

APPENDIX D

Groundwater Inflow Estimation



Toad River, Alaska Highway, BC

Dewatering Calculations

Project #635734

Dewatering sand

min. depth to water (m) bgs 5
max. drawdown depth (m) bgs 8
depth to bottom of aquifer (m) 20
length (a) 50
width (b) 32
 $r_s =$ 22.6 m
 $H =$ 15 m
 $h =$ 12 m

K (m/sec) = 1.30E-06 0.021666667 μ /s
 $T =$ 0.325 μ m/s 19.5 μ m/min 1.95E-05
 r_i (radius of influence) = 2L L = 50 m 50 m L = distance to water source

steady state flowrate **Q** 4.159E-04 (m³/s)
24.95 (L/min) 6.59 US gal/min 0.4 (L/sec)

Initial volume of water in excavation:

Proposed Excavation: 50m(L)X32m(W)X3m(sat thickness)X0.3(porosity) m3 m3
1920 960
Assumes 50% of water will be part of soil disposal: 960

Volume of water to be removed after 1 day of rain (15 mm):

Proposed Excavation: 50m(L)X32m(W)X0.015 m3 m3
24.0 24

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2016/07/21 17:23

reference: Construction Dewatering, J.Patrick Powers, page 103, equation 6.3

Toad River, Alaska Highway, BC

Dewatering Calculations

Project #635734

Dewatering sand

min. depth to water (m) bgs
max. drawdown depth (m) bgs
depth to bottom of aquifer (m)
length (a)
width (b)

7
8
20
50
32

$r_s =$ 22.6 m
 $H =$ 13 m
 $h =$ 12 m

K (m/sec) = 5.00E-07 0.008333333 μ /s

$T =$ 0.108333333 μ m/s

r_i (radius of influence) = $2L$ $L = 50$ m 50 m $L =$ distance to water source

6.50E-06

steady state flowrate **Q** 4.936E-05 (m^3/s)
2.96 (L/min) 0.78 US gal/min 0.05 (L/sec)

Initial volume of water in excavation:

Proposed Excavation: 50m(L)X32m(W)X3m(sat thickness)X0.3(porosity) m3 m3
1920 960
Assumes 50% of water will be part of soil disposal: 960

Volume of water to be removed after 1 day of rain (15 mm):

Proposed Excavation: 50m(L)X32m(W)X0.015 m3 m3
24.0 24

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2016/07/21 17:23

reference: Construction Dewatering, J.Patrick Powers, page 103, equation 6.3

Proposed Excavation Size (m2)	Estimated Pump Rate (L/sec)		Initial Volume of Water in Excavation (m3)	Volume of Water in Excavation Accumulated after 1 day of rain (m3)
	High K	Low K		
1600	0.42	0.05	960	24

Assumes a hydraulic conductivity for the sand between 5×10^{-7} m/s and 1.3×10^{-6} m/s (as per slug test results from BH83 and BH06 (MW-01) and 13-94)

Depth to bottom of aquifer = 20 m bgs

Methodology:

Jacob Approximation
Radius of Influence

$$Ro = ((2.25 * T * t / S) ^ {1/2}$$

Ro (m) radius of influence
T (m2/s) transmissivity
t (s) time since start of pumping
S storage coefficient/specific yield

Calculations:

T (m2/s)	1.95E-05	1.95E-05	1.95E-05	T (m2/s)	6.50E-06	6.50E-06	6.50E-06
t (s)	21600	360000	36000	t (s)	21600	360000	36000
S	0.4	0.4	0.4	S	0.4	0.4	0.4
Ro (m)	1	20	2	Ro (m)	0	7	1
min	360	6000	600	min	360	6000	600
hr	6	100	10	hr	6	100	10
day	0.3	4.2	0.4	day	0.3	4.2	0.4

Toad River, Alaska Highway, BC

Dewatering Calculations

Project #635734

Dewatering sand

min. depth to water (m) bgs
max. drawdown depth (m) bgs
depth to bottom of aquifer (m)
length (a)
width (b)

5
8
20
25
16

$r_s =$ 11.3 m
 $H =$ 15 m
 $h =$ 12 m

K (m/sec) = 1.30E-06 0.021666667 μ /s

$T =$ 0.325 μ m/s

r_i (radius of influence) = $2L$ $L = 50$ m 50 m $L =$ distance to water source

1.95E-05

steady state flowrate **Q** 2.222E-04 (m^3/s)
13.33 (L/min) 3.52 US gal/min 0.2 (L/sec)

Initial volume of water in excavation:

Proposed Excavation: 50m(L)X32m(W)X3m(sat thickness)X0.3(porosity) m3 m3
1920 960
Assumes 50% of water will be part of soil disposal: 960

Volume of water to be removed after 1 day of rain (15 mm):

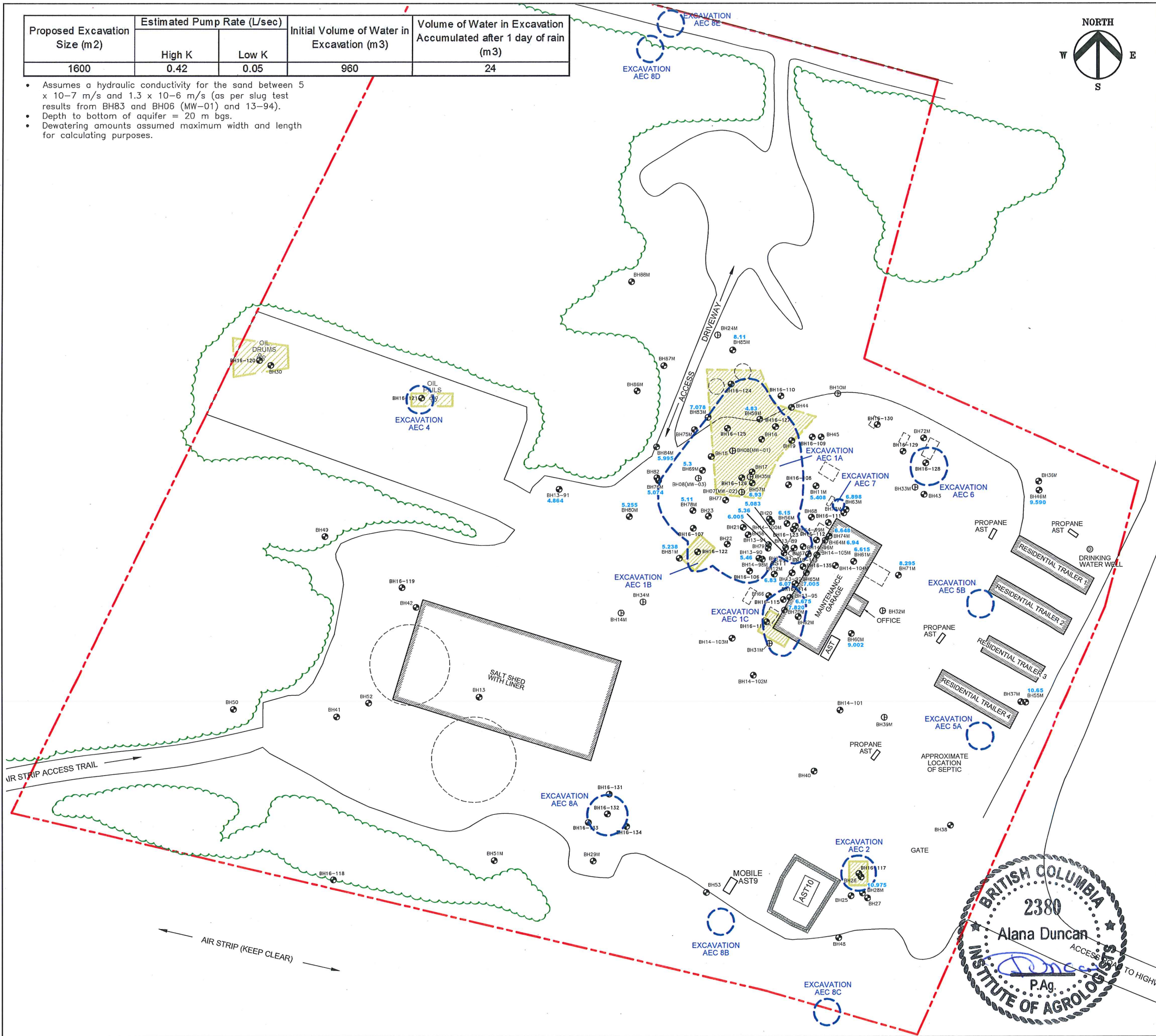
Proposed Excavation: 50m(L)X32m(W)X0.015 m3 m3
24.0 24

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2016/07/21 17:23

reference: Construction Dewatering, J.Patrick Powers, page 103, equation 6.3

Proposed Excavation Size (m2)	Estimated Pump Rate (L/sec)		Initial Volume of Water in Excavation (m3)	Volume of Water in Excavation Accumulated after 1 day of rain (m3)
	High K	Low K		
1600	0.42	0.05	960	24

- Assumes a hydraulic conductivity for the sand between 5 x 10-7 m/s and 1.3 x 10-6 m/s (as per slug test results from BH83 and BH06 (MW-01) and 13-94).
- Depth to bottom of aquifer = 20 m bgs.
- Dewatering amounts assumed maximum width and length for calculating purposes.



LEGEND

- SUBJECT PROPERTY LIMITS
- MONITORING WELL
- ⊕ DESTROYED MONITORING WELL
- ⊙ DRINKING WATER WELL
- EXISTING STRUCTURE
- FORMER STRUCTURE
- ACTIVE YARD
- EXCAVATION BOUNDARY (PGL 2008)
- TREELINE
- 7.79 GROUNDWATER DEPTH (mbgs) AUGUST 17, 2014
- APPROXIMATE EXTENT OF CONTAMINATED SOIL

NOTES

- ORIGINAL DRAWING IN COLOUR.
- LOCATION OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHOULD BE CONFIRMED ON SITE. NOT ALL UTILITIES MAY BE SHOWN.
- SEE APPENDIX B FOR COMPLETE AUGUST 17, 2014 MONITORING REPORT.
- SEE APPENDIX A TABLES 11 THROUGH 17 FOR GROUNDWATER CONCENTRATIONS

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
1	2016-08-09	ISSUED TO CLIENT
REV.	DATE	DESCRIPTION
1	2016-08-09	ISSUED TO CLIENT
REV.	DATE	DESCRIPTION

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
1	2016-08-09	ISSUED TO CLIENT	BB	AD
REV.	DATE	DESCRIPTION	BY	CHK

0 10 20 30 40 50
METRES



CLIENT NAME:	PUBLIC WORKS AND GOVERNMENT SERVICES CANADA	PROJECT LOCATION:	TOAD RIVER ALASKA HIGHWAY, BC
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TITLE:	GROUNDWATER DEPTH (AUGUST 17, 2014)
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DWN BY: BB	SCALE: 1:900	DATE: 2016-08-09	DWG No: 635734-304
CHK'D: AD	PLOT: 20160809.0630	CADFILE: 635734R5	REV.: 1



Project No.: [621514](#)
 Date: 2014-08-17
 Observer: ME/SZ
 Weather: 24°C Partly Cloudy
 Time: 8:00:00
 Approved by: ME

Public Works and Gov't Services Canada
 Toad River Maintenance Camp
 Km 648.7 Alaska Highway
 BC

Monitoring	Reference	Depth to	Apparent	Depth to	Potential	Depth to	Calculated		
Well	Elevation ¹	NAPL ²	Thickness ³	Water	Elevation	Bottom	Conc. ⁴	Time	Comments
No.	(m)	(m)	(mm)	(m)	(m)	(m)	(ppm)		
BH11M	708.194	-	0	5.408	702.79	8.23	5	16:18	*
BH12M	708.191	-	0	6.830	701.36	8.21	230	14:50	
BH28M	708.290	-	0	10.975	697.32	11.32	80	13:02	
BH46M	707.948	-	0	9.590	698.36	14.24	330	13:25	
BH55M	708.330	-	0	10.650	697.68	13.61	105	13:10	
BH56M	708.316	-	0	6.150	702.17	9.87	5	16:00	
BH57M	708.292	5.480	1,450	6.930	702.52	10.80	5	8:36	2014 08 18
BH59M	707.926	-	0	4.830	703.10	8.04	5	16:24	top of pipe broken
BH60M	708.497	-	0	9.002	699.49	11.06	200	13:34	
BH61M	707.508	-	0	6.615	700.89	9.51	150	13:49	
BH63M	708.072	-	0	6.898	701.17	10.04	165	16:14	
BH64M	708.382	-	0	6.940	701.44	9.98	5	16:08	
BH65M	708.330	-	0	7.005	701.32	7.94	5	14:46	
BH69M	708.424	-	0	5.300	703.12	6.01	320	17:00	
BH70M	708.346	-	0	7.820	700.53	8.21	120	14:21	
BH71M	708.517	-	0	8.295	700.22	9.28	5	13:33	
BH74M	708.402	-	0	6.648	701.75	7.59	5	16:04	
BH76M	708.205	-	0	5.074	703.13	5.70	75	16:45	
BH78M	708.137	-	0	5.110	703.03	6.87	5	16:58	
BH80M	708.354	-	0	5.255	703.10	6.81	5	16:47	
BH81M	707.186	-	0	5.238	701.95	6.04	5	16:54	
BH83M	709.819	-	0	7.078	702.74	10.16	5	16:28	
BH84M	709.144	-	0	5.995	703.15	7.15	5	16:43	
BH85M	710.806	-	0	8.110	702.70	10.15	5	16:38	
BH13-89	707.160	-	0	5.083	702.08	5.37	125	15:54	
BH13-90	707.186	-	0	5.460	701.73	6.95	5	14:55	
BH13-91	701.875	-	0	4.864	697.01	5.32	5	16:51	
BH13-92	702.934	-	0	6.070	696.86	7.53	130	14:40	
BH13-93	707.217	-	0	5.360	701.86	7.48	155	15:46	
BH13-94	707.123	5.305	700	6.005	701.68	6.82	1,450	15:00	
BH13-95	707.357	-	0	6.675	700.68	7.61	90	14:26	

NOTES: * 3/8" Waterra in well during measurement.

¹ Reference Elevation is a mark on the rim of the monitoring well standpipe surveyed with respect to Geodetic Datum.

² Non-Aqueous Phase Liquid.

³ NAPL specific gravity assumed to be 0.80.

⁴ 1% LEL is approximately equivalent to 110 ppm.