	**Q_{20}**	**Q_{50}**	**Q_{100}**	**Q_{200}**	**Q_{500}**
GS-21	Creek in Y Valley	788	1148	1404	1738	1998	2259	2542	2920
GS-22	Williams Creek	332	485	594	737	848	960	1082	1245
REGION 4		**Peak Flows Estimated from Regression Equations for Region 4 (cfs)**							
Station	**Stream**	**Q_2**	**Q_5**	**Q_{10}**	**Q_{20}**	**Q_{50}**	**Q_{100}**	**Q_{200}**	**Q_{500}**
GS-21	Creek in Y Valley	451	709	911	1186	1403	1624	1858	2196
GS-22	Williams Creek	177	288	378	502	601	703	811	969

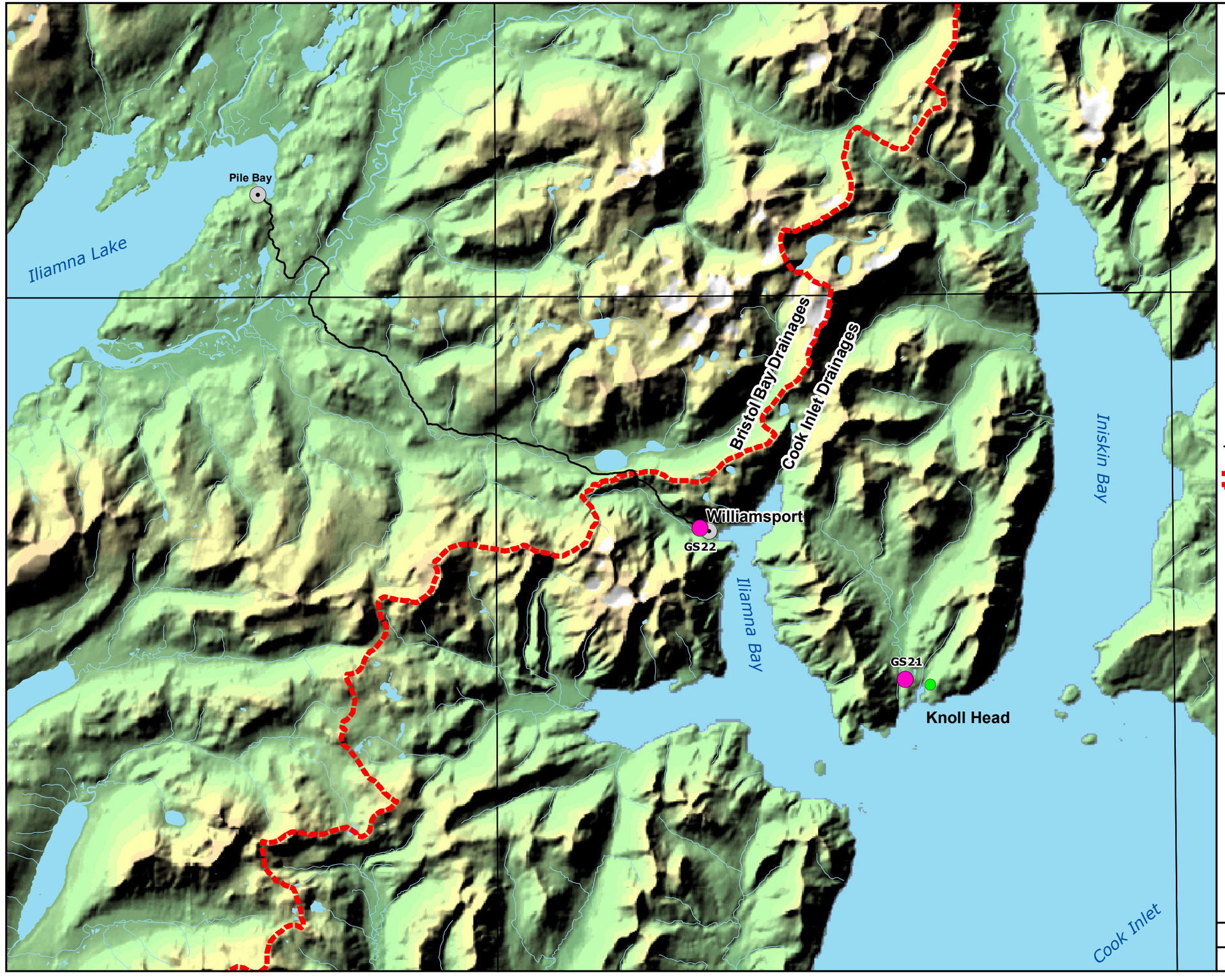
Notes:

a. Based on U.S. Geological Survey regional regression equations.

cfs = cubic feet per second.

Q_T = peak flow with average recurrence interval of T years.

Field crew taking a discharge measurement using the wading method on Williams Creek.



THE pebble PARTNERSHIP

Figure 31-1
Surface Water Gage Stations
Transportation Corridor
Cook Inlet Study Area
2004-2005

Legend

- Surface Water Gage Station (Pebble Project)
- **GS21**: Example of Pebble Project Surface Water Gage Station Identification Number
- Knoll Head
- Communities
- Existing Roads
- Bristol Bay/Cook Inlet Drainage Boundary

0 1 2 3 4 Miles

0 1 2 3 4 Kilometers

N

Scale 1:119,028

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

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