DONLIN GOLD

Water Quality Permits for Large Projects in Alaska

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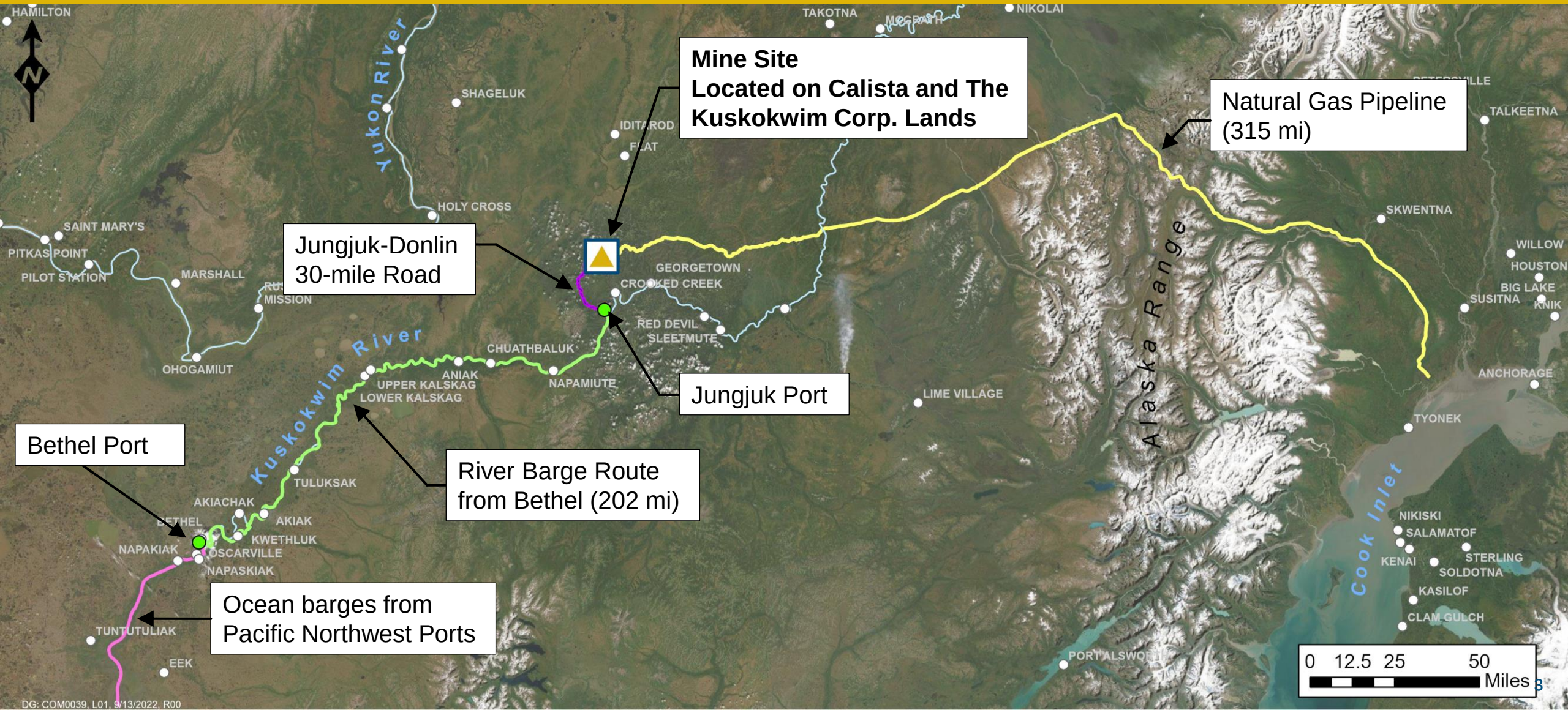
DONLIN GOLD

Project Location

Project Description



Todays Discussion

- Alaska's Water Quality Standards – What they are and what applies
- Example of a Permit Timeline
  - Baseline Data Collection
  - Permit Application and Processing
  - Compliance, Monitoring and Renewals
- Challenges
- Working on Alaska Native Lands – Valued Partners

Alaska's Water Quality Standards

Enter the appropriate **Hardness** value for the water you are interested in: 25 mg/L as CaCO3 ****

color key: orange highlighting: the most stringent criterion
yellow highlighting: the criterion depends on the hardness

Calculation of Hardness
adapted from Standard Methods, Method 2340B
input calcium and magnesium concentrations:

		units in mg/L
Calcium:	3.28	
Magnesium:	10.4	Resulting Hardness: 51.0

all units in micrograms per liter (ug/L)

all units in micrograms per liter (ug/L)

Parameter	Drinking Water	Stockwater	Irrigation Water	Aquatic Life-Fresh Water										Human Health Criteria for NonCarcinogens	
				Acute					Chronic						
				the criterion is	as	*using the conversion factor*	the criterion is	as	the criterion is	as	*using the conversion factor*	the criterion is	as	Water + Aquatic Organisms	Aquatic Organisms Only
alkalinity									20,000 minimum						
aluminum			5,000	750	TR				87	TR					
antimony	6													14	4,300
arsenic	10	50	100	340	TR	*1*	340	D	150	TR	*1*	150	D		
barium	2,000														
beryllium	4		100												
boron			750												
cadmium	5	10	10	0.52	TR	*1.002*	0.52	D	0.10	TR	*0.967*	0.09	D		
chloride				860,000					230,000						
chlorine (total residual)				19					11						
chromium (total)	100		100												
chromium III				579.32	TR	*0.316*	183.07	D	27.69	TR	*0.86*	23.81	D		
chromium VI		50		16	D				11	D					
cobalt			50												
copper			200	3.79	TR	*0.960*	3.64	D	2.85	TR	*0.960*	2.74	D	1,300	
cyanide (as free CN)	200 *			22 **					5.2 **					700	220,000
fluoride	4,000		1,000												
iron			5,000						1,000						
lead		50	5,000	13.98	TR	*0.993*	13.88	D	0.54	TR	*0.993*	0.54	D		
lithium			2,500												
manganese			200											50	100
mercury	2			1.4	D				0.77	D				0.05	0.051
molybdenum			10												
nickel	100		200	145.21	TR	*0.998*	144.92	D	16.14	TR	*0.997*	16.10	D	610	4,600
nitrate (as N)	10,000														
nitrite (as N)	1,000														
nitrate + nitrite	10,000														
selenium***	50	10	20	1/[([selenite]/185.9) +([selenate]/12.83]	TR	*0.922*	--	D	5	TR	*0.922*	4.60	D	170	11,000
silver				0.37	TR	*0.850*	0.32	D							
thallium	2													1.7	6.3
vanadium			100												
zinc			2,000	37.02	TR	*0.978*	36.20	D	37.02	TR	*0.986*	36.50	D	9,100	69,000

- Alaska's Water Quality Standards
  - Different standards have been developed for different uses – Drinking water (applied to surface waters too), Stockwater, Irrigation, Aquatic Life (both acute and chronic as well as a mix of total and dissolved), and 2 sets of human health criteria
  - This makes for up to 9 sets of criteria
  - Because all waters have been designated for all uses, the most stringent criteria for each constituent is applied for permitted discharges

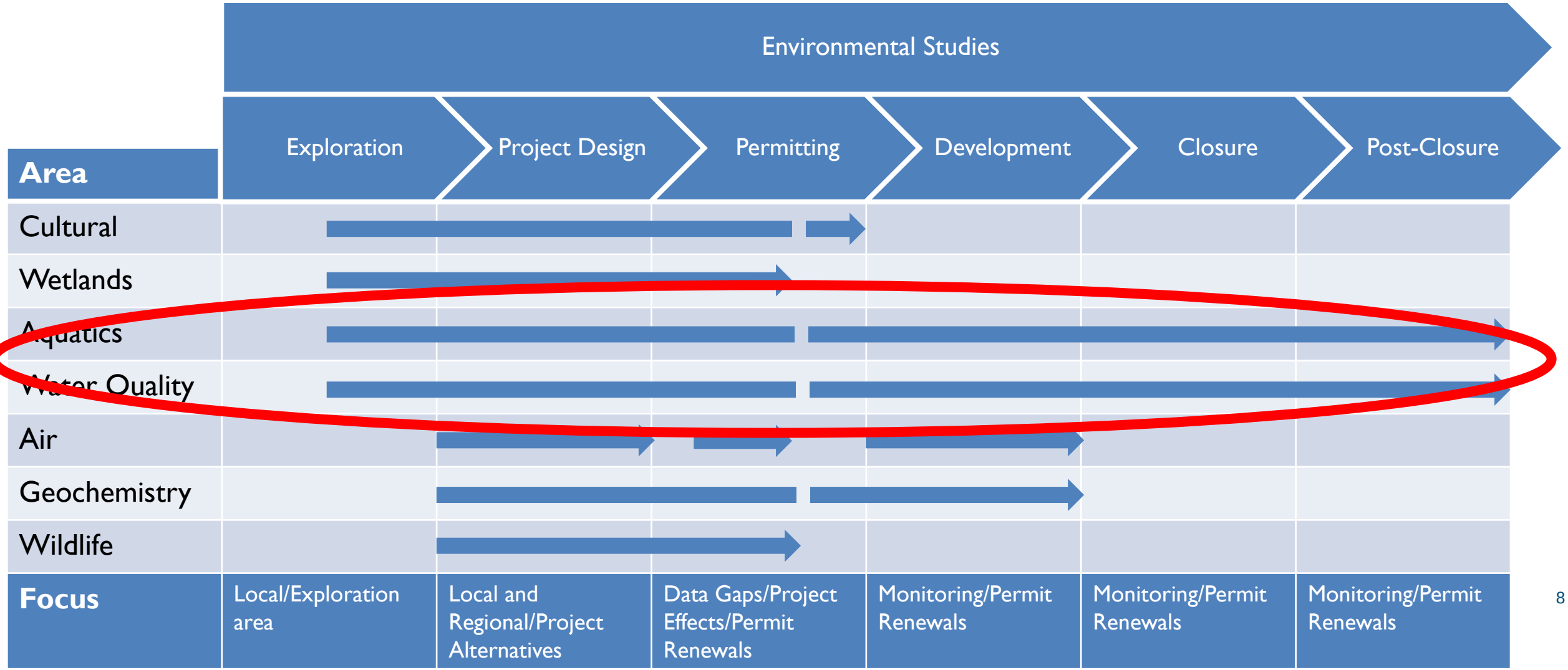
Environmental Baseline Studies Programs

- Air quality
- Cultural Resources
- Fish and Aquatic Resources
- Geochemistry
- Geotechnical
- Hydrology/Ground and Surface Water Quality
- Land Use
- Marine and River
- Mercury
- Noise
- Public Health
- Recreation
- Snow Surveys
- Socioeconomics
- Stream and sediment
- Subsistence
- Vegetation
- Visual Aesthetics
- Wetlands
- Wildlife

Planning for an Environmental Program

- Start early.
- Figure out data needs
  - Think through your permitting (e.g., NEPA), engineering, and future monitoring needs.
  - For water quality, understand the standards and ensure the baseline work will support all constituents (start broadly)
  - Talk to the agencies and present the baseline collection program in advance to get agency comments, views and perspectives
  - **Communicate with your stakeholders about project concerns, including those that oppose the project.**
- Form a good team
  - Field and office staff
  - Consultants
  - Labs
- Systems are a key to success

Environmental Studies Timeline



Surface Water Sampling Program

Sampling Progression

Legend

- Inactive Sampling Station
- Active Sampling Station

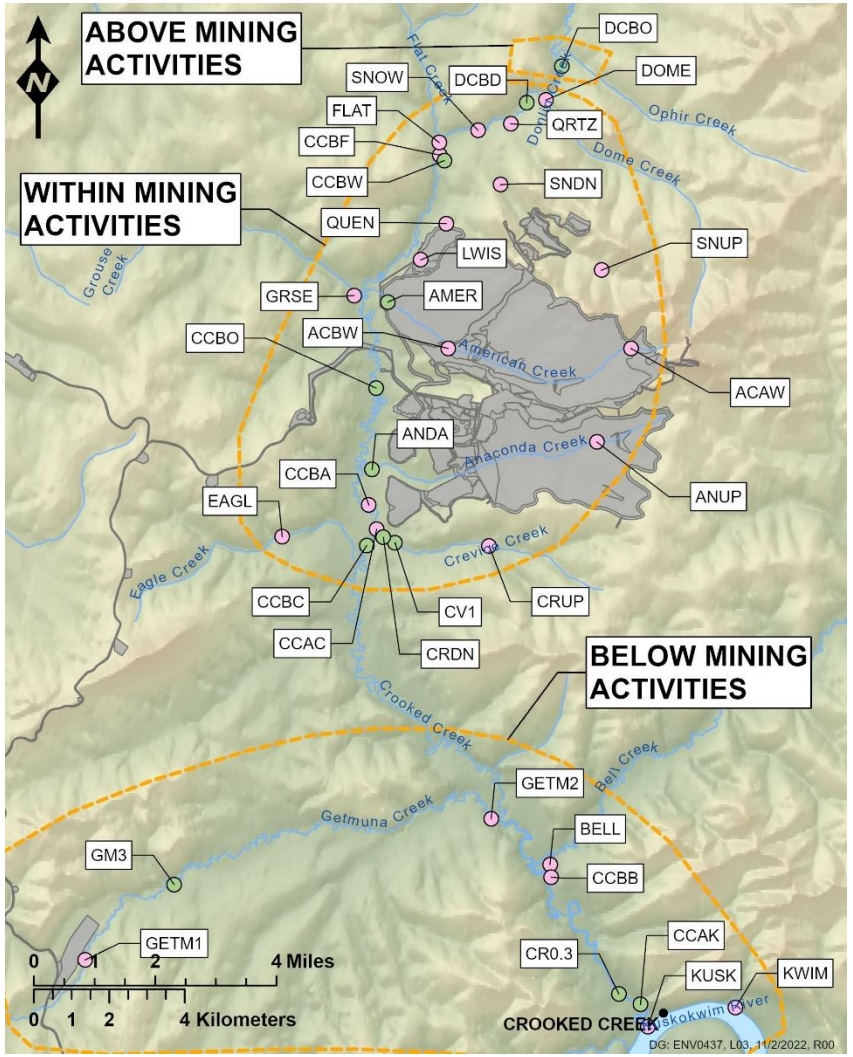
STATION	1996	1997	1998	1999	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2019	2020	2021	2022
Above Mining Activities																							
DCBO																							
Within Mining Activities																							
ACAW																							
ACBW																							
AMER																							
ANDA																							
ANUP																							
CCAC																							
CCBA																							
CCBC																							
CCBF																							
CCBO																							
CCBW																							
CRDN/CV1																							
CRUP																							
DCBD																							
DOME																							
EAGL																							
FLAT																							
GRSE																							
LWIS																							
QRTZ																							
QUEN																							
SNDN																							
SNOW																							
SNUP																							
Below Mining Activities																							
BELL																							
CCAK/CR0.3																							
CCBB																							
GETM1																							
GETM2																							
GM3.0																							
KUSK																							
KWIM																							

Wetland Mitigation

WWD?

Hg-study

LEARNING | BASELINE/PERMITTING (NEPA) | PERMITTING



APDES Permit Timeline – Key Milestones

Item	NEPA	APDES
Baseline Data Collection		2006
EIS Scoping Process	2012	
Initial Meeting with ADEC and EPA		Oct 2014
Proposed permit approach to ADEC/EPA		July 2015
Draft EIS	Nov 2015	
Submit draft application		Nov 2015
Draft Permit Issued		Dec 2017
Public Comment Period		Dec 2017-Feb 2018
Final EIS Published	April 2018	
APDES Permit Issued		May 2018

Compliance, Monitoring and Renewals

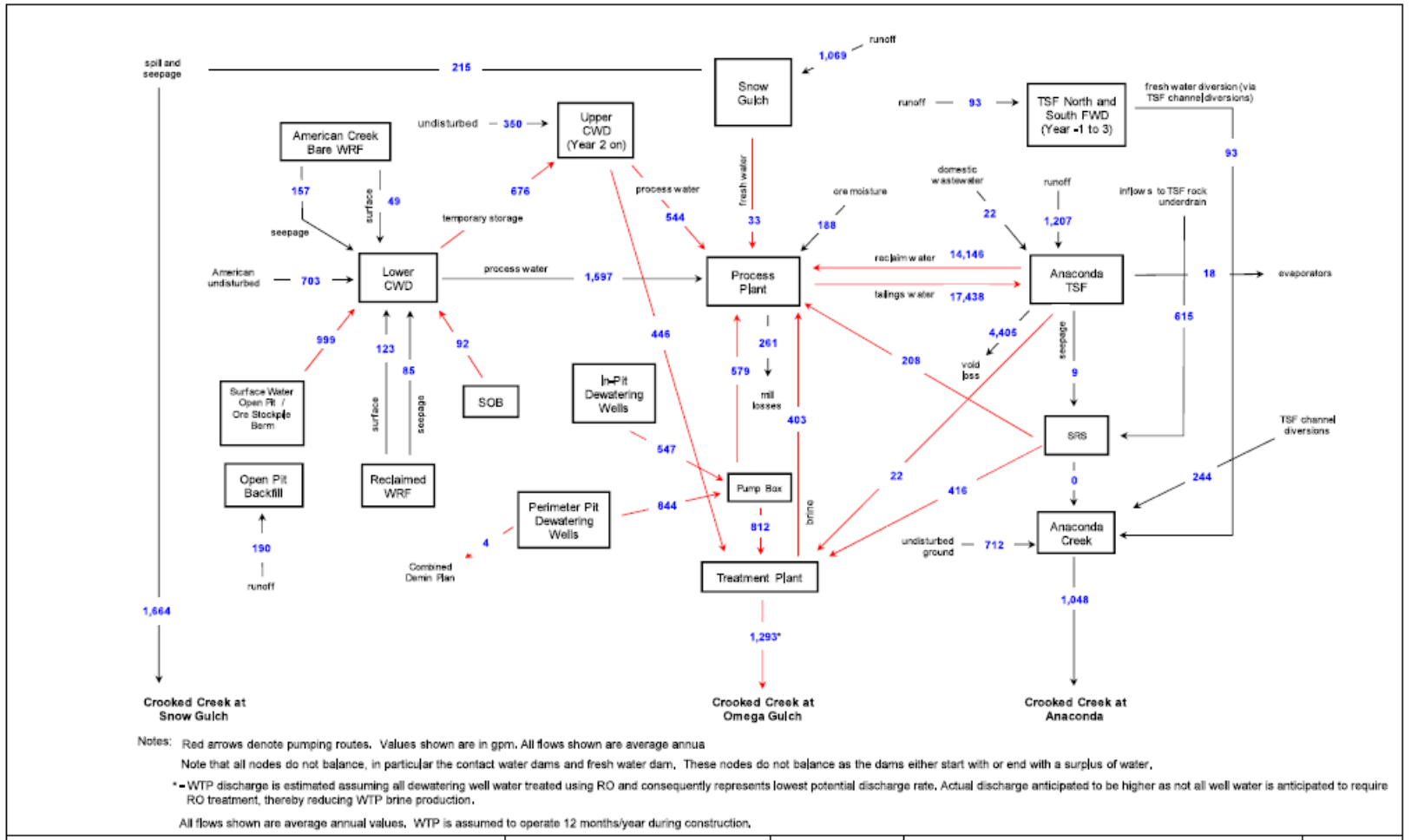
Table 3
Donlin Operations Water Treatment Plant Discharge, Outfall 001
Pollutant Maximum Concentrations, Maximum Mass, and Average Daily Mass

Constituent	Unit	Maximum Concentration in WTP Effluent[1]	Maximum Mass Discharge[4] (kg/day)	Average Mass Discharge, First 10 Years of Operation[5] (kg/day)	Source (ADEC Engineering Study Code)
Aluminum	mg/L	<0.05	1.0	0.54	2
Ammonia	mg/L	<0.5	10	5.4	2
Antimony	mg/L	<0.005	0.10	0.054	2
Arsenic	mg/L	<0.006	0.12	0.065	2
Barium	mg/L	<0.4	8.2	4.3	2
Beryllium	mg/L	<0.00059	0.012	0.0063	See Note 6
Boron	mg/L	<0.05	1.0	0.54	2
Cadmium	mg/L	<0.0001	0.0020	0.0011	2
Calcium[2]	mg/L	<240	4896	2580	2
Chloride	mg/L	<1	20	11	2
Chromium, total	mg/L	<0.002	0.041	0.022	2
Cobalt	mg/L	<0.001	0.020	0.011	2
Copper	mg/L	<0.001	0.020	0.011	2
Fluoride	mg/L	<0.4	8.2	4.3	2
Iron	mg/L	<0.05	1.02	0.54	2
Lead	mg/L	<0.001	0.020	0.011	2
Lithium	mg/L	<0.17	3.5	1.8	See Note 6
Magnesium[2]	mg/L	<240	4896	2580	2
Manganese	mg/L	<0.05	1.02	0.54	2
Mercury	mg/L	<0.000012	0.00024	0.00013	2
Molybdenum	mg/L	<0.005	0.10	0.05	2
Nickel	mg/L	<0.005	0.10	0.054	2
Nitrate	mg/L	<5.1	104	55	See Note 6
Potassium	mg/L	<120	2448	1290	See Note 6
Selenium	mg/L	<0.0048	0.10	0.052	2
Silicon	mg/L	<19	388	204	See Note 6
Silver	mg/L	<0.0009	0.018	0.010	See Note 6
Sodium[2]	mg/L	<240	4896	2580	2
Strontium	mg/L	<7.9	161	85	See Note 6
Sulfate	mg/L	<60	1224	645	2
TDS	mg/L	<240	4896	2580	2
Thallium	mg/L	<0.00058	0.012	0.0062	See Note 6
TSS	mg/L	<1	20	11	2
Vanadium	mg/L	<0.0084	0.17	0.09	See Note 6
WAD Cyanide	mg/L	<0.005	0.10	0.054	2
Zinc	mg/L	<0.02	0.41	0.22	2
Biochemical Oxygen Demand[3]	mg/L	<6.8	139	73	See note 3
Chemical Oxygen Demand[3]	mg/L	<12.4	253	133	See note 3
Total Organic Carbon[3]	mg/L	<4.24	86	46	See note 3

Notes:

- Predicted Compliance based on Reasonable Potential Analysis of numerous constituents – initial permit relies on very conservative estimates from modeling
- Initial permit contains many constituent limits
- Samples gathered at discharge (1 location) and from numerous stream locations and various intervals and submitted to agencies
- As operations advance and data is gathered and analyzed, limits may be adjusted in subsequent permits or removed if not present
- Requires renewal every 5 years

Compliance, Monitoring and Renewals



Notes: Red arrows denote pumping routes. Values shown are in gpm. All flows shown are average annua

Note that all nodes do not balance, in particular the contact water dams and fresh water dam. These nodes do not balance as the dams either start with or end with a surplus of water.

*- WTP discharge is estimated assuming all dewatering well water treated using RO and consequently represents lowest potential discharge rate. Actual discharge anticipated to be higher as not all well water is anticipated to require RO treatment, thereby reducing WTP brine production.

All flows shown are average annual values. WTP is assumed to operate 12 months/year during construction.

Reference: SRK, 2017. Donlin Gold Water Resources Management Plan, Figure B-2a.	SCALE: N/A	DONLIN GOLD	SCHEMATIC WATER BALANCE - OPERATIONS (LOM Year 2 to Year 27) DONLIN GOLD PROJECT	FIGURE: 5

Water management at large mine operations can be very complex and requires a full-time team to oversee and operate

Monitoring is not only required at the discharge, but includes monitoring of the aquatic and hydrologic environment of the entire drainage

Donlin also submitted an Aquatic Resource Monitor Plan to ADF&G for watershed aquatic resources that will supplement the water discharge monitoring requirements in the APDES

ALASKA WATER QUALITY CHALLENGES

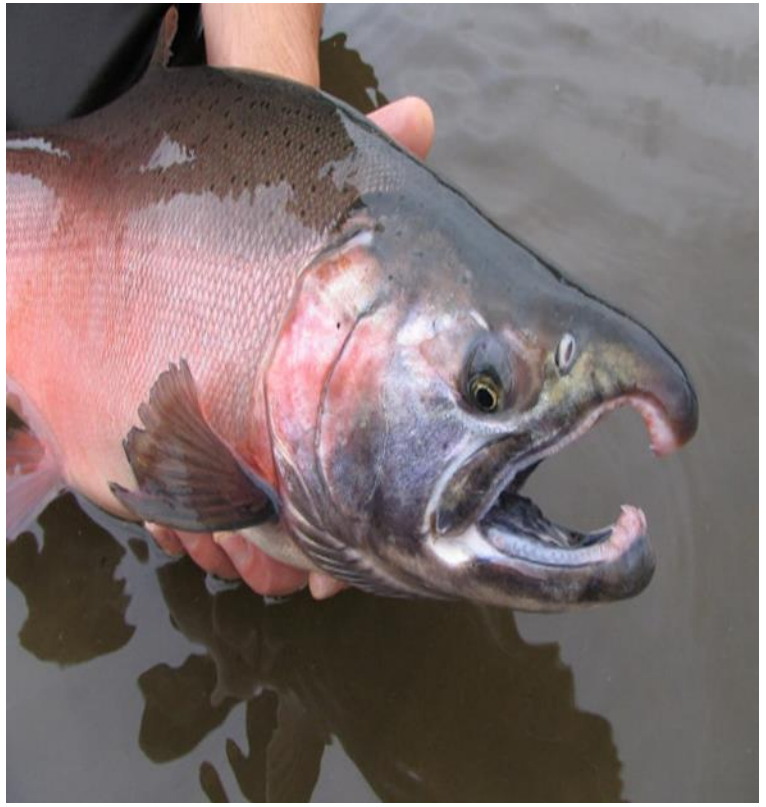
Water Quality Standards

- Alaska has among most stringent water quality standards in US, presents significant challenges for permittees particularly since site-specific criteria and use removal are very difficult to obtain
- All surface waters are protected for all uses, especially problematic because there is very little actual or potential drinking water use in rural Alaska and a number parameters (e.g., arsenic) are naturally found above drinking water/consumption standards
- There are provisions that allow for natural background consideration but difficult to implement generally because of highly variable levels of metals (driven by TSS)
- As a result, Alaska permittees such as Donlin are often required to treat water to levels much cleaner than the baseline conditions – Donlin must use RO for most of wastewater
  - In a State when many communities do not even have secondary treatment

ALASKA WATER QUALITY CHALLENGES

Water Quality Standards (continued)

- Like other Region 10 states, EPA has pushed Alaska to update its Human Health Criteria (HHC)
  - In large part this is driven by the significant quantities of fish caught and consumed, including for subsistence, by rural/Native Alaskans
  - Salmon specifically are consumed at very high levels – more than just food but part of the culture of our region
  - Revisions to fish consumption numbers make sense but public does not see the implications for permittees and watershed assessment
  - For Donlin(and other mines), arsenic (potential HHC well below background) and mercury (naturally occurring and HHC tissue based) could be especially difficult to implement, variances only provide near term relief



ALASKA WATER QUALITY CHALLENGES

Water Programs – Current and Potential Future Issues

- Mitigation for wetlands impacts under 404 challenging in western Alaska where most wetland areas are pristine, we were able to use some reclamation of historic placer areas but otherwise pushed to preservation where greater benefit could be provided by water, wastewater, and solid waste projects in communities (do not fit traditional Corps “credit” methodologies)
- Water quality is a major driver in Federal permitting for mines, while the State in theory has lead for protection, Federal agencies typically have their own (and frequently conflicting views) on how it should be addressed, often takes years to resolve and creates significant litigation risk.
- Permafrost presents Alaska-specific WOTUS questions under Sackett as a barrier to direct hydraulic connection
- Concerns over expected EPA Maui guidance – mines typically interact with groundwater, will the guidance overwhelm permittees and agencies with technical requirements not equipped to address
- EPA suggestions that broader environmental justice concerns (e.g., fair labor practices) could be used to delay or stop discharge permit issuance

ALASKA WATER QUALITY CHALLENGES

Public Perceptions and Communication

- Dialogue with agencies on water quality issues is often highly technical (bases for criteria, modeling, risk assessment, etc.), NEPA and permit documents frequently assume high level of scientific expertise
  - Regulations can also be very complicated to apply
- For projects in western Alaska, most stakeholders have high school education or less with limited technical and regulatory knowledge
  - And mere mention of parameters like mercury, cyanide, arsenic, etc. raises significant concerns, NGOs are especially adept at perpetuating such fears where we operate
- Much of this is on us but would be helpful if agencies had greater capabilities/resources to communicate with public on key risk areas and how they are being addressed, agency conflicts to not help
  - Our partnerships with Alaska Native Corporations are especially helpful in establishing stakeholder trust although significant capacity building is necessary

Working on Alaska Native Lands – A Valued Partnership

Mine Site
Located on Calista and The Kuskokwim Corp. Lands

CALISTA CORPORATION

THE KUSKOKWIM CORPORATION

- Mine site located on lands owned by Calista Corporation and The Kuskokwim Corporation (TKC).
- Working with Calista and TKC to develop the project.
- Calista and TKC review all permit applications before they are submitted
- Hiring preference for shareholders of Calista and TKC.
- Bidder preference for Calista and TKC subsidiaries.
- Both corporations have contractual payments that date back to 2006 and will increase for both in a production scenario

Donlin Gold Field Environmental Team