FIELD REPORT
CITY OF EKWOK
SEWER IMPROVEMENTS
FINAL

Bristol Project No. 28060
February 2010

Prepared for:
City of Ekwok
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ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
bgs	below ground surface
Bristol	Bristol Environmental & Engineering Services Corporation
CFU	Colony Forming Unit
City	City of Ekwok
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
KAE	Kuskokwim Architects and Engineers
MCL	maximum contaminant level
mg/L	milligrams per liter
MH	Manhole
mL	milliliters
ROW	Right of Way
VGES	Variable Grade Effluent System
VSW	Village Safe Water

1.0 INTRODUCTION

This field report presents the scope of work and describes the tasks completed by Bristol Environmental & Engineering Services Corporation (Bristol) between June and September 2009. This work is directly related to the Ekwok Sewer Improvement Project conducted for the City of Ekwok (City) in conjunction with the Alaska Department of Environmental Conservation (ADEC) Village Safe Water (VSW) Program. Bristol was tasked with the following:

- Supervising the installation of monitoring wells near the sewage lagoon;
- Supervising the installation of a new residential drinking water well;
- Well sampling for both the monitoring wells, the new drinking water well, and existing water wells near the lagoon;
- Manhole and sewer main inspections (lamping) of the existing sewer system; and
- Septic system adequacy testing and alternate site percolation testing for residences in the Sunshine View Subdivision.

Refer to Figures C1 through C4 for an overview of the project.

A Wildlife Survey for the sewage lagoon site was completed by ABR, Inc. in conjunction with this field work and is included as Appendix A. This work was done as a result of a March 26, 2009 request by the Federal Aviation Administration (FAA) to update the existing Wildlife Hazard Assessment for the runway prior to the issuance of a concurrence by the agency for any upgrades to the sewage lagoon. This request was made due to the proximity of the lagoon to the runway (less than 5,000 feet).

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2.0 FIELD NARRATIVE

The following is a trip report and narrative for the field work completed during June and September of 2009:

6/3/09: Kyle Petersen checked into the Bristol Inn in Dillingham on route from Togiak. Overnight in Dillingham.

6/4/09: Kyle Petersen flew to Ekwok on Shannon's Air. Arrived in Ekwok at approximately 11:30 AM. Met with Curtis Hefty and Kyle Haken of Hefty Drilling. They were in the process of drilling the Health Clinic well [separate project]. Coordinated the upcoming drilling. Met with Richard Stermer [City of Ekwok (City)] to discuss the drilling work over the next few days. Attempted to locate some of the sewer system's existing manholes prior to starting work at the lagoon.

Mobilization of the drill rig was assisted by the City's backhoe (operated by Richard Stermer). The drill rig was mobilized to the first lagoon monitoring well site at approximately 3:00 PM. The first well (MW-L1) was installed on the southeast side of the lagoon, approximately halfway between its southern and eastern borders. The well was finished, and the drill rig was mobilized to the site of MW-L2, near the north corner of the lagoon.

6/5/09: MW-L2 and MW-L3 were installed near the lagoon. The City provided intermittent assistance with mobilizing the drill rig to and from the MW-L3 drilling site. All the wells near the lagoon were installed with manual slots in the well casing – screens were not installed. All three lagoon wells were advanced to approximately 14 feet each, and were 4 inches in diameter. Drilling began on Frank Nicholai's well, but was not advanced beyond approximately 15 feet.

6/6/09: Drilling continued at Frank Nicholai's well. The drillers from Hefty Drilling had to fly to Dillingham to pick up the screen that they had ordered. The well was finished at approximately 6:00 PM. The existing "deep well" near Frank's well was capped by welding a steel plate onto it. The driller did not bring bentonite to fully close the well. This work is recommended during the future sewer project.

Kyle Petersen met with Richard King to discuss his septic system.

6/7/09: Completed water sampling at the lagoon wells, Frank Nicholai's well, and the wells for Luki Akelkok, Herman Acovak, and Albert Wallona. Finished water sampling at approximately 10:00 AM. Flew from Ekwok to Dillingham on Shannon's air at 1:00 PM. Landed in Dillingham at 2:30 PM. Flew to Anchorage via PenAir at 5:30 PM. Arrival in Anchorage at 6:30 PM.

6/8/09: Delivered water samples to Analytica at 8:30 AM.

6/14/09: Kyle Petersen and Mike Himler (Staff Engineer) of Bristol flew from Anchorage to Dillingham on PenAir, and from Dillingham to Ekwok on Mulchatna Air. We began to search for the existing manholes in town, and had located all but two of them [Manhole (MH)13 and MH3] by the evening. Two manholes were apparently underneath the road, in gravel.

6/15/09: Located one remaining manhole (MH13) by swing tie / metal detection, and the other remaining manhole (MH3) solely based on a metal detector. Borrowed a chainsaw from the City and began clearing vegetation around manholes. Kenny Jensen (City of Ekwok) dug out the two remaining manholes from the road with the backhoe. MH13 was under approximately 2.75 feet of compacted gravel. We began inspecting / lamping the sewer main, starting at MH13A, and had entered all manholes downstream of this manhole up to MH7 (essentially, all of the newer main with insulation in the manholes). The two most shallow manholes were constructed in a manner that makes it extremely difficult to put the insulation back in place. The insulation for MH6 was not properly installed when it was opened. We attempted to place this insulation properly, but the construction made it extraordinarily difficult. We asked the City to cut the existing "insulation cover" in quarter sections so that it could be installed correctly. The insulation was not placed in the manhole after the inspection was completed. [The City reported that this insulation was placed back in the manhole in fall of 2009].

6/16/09: Mike Himler, Kyle Petersen, and Lynn Marino surveyed all of the on-site systems in the Sunshine View Subdivision. Most of the systems had standing water approximately 2 feet below ground surface (bgs) at the leachfield monitoring tubes, with the exception of Kenny Jensen's system which had standing water at 6 feet bgs, and Peter Walcott's residence which had standing surface sewage at the leachfield.

Kenny Jensen's system was the only candidate system where a septic tank adequacy test was recommended. A septic tank adequacy test was ultimately not completed for the Kenny Jensen house due to the City not having any functioning equipment available that could move the septage trailer. It was decided not to test Kenny Jensen's system unless his septic tank could be pumped immediately afterwards.

Jim and Alice Karasti appear to be experiencing significant bluff erosion on their property, most likely from their leachfield. Peter Walcott's house is very close to the Karasti home. The erosion on the Karasti lot could potentially extend to the Walcott and King lots if the problem continues and is not resolved. The Karasti lot did not appear to have a suitable location for an alternative (replacement) leachfield.

We met with Murdo MacLeod, who indicated that he now wanted to be connected to the public sewer system.

Attended a City council meeting at 1:00 with Lynn Marino, the City, and J.J. Frost from ABR Inc. We discussed the wildlife hazard assessment that ABR Inc. would be conducting for the lagoon and airport. The following council members were in attendance: Richard Stermer, Jim Karasti, Julia Brandon, Alice Karasti, and Ernie Nelson. Lynn Marino left on an afternoon flight to Dillingham (and subsequently to Anchorage).

6/17/09: Began percolation testing. Test pits were dug at the King and Walcott residences. The King residence showed no appreciable soil problems, although space for an alternative field was limited by the presence of nearby buildings.

Peter Walcott's property had frozen soil at 4 feet bgs near the existing leachfield and 2 feet bgs at a second test pit. The City backhoe stalled three times as the test pit was dug at Peter Walcott's property. Peter owns two lots (3A and 3B). Suitable soil was not identified on Lot 3B where his house is located. Percolation testing was completed for the King and Walcott residences. The percolation test for Peter Walcott's residence was completed on Lot 3A, which is adjacent to the lot where his home is located.

6/18/09: The City backhoe was not operating well at all, and stalled regularly during excavation at Sandra Stermer's residence and the Brandon residence. It was decided not to dig additional

test pits at either the Jensen or Nicoli residences due to the poor condition of the backhoe. In order to conduct a percolation test at the Nicoli residence, a significant amount of clearing would have been required. Swing ties were completed for the previously drilled monitoring wells, Frank Nicholai's well, and the test pits dug during this trip.

6/19/09: Completed percolation testing for the Julia and Billy Brandon residence and Sandra Stermer residence. Demobilized field equipment. Kyle Petersen and Mike Himler flew back to Dillingham via Shannon's Air Taxi, and to Anchorage via PenAir. J.J Frost from ABR was on the same flight back to Anchorage.

9/2/09: Kyle Petersen flew into Ekwok on Mulchatna Air on a late morning flight from Dillingham (Kyle was in Dillingham for a separate job). Took swing ties of service line from the new jail to the City building. Surveyed bathrooms at Alex Nelson Jr. and Murdo MacLeod residences. Checked monitoring tubes from percolation test pits dug in June 2009. No water was noted in any of the monitoring tubes. Discussed repairing the insulation for MH6 with Ernie Nelson, City Administrator. The insulation had not been repaired/installed since the June site visit. [The City reported that this insulation was placed back in the manhole in fall of 2009].

9/3/09: Collected groundwater samples from monitoring wells MW-L1, MW-L2, and MW-L3. Collected nitrate and coliform samples from the four homes closest to the sewage lagoon (Albert Wallona, Herman Acovak, Luki Akelkok, and Letia Walcott). Flew out of Ekwok to Dillingham on Mulchatna Air. Delivered coliform samples to the Kanakanak Hospital Environmental Health laboratory. Flew from Anchorage to Dillingham on the evening PenAir flight.

9/4/09: Delivered nitrate samples to Analytica in the morning.

3.0 SEWER MAIN INSPECTION

The Ekwok sewer system was inspected between June 14th- 15th 2009. The results of the sewer main inspection are provided in Table 3.1. The cleanout near MH1 was not evaluated during the site visit. Refer to Figure C4 for a location map of the existing sanitary sewer system.

Table 3.1 Sewer Main Inspection

Manhole Run		Lamping Result	Notes
1	2	No visible light	Minimal grouting or sealant at MH1 barrel section joints. Visible solids in flow channel.
2	3	No visible light	No grouting or sealant visible at MH2 barrel section joints. Gravel present in flow channel.
3	4	No visible light	No grouting visible at MH3 barrel section joints.
4	5	No visible light	No grouting visible at MH4 barrel section joints.
5	6	Clear / Full Moon	Significant solids at MH5 inlet. Trickling water visible through MH.
5	Lift Station	No visible light	Significant solids at MH5 inlet. MH5 invert needs to be reconfigured due to solids deposition.
6	7	Clear / Full Moon	Minor solids at MH7 invert.
7	9	Barely visible "aura" (full eclipse)	MH8 was not constructed as stated in the original project drawings, there may be a possible obstruction in the main. Water running normally through pipe.
9	10	3/4 Moon	Solids in bottom of pipe.
10	11	7/8 Moon	Trickling water through MH.
11	11A	Clear / Full Moon	Trickling water through MH.
11	12	Clear / Full Moon	Trickling water through MH.
12	13	Clear / Full Moon	Trickling water through MH.
13	13A	Clear / Full Moon	No solids. Trickling water.

In general, the sections of the sewer system from the original Public Health Service project (MH1 to MH5 and the Lift Station) appear to be clogged or have settled, assuming the mains were installed with straight invert slopes, in a manner typical of a conventional gravity system [versus installed without regard to slope, as would be typical for a standard Variable Grade Effluent System (VGES)]. The sewer mains running from Nakelutin Subdivision to MH9 appear to be in adequate condition. The section of main from MH7 to MH9 may be clogged or sagging

(assuming it was originally installed with a straight slope). MH6 and MH7 do not appear to have been installed with sufficient insulation / cover to prevent (ground) freezing.

MH5 has an inlet channel that is approximately three feet above the bottom of the manhole. This inlet has created a damming effect at the bottom of the channel from solids buildup, effectively limiting flow from the older section of the sewer system (MHs 1 through 4). This configuration may have been adequate when all the services were functioning similar to a VGES, but the addition of two standard wastewater services directly upstream of the manhole has probably exacerbated the buildup of solids. It is suggested that the inlet (from MH 6) be reconfigured with a drop channel to alleviate this issue. Solids buildup from MHs 1 through 4 are also likely contributing to sediment buildup in MH5.

Overall, it is recommended that the sewer system be inspected by TV camera in those areas identified as potentially clogged during the inspection. It is unknown if the sewer main in these areas are actually clogged, or if they weren't installed to a constant grade with the assumption that the system would operate as a VGES.

4.0 WATER QUALITY TESTING

Tables 4.1 and 4.2 show the results of the water quality results from the June 2009 and September 2009 water sampling effort. Groundwater samples were collected from the three monitoring wells installed near the sewer lagoon in June 2009. Drinking water samples were collected from homes in close proximity to the sewer lagoon (typically from the kitchen faucet). Nitrates were detected at three of the homes, although none of the readings exceeded the drinking water maximum contaminant level (MCL) for nitrates [10 milligrams per liter (mg/L)]. Total coliforms were detected at two monitoring wells, and two residences. No E.coli or fecal coliform readings were detected at any of the monitoring wells or residential wells sampled. Albert Wallona's residence showed nitrate readings during both the June and September sampling events, and a total coliform reading during the June sampling event. The Wallona residence is the closest house to the sewage lagoon. Well logs are provided in Appendix B. Detailed water quality results are provided in Appendix C. Sample locations are provided in Figure C1.

Table 4.1 Water Quality Testing (June 2009)

Well	Lot	Nitrate (mg/L)	Total Coliform	E. Coli	Fecal Coliform (CFU/100mL)
Lagoon Monitoring Well (MW-L1)	USS No. 4878 Tract A	1.45	Fail	Pass	N/D
Lagoon Monitoring Well (MW-L2)	USS No. 4878 Tract A	0.102	Fail	Pass	N/D
Lagoon Monitoring Well (MW-L3)	USS No. 4878 Tract A	0.388	Pass	Pass	N/D
Frank Nicholai (new well)	USS No. 4878 Tract C Lot 2	0.490	Pass	Pass	N/D
Albert Wallona	Ekwok Townsite Replat, P89-1, Lots 5&7, Nlk 2, & Lot 13 Blk2	0.925	Fail	Pass	N/D
Herman Acovak	Ekwok Townsite Lots 1-4, Blk 2 / G St. ROW	N/D	Pass	Pass	N/D
Luki & Pauline Akelkok	Lots 2 & 4-7, Blk 3, Ekwok Townsite, USS 4878	N/D	Pass	Pass	N/D
MCL		10.0	Pass/Fail	Pass/Fail	Pass/Fail

Notes:

MCL	=	maximum contaminant level	USS	=	United States Survey
mg/L	=	milligrams per liter	ROW	=	Right of Way
mL	=	milliliters			

Table 4.2 Water Quality Testing (September 2009)

Well	Lot	Nitrate (mg/L)	Total Coliform	E. Coli
Lagoon Monitoring Well (MW-L1)	USS No. 4878 Tract A	N/D	Pass	Pass
Lagoon Monitoring Well (MW-L2)	USS No. 4878 Tract A	N/D	Pass	Pass
Lagoon Monitoring Well (MW-L3)	USS No. 4878 Tract A	0.234	Pass	Pass
Albert Wallona	Ekwok Townsite Replat, P89-1, Lots 5&7, Nlk 2, & Lot 13 Blk2	0.710	Pass	Pass
Herman Acovak	Ekwok Townsite Lots 1-4, Blk 2 / G St. ROW	N/D	Pass	Pass
Luki & Pauline Akelkok (collected from hose bib)	Lots 2 & 4-7, Blk 3, Ekwok Townsite, USS 4878	N/D	Fail	Pass
Letia Walcott	Lots 10A ,11A, & 12, Block 3, Ekwok Townsite, USS 4878	0.155	Pass	Pass
	MCL	10.0	Pass/Fail	Pass/Fail

Notes:

MCL = maximum contaminant level
mg/L = milligrams per liter
N/D = nondetect
ROW = Right of Way
USS = United States Survey

It is unknown if the nitrate or coliform readings are attributable to surface (or other) contamination, or are the result of influence from the sewer lagoon. The wells in question are all shallow wells, and susceptible to influence from surface contamination. A "control" test of homes that would be considered to be far enough away from the lagoon to not be influenced by the facility was not conducted. In retrospect, perhaps testing of wells remote to the lagoon would be helpful in determining whether wells near the lagoon are experiencing higher levels of nitrates and total coliforms.

Water quality results for Frank Nicholai's well showed highly mineralized water with high levels of manganese and iron. A water softener system will probably be required to use this well.

Table 4.3 Frank Nicholai – Additional Water Quality Testing (June 2009)

Sample	Result	MCL	Units
Arsenic	0.325	10	µg/L
Manganese	0.0723	0.05 [1]	mg/L
Iron	1.4	0.3 [1]	mg/L
Gasoline Range Organics (GRO)	N/D		µg/L
Diesel Range Organics (DRO)	N/D		µg/L

Notes: 1) = Secondary MCL

MCL = maximum contaminant level
mg/L = milligrams per liter
N/D = nondetect
µg/L = micrograms per liter

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5.0 SUNSHINE VIEW LEACHFIELDS

A survey was performed for the existing on-site systems in the Sunshine View subdivision. These residences are not planned for sewer service as part of the upcoming sewer project.

Table 5.1 Leachfield Survey Results

Resident	Lot #	~ Depth to Water in Leachfield Mon. Tube ('bgs)	Notes
Kenny Jensen (formerly Anecia Nelson)	Sunshine View Subdivision P89-2, Lot 2A Block 12 (P89-2)	6	Homeowner reports no known backups or other issues. Kuskokwim Achitects and Engineers [KAE] reported leachfield level as 0.7' lower than septic tank level in 2005.
Sandra Stermer	Sunshine View Subdivision P89-2, Lot 2B Block 12 (P89-2)	2	System repaired by owner in 2005 or 2006.
Carol and Nick Nicoli	Sunshine View Subdivision P89-2, Lot 2C Block 12 (P89-2)	2	One backup reported, probably because the septic tank had not been pumped. Leachfield depth was reported as 0.8' bgs in 2005 by KAE.
Julia and Billy Brandon	Sunshine View Subdivision P89-2, Lot 2D Block 12 (P89-2)	2	One backup reported, probably because the septic tank had not been pumped. Leachfield reported as non-functioning by KAE in 2005.
Peter Walcott	Sunshine View Subdivision P89-2, Lot 3B Block 12 (P89-2)	2	System has failed. Raw sewage on ground. This was the same situation reported by KAE in 2005. Homeowner had 10 occupants in house during field visit.
Jim and Alice Karasti	Sunshine View Subdivision P89-2, Lot 3C Block 12 (P89-2)	2	Bluff erosion from adjacent leachfield. Leachfield Settlement. Small lot. No space available for alternate field.
Richard and Lorraine King	Sunshine View Replat, P91-14, Lot 3D-1 Block 12	2	Regular sewage backups.

Percolation tests were completed for four residences. Equipment failures precluded percolation testing at the Jensen and Nicoli properties. A suitable alternative leachfield site was not identified on the Karasti property. Detailed percolation test results are provided in Appendix D. Maps of the evaluated properties, showing test pit locations, existing on-site systems and wells, and areas where the development of on-site systems would be restricted are shown on Figures C2 and C3.

Table 5.2 Percolation Test Results

Resident	Perc. Rate (min/inch)	Notes
Sandra Stermer	2.6	Reported as 3.6 min/inch by KAE in 2005 (different test pit).
Julia & Billy Brandon	4.5	No known issues with development of alternative leachfield.
Peter Walcott	0.42	Test pit located on adjacent lot (3A) since a suitable site could not be found on Lot 3B. Soil is not suitable for a standard system.
Richard and Lorraine King	4.71	Limited options for leachfield sites due to bluff proximity, and proximity to well and other structures

It is believed that the failures that have occurred for the Sunshine View on-site systems could be due to a failure of the "Infiltrator" absorption fields. This may be the result of clogging of the underlying soil matrix from passing fines, and clogging of the Infiltrators' manifold systems. Richard Stermer reported that during repairs completed on Sandra Stermer's system (in approximately 2005), that the system failure appeared to be solely a result of the infiltrators.

Of the 7 occupied homes in the Sunshine View Estates parcels, Kenny Jensen's house was the only one with a potentially properly functioning system. All the other homes had standing water in their leachfields at approximately 2 feet bgs, which closely mirrors the findings of Kuskokwim Architects and Engineers' [KAE's] 2005 field investigation.

The monitoring tubes for all of the evaluated leachfields were installed with non-uniform materials and installation heights (relative to each other). Drawings for individual systems are not available, and the only documentation appears to be "standard details" for the systems that were put in. The leachfield and septic tank locations shown on the 1991 plan drawings (ANTHC Project # 86-121) do not reflect their actual locations.

It is recommended that the leachfields for at least 5 of the 7 existing Sunshine View homes be replaced. The septic tanks and service lines should be considered for replacement during this work (although no problems are known for the tanks and service lines, their replacement would extend the service life of these on-site systems).

All new fields should be installed with diverter valves so that the older leachfield can be used. If the current problems are from biomat formation in the soil, the fields might be usable after a few years of non-use. It is recommended that the older fields be replaced with classic gravel-packed trenches versus the existing infiltrators.

Table 5.3 shows the known groundwater depths from residential wells in the Sunshine View Subdivision. A more detailed discussion for the Karasti and Walcott properties follows.

Table 5.3 Sunshine View Groundwater Depths

Resident	Lot	Well Soil (to 14' bgs)	Groundwater Depth
Kenny Jensen	Sunshine View Subdivision P89-2, Lot 2A Block 12 (P89-2)	Sand, Sandy Gravel	21
Sandra Stermer	Sunshine View Subdivision P89-2, Lot 2B Block 12 (P89-2)	Sand, Sandy Gravel	25
Carol and Nick Nicoli	Sunshine View Subdivision P89-2, Lot 2C Block 12 (P89-2)	Unknown	unknown
Julia and Billy Brandon	Sunshine View Subdivision P89-2, Lot 2D Block 12 (P89-2)	Sandy Silt	32
Peter Walcott	Sunshine View Subdivision P89-2, Lot 3B Block 12 (P89-2)	Silty Sand	49
Jim and Alice Karasti	Sunshine View Subdivision P89-2, Lot 3C Block 12 (P89-2)	Sand, Gravel	40
Richard and Lorraine King	Sunshine View Replat, P91-14, Lot 3D-1 Block 12	Sand, Gravel	42

5.1 KARASTI PROPERTY

Jim and Alice Karasti's property is unsuitable for a standard septic system, based upon the lot size (approximately 1 acre), and the erosion that is occurring on the bluff downhill (west) of the leachfield. The edge of the field was built right at the 50-foot minimum separation distance that leachfields are required to maintain from steep slopes. The adjacent Right of Way (ROW) owned by the City for 5th Street is not a suitable effluent disposal site due to the proximity of nearby shallow wells, and the possibility of the street being upgraded in the future. A service line across the existing developed section of 5th Avenue to the undeveloped City ROW east of the road (near the airport property) would be at least 200 feet long – perhaps longer to maintain separation distances from nearby residential wells. It is not believed that a permanent easement

for a private disposal system would be allowed on this public ROW. Furthermore, routing effluent upgradient of an existing shallow well is not recommended. The existing leachfield is not a suitable disposal site for effluent of any quality due to the potential to further exacerbate erosion of the adjacent bluff. Therefore, packaged wastewater disposal systems (ExtremeSTP or similar systems) are also not recommended.

The Karsti property should either 1) have its existing leachfield replaced (and potentially located underneath the Karsti's existing bunkhouse, which itself would have to be relcoated or removed), or 2) be served by a holding tank. Further evaluation is recommended to determine whether replacing the leachfield would provide a long term solution to the wastewater disposal issues for this property. If the leachfield is replaced in kind, the field should be monitored to ensure that effluent disposal does not continue to exacerbate the erosion issue on the bluff.

5.2 WALCOTT PROPERTY

Peter Walcott owns two lots adjacent to one another (Lot 3A and Lot 3B). It is not believed that a standard leachfield can be installed on Lot 3B due to separation distance requirements (lot lines, bluff, drinking well) and the presence of frozen soil on his property. The owner's leachfield is relatively close to Karasti's leachfield, and the installation of any system within 100 feet of the bluff is not recommended. It may be necessary to install a system on the owner's adjacent lot (3A), which would require the installation of a sand filter (or alternate system); possibly an integral lift station pumping chamber (STEP system); a new resized septic tank (for both the pumping chamber and the owner's actual usage - up to 10 people in the household) ; and insulation for the service piping.

6.0 REFERENCES

Maclean, Dan (KAE). July 27 - August 2005. Village Safe Water Trip Report.

Paug-Vik Development Corporation, September 2002. Ekwok Groundwater Investigation and Well Rehabilitation Study.

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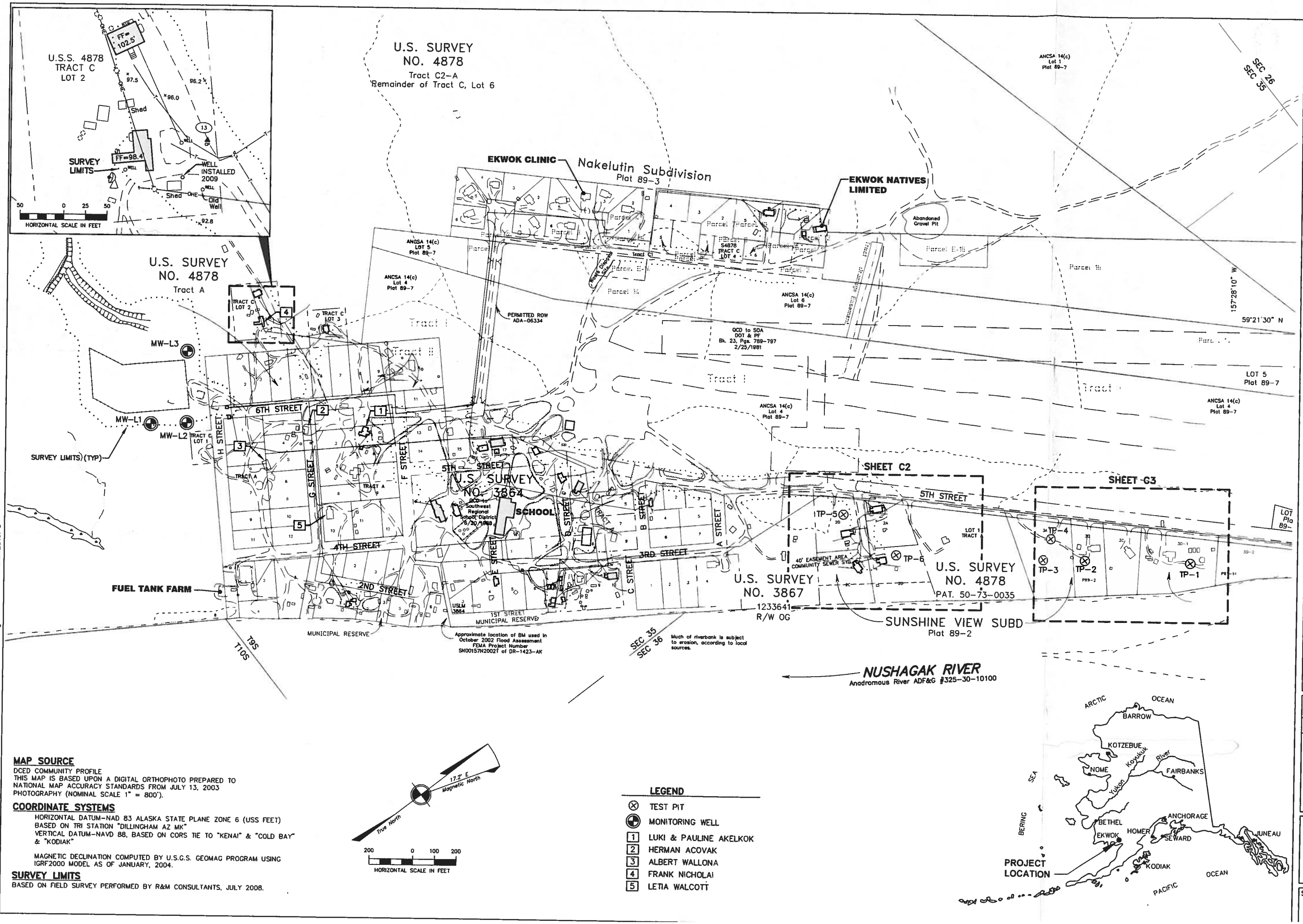
FIGURES



MAP SOURCE

DCED COMMUNITY PROFILE
THIS MAP IS BASED UPON A DIGITAL ORTHOPHOTO PREPARED TO NATIONAL MAP ACCURACY STANDARDS FROM JULY 13, 2003 PHOTOGRAPHY (NOMINAL SCALE 1" = 800').

COORDINATE SYSTEMS

HORIZONTAL DATUM-NAD 83 ALASKA STATE PLANE ZONE 6 (USS FEET)
BASED ON TRI STATION "DILLINGHAM AZ MK"
VERTICAL DATUM-NAVD 88, BASED ON CORS TIE TO "KENAI" & "COLD BAY" & "KODIAK"

MAGNETIC DECLINATION COMPUTED BY U.S.G.S. GEOMAG PROGRAM USING IGRF2000 MODEL AS OF JANUARY, 2004.

SURVEY LIMITS

BASED ON FIELD SURVEY PERFORMED BY R&M CONSULTANTS, JULY 2008.

LEGEND

- TEST PIT
- MONITORING WELL
- [1] LUKI & PAULINE AKELKOK
- [2] HERMAN ACOVAK
- [3] ALBERT WALLONA
- [4] FRANK NICHOLAI
- [5] LETIA WALCOTT

VILLAGE SAFE WATER

Bristol ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION

Project No. 28060

CITY OF EKWOK
SANITARY SEWER IMPROVEMENTS

FIELD REPORT
PROJECT OVERVIEW

BY	DATE	REVISION

CAD FILE NAME 28060_G1-5.DWG

Project No. 28060
Date 02/10/10
Designed KLP
Drawn SJW
Approved KLP

Sheet No.
C1

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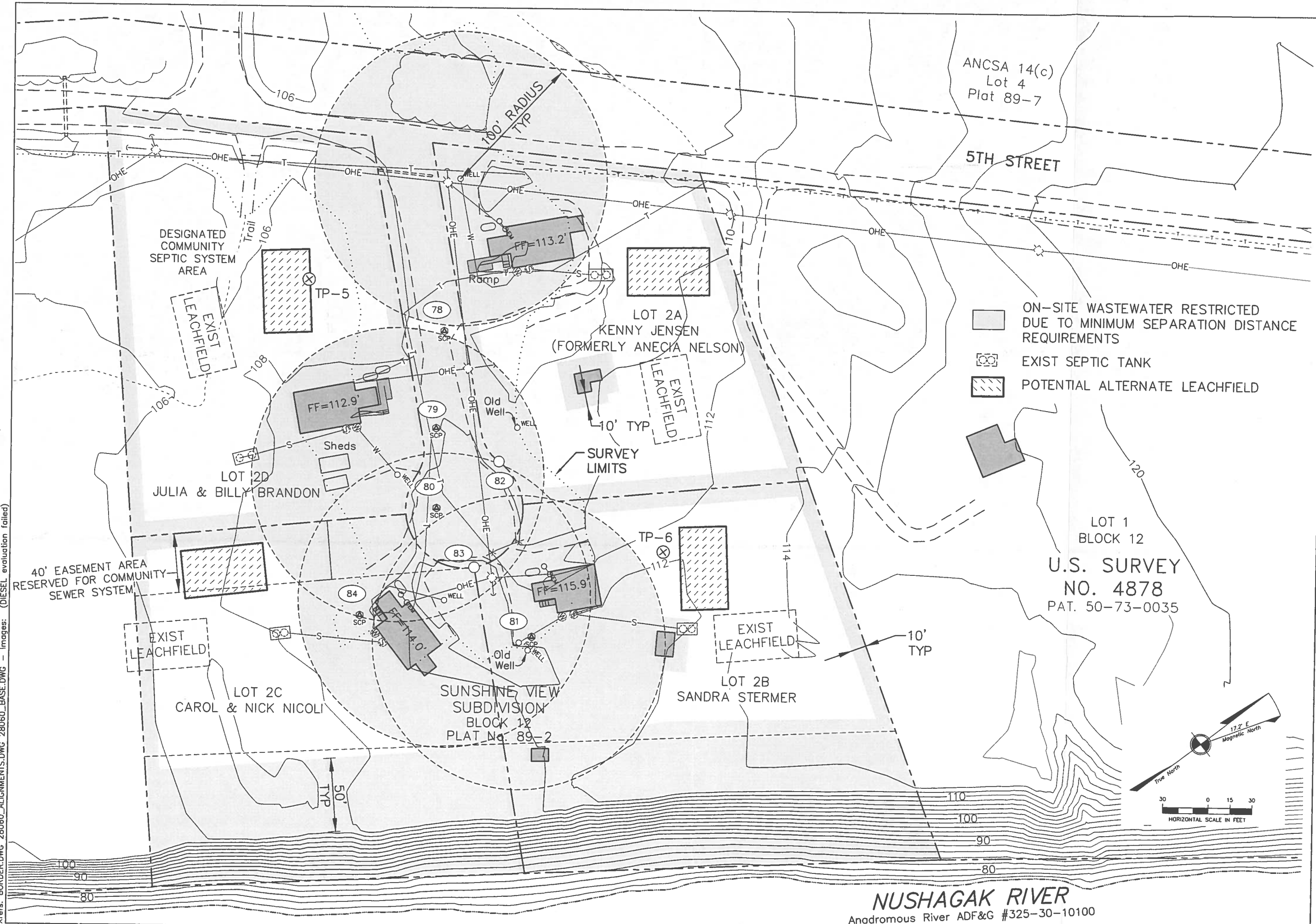

VILLAGE SAFE WATER

Bristol ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION

Project No 28060

CITY OF EKWOK
SANITARY SEWER IMPROVEMENTS
FIELD REPORT
SUNSHINE VIEW SUBDIVISION
ON-SITE SYSTEMS

REVISION	BY	DATE

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Drawn	SJW
Approved	KLP

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ANCSA 14(c)
Lot 4
Plat 89-7

5TH STREET

122

OHE

TP-4

100' RADIUS TYP

WELL

Old Well

SUNSHINE VIEW SUBDIVISION
BLOCK 12
PLAT No. 89-2

TP-2

TP-3

10' TYP

EXIST LEACHFIELD

50' TYP

PETER WALCOTT
LOT 3A

PETER WALCOTT
LOT 3B

JIM & ALICE KARASTI
LOT 3C

RICHARD & LORRAINE KING
LOT 3D-1

LOT 3D-2
P91-14

TP-1

120
110
100
90
80

APPROX. LOCATION OF EXISTING BLUFF EROSION

NUSHAGAK RIVER
Anadromous River ADF&G #325-30-10100

ON-SITE WASTEWATER RESTRICTED DUE TO MINIMUM SEPARATION DISTANCE REQUIREMENTS

EXIST SEPTIC TANK

POTENTIAL ALTERNATE LEACHFIELD

17.2° E
Magnetic North
True North

30 0 15 30
HORIZONTAL SCALE IN FEET

VILLAGE SAFE WATER

Bristol ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION
Project No. 28060

CITY OF EKWOK
SANITARY SEWER IMPROVEMENTS
FIELD REPORT
SUNSHINE VIEW SUBDIVISION
ON-SITE SYSTEMS

REVISION	BY	DATE

CAD FILE NAME 28060_C2-C3_TP_LOCATION.DWG

Project No. 28060
Date 02/10/10
Designed KLP
Drawn SJW
Approved KLP

Sheet No.
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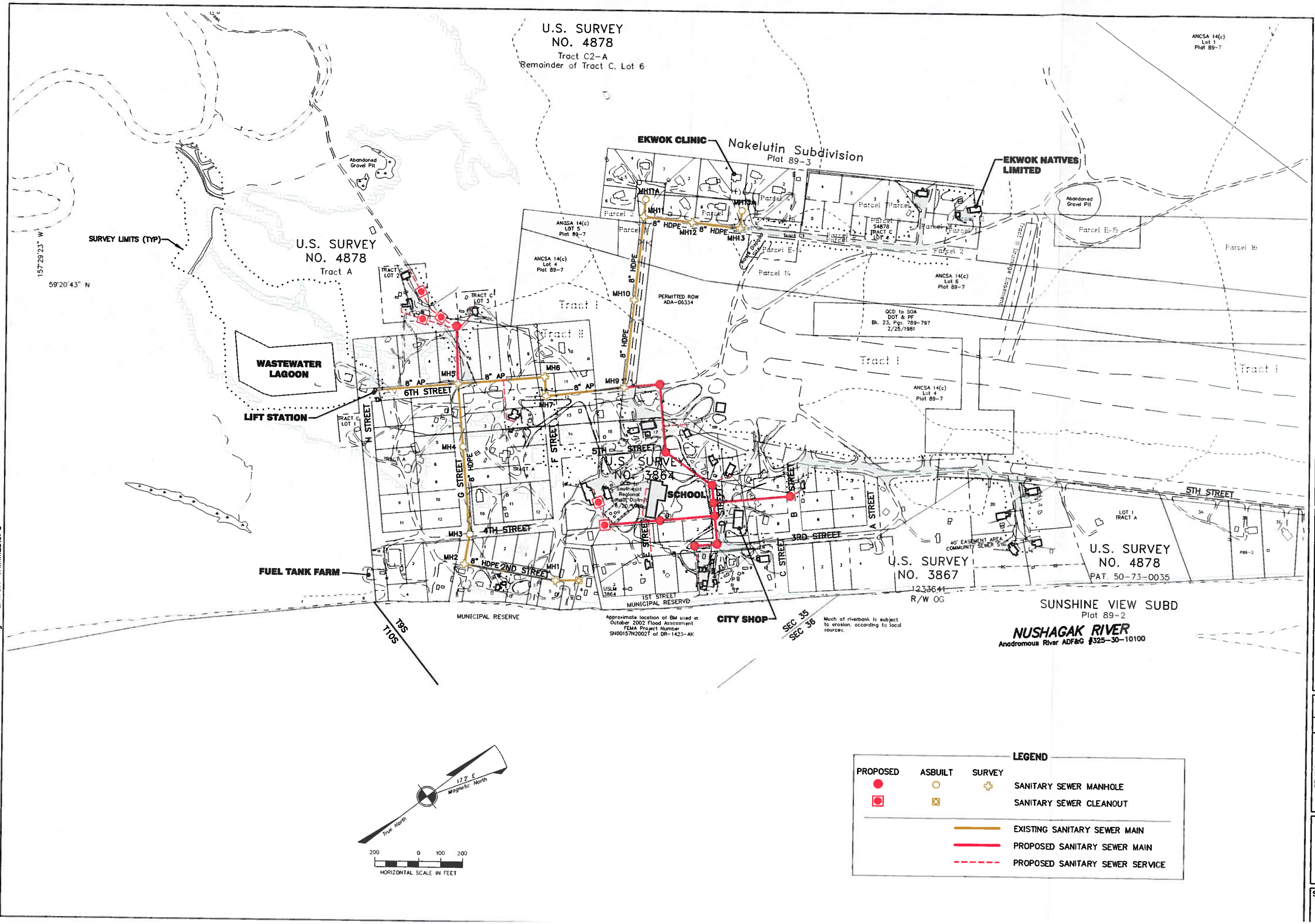

VILLAGE SAFE WATER

Bristol Engineering Services Corporation

Project No. 28060

CITY OF EKWOK
SANITARY SEWER IMPROVEMENTS

EXISTING AND PROPOSED SANITARY SEWER SYSTEM

REVISION	BY	DATE

CAD FILE NAME 28060_TEST_PIT_C4.DWG

Project No. 28060
Date 02/10/10
Designed KLP
Drawn SJW
Approved FJV

Sheet No.
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APPENDIX A

Wildlife Survey in Ekwok, Alaska 2009

FINAL REPORT

WILDLIFE SURVEY OF THE SEWAGE LAGOON IN EKWOK, ALASKA, 2009

GERALD V. FROST AND ROBERT M. BURGESS

PREPARED FOR

CITY OF EKWOK
EKWOK, ALASKA

PREPARED BY

ABR, INC.–ENVIRONMENTAL RESEARCH & SERVICES
FAIRBANKS, ALASKA

IN CONJUNCTION WITH

BRISTOL ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION
ANCHORAGE, ALASKA

WILDLIFE SURVEY OF THE SEWAGE LAGOON IN EKWOK, ALASKA, 2009

FINAL REPORT

Prepared for
City of Ekwok
P.O. Box 49
Ekwok, AK 99640

By
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September 2009

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INTRODUCTION

In July 2009, Bristol Environmental and Engineering Services Corporation and the City of Ekwok contracted with ABR, Inc., to provide an evaluation of potential wildlife hazards at the Ekwok Airport. Of particular interest were potential effects of proposed improvements to the sewage lagoon area, located 2,200 feet from the southwest end of the runway, which was constructed in 2005–2006 (Figure 1).

Ekwok, Alaska, is located in the Bristol Bay region, on the west bank of the Nushagak River, about 43 miles northeast of Dillingham. Ekwok is reportedly the oldest continuously occupied Yup'ik community on the river and was incorporated as a Second Class City in 1974. According to the 2000 US Census, the population of Ekwok is 130, with an average annual growth rate of 2.27% and a projected population of 203 in 2021. No roads connect Ekwok to other communities and air transportation is Ekwok's primary means of obtaining passenger service, food, supplies, and medicines. River travel occurs by barge and skiff during ice-free months and by snowmachine in winter, but the river is often impassible. The majority of passengers, air freight, and all mail travel to Ekwok through the regional hub of Dillingham. In 2005, Ekwok Airport enplanements totaled approximately 1,500 air taxi operations and 700 itinerant operations (http://www.city-data.com/airports/Ekwok-Airport-Ekwok-Alaska.html), but the Alaska Department of Transportation and Public Facilities (ADOT&PF) believes operations are higher than recorded enplanements (PDC and ADOT&PF 2003).

In 2003, prior to construction of the new runway and other airport improvements, a wildlife field survey was conducted to investigate the likelihood of wildlife hazards associated with airport improvements (MACTEC 2003) and an Environmental Assessment was prepared (PDC and ADOT&PF 2003). These reports were reviewed for background information and for comparison with observations in 2009.

The existing landfill is 1,400 ft from the runway, a recognized non-standard condition at the Ekwok Airport, as this is inside the 5,000-ft minimum distance recommended by the Federal Aviation Administration (FAA). Interim recommendations of the FAA to reduce wildlife hazards to aircraft included 1) burn animal carcasses and food waste frequently, 2) consider installation of a perimeter fence around the landfill to exclude terrestrial wildlife, and 3) consider construction of overhead grid netting attached to a perimeter fence to exclude avian wildlife (letter dated 5 September 2003 from Corey Rossi, USDA, to Gabriel Mahns, FAA). According to ADOT&PF,

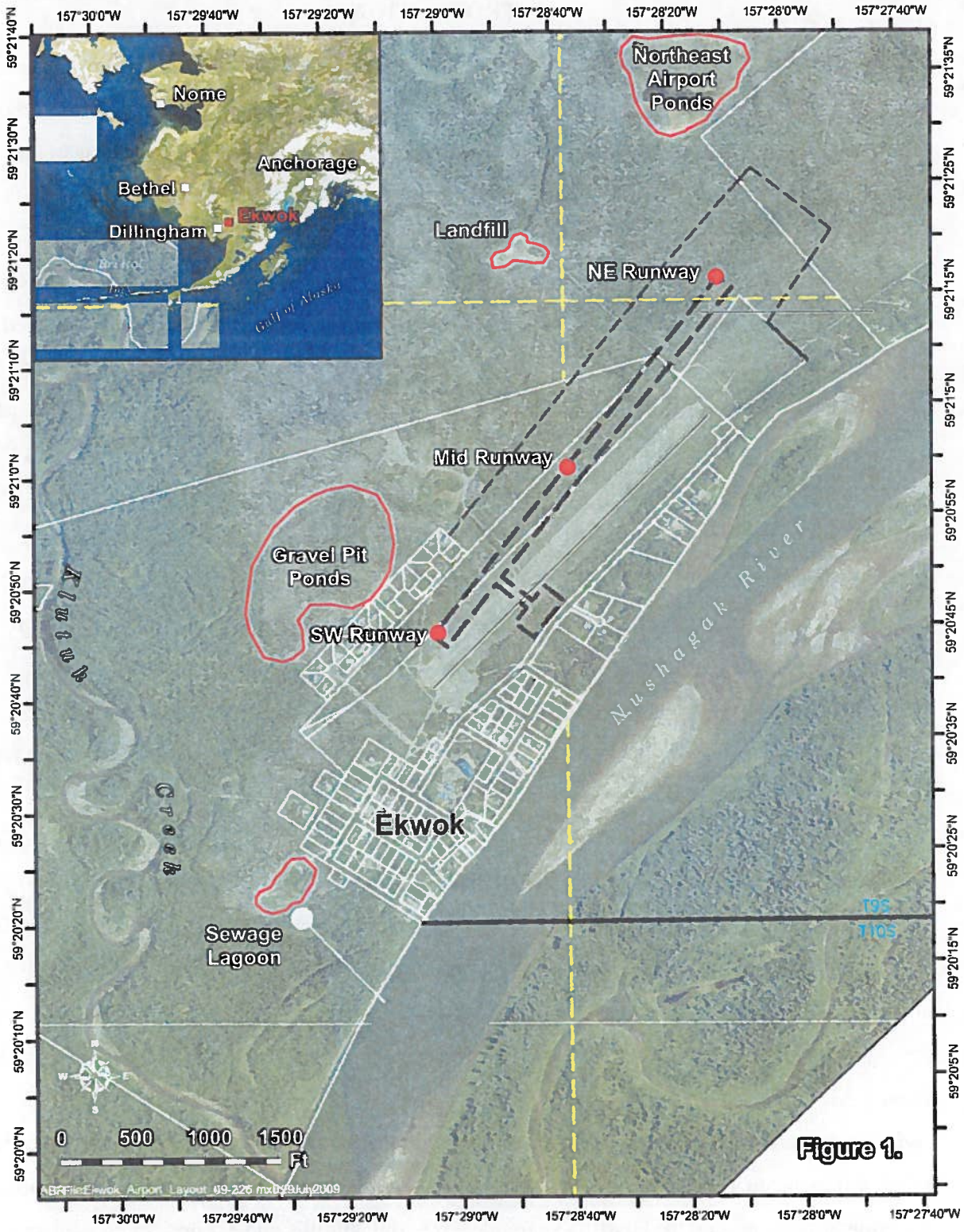


Figure 1. Map of Ekwok, Alaska, showing locations of the airport, landfill, and sewage lagoon, July 2009.

the City of Ekwok is seeking grants to relocate the landfill (PDC and ADOT&PF 2003) and ADOT&PF has urged the City to contact the USDA directly to discuss the details for implementation of these measures (Airport Layout Plan for Ekwok Airport, 2004, http://www.dot.state.ak.us/stwdav/ALP/Ekwok_ALP.pdf).

The Ekwok sewage lagoon also is less than 5,000 ft from the airport and, as such, is considered by the FAA to be incompatible with the airport. Currently, the lagoon area is surrounded by cyclone fencing and standing water is limited to a single pool, with a surface area of ~150 m^2, in the southeast corner of the fenced area (Figure 2). Most of the current sewage lagoon area is dry and has become filled with trees and shrubs. The City of Ekwok is planning to construct sewage system upgrades in 2010, including expansion of the piped sewer system, upgrade of the lift station, and improvements to the sewage lagoon. Although overgrown with trees and shrubs, the Ekwok sewage lagoon was constructed as a 2-cell lagoon. A design report for the original facility is unavailable and the original design intent for the facility is unknown. Cell 1 may have been intended as a combination facultative/percolation cell and Cell 2 may have been constructed as an overflow cell, or secondary percolation cell. Under current conditions, there is typically no appreciable standing wastewater in Cell 1, apart from a lined "sludge pit," and a small pool of sewage near this pit.

The lagoon improvements will include lining the first cell and raising the berm height. The liner installation will lead to standing water in Cell 1. The current dimensions of Cell 1 are approximately 215 ft by 160 ft or about 1 acre. The effective footprint of Cell 1 will increase slightly to accommodate the increased berm height. Improvements to Cell 1 will create a full facultative cell with no percolation. Standing water will be continuously retained in Cell 1. Cell 2 will not be lined or significantly modified and will function as an unlined percolation cell that will not typically retain standing water.

STUDY AREA

Vegetation in the vicinity of Ekwok is classified as mixed woodland forest (Viereck et al. 1992). Dominant trees are white spruce (*Picea glauca*), black spruce (*Picea mariana*), Kenai birch (*Betula papyrifera*), and quaking aspen (*Populus tremuloides*) with an understory of bog blueberry (*Vaccinium uliginosum*), dwarf arctic birch (*Betula nana*), crowberry (*Empetrum nigrum*) and lowbush cranberry (*Vaccinium vitis-idaea*). Tall shrub habitats dominated by alder

Figure 2. Ekwok sewage lagoon, Ekwok, Alaska, June 2009. Top Photo: view is to southwest. The areal extent of the waterbody in the foreground is ~150 m^2. Bottom Photo: The remainder of the ~8,600 m^2, two-cell sewage lagoon is not currently flooded and has become vegetated by willow, balsam poplar, and bluejoint. No wildlife use of the waterbody was observed during field surveys.

(*Alnus crispa*) and willows (*Salix* spp.) are common near the Nushagak River and Klutuk Creek, as well as in revegetating disturbed areas in and near the village (e.g., the sewage lagoon). Two wetlands were delineated in the airport vicinity (PDC and ADOT&PF 2003), a palustrine, semipermanently flooded, persistent emergent marsh on the northern edge of the airport property (>30 acres, ponds surveyed during this study were located in this area) and a palustrine, saturated, broad-leaved deciduous shrub bog adjacent to the runway (1.4 acres).

Wetland and upland habitats in the Ekwok vicinity support moose (*Alces alces*), caribou (*Rangifer tarandus*), brown bear (*Ursus arctos*), black bear (*U. americanus*), wolverine (*Gulo gulo*), tundra hares (*Lepus othus*), snowshoe hares (*Lepus americanus*), lynx (*Lynx canadensis*), and red fox (*Vulpes vulpes*) (PDC and ADOT&PF 2003). The airport is within a designated moose winter use area and borders a moose calving area delineated along the banks of the Nushagak River. The Mulchatna caribou herd uses the area, but the airport is outside of caribou migration routes. Brown bears concentrate seasonally along nearby Klutuk Creek and other fish-bearing streams (ADNR et al. 1988).

Wetlands in the Ekwok area support significant populations of migratory waterfowl, swans, shorebirds, and cranes (Alaska Coastal Management Program 1992). From PDC and ADOT&PF 2003, summer resident bird species include yellow warbler (*Dendroica petechia*), Wilson's Warbler (*Wilsonia pusilla*), Common Redpoll (*Carduelis flammea*), and Fox Sparrow (*Passerella iliaca*). Year-round resident bird species include Spruce Grouse (*Falcipennis canadensis*), Black-billed Magpie (*Pica pica*), and Common Raven (*Corvus corax*) (PDC and ADOT&PF 2003). Tree Swallows (*Tachycineta bicolor*) and American Robins (*Turdus migratorius*) were noted as particularly abundant near the Ekwok Airport during surveys conducted for the landfill wildlife hazard assessment (MACTEC 2003). One Bald Eagle (*Haliaeetus leucocephalus*) nest is known on Klutuk Creek, approximately 2 miles south of the airport, but trees in the vicinity of the airport are generally considered unsuitable for eagle nesting (PDC and ADOT&PF 2003).

METHODS

Wildlife surveys were conducted at a total of 7 sites at and near the Ekwok airport: 3 sites along the active runway, and 1 site each at the sewage lagoon, landfill, gravel pit pond, and a small pond located northeast of the airport. Surveys were conducted for 15–30 minute periods at the airport sampling sites, and 10–15 minute periods at all other sites. At the 3 runway sites, the

species, flock size, time of observation, and altitude (when possible) was recorded for all birds observed overflying the runway and/or adjacent approach areas (e.g., areas along the runway centerline within ~300 m of the runway thresholds). Birds detected on the ground within the cleared airport perimeter also were recorded. At the other sites, observations were restricted to birds using habitats within the immediate area of interest (e.g., during surveys at the landfill, birds using adjacent forested habitats were not recorded). Wildlife observations also were recorded incidentally while walking between sampling sites, as well as at other locations around the village (e.g., Nushagak River corridor).

Brief habitat evaluations were conducted at each sampling site, and throughout the cleared airport perimeter. Vegetation structure and dominant species were recorded.

Brief, informal interviews were conducted with pilots and local residents whenever possible. Interviewees were asked about their knowledge of wildlife hazards and incidents around the airport, as well as the seasonal abundance of large-bodied, flocking birds, particularly for spring and fall migration when larger flocks would be expected and during winter, when resident birds may be found in flocks.

RESULTS AND DISCUSSION

WILDLIFE SURVEYS

Survey conditions were excellent during all field surveys on 17–19 June 2009. Mild temperatures, light winds, and mostly sunny skies prevailed, except for convective cloud build-up and brief rainfall on 18 June. Patchy fog developed early the morning of 19 June, but dissipated rapidly and did not hinder visual surveys conducted at the Ekwok airport.

AIRPORT OPERATIONS AREA

A mosaic of disturbed habitats occurs within the airport perimeter. Many vegetation patches pertain to remnant understory vegetation following clearing of forest, particularly near the new active runway. Low ericaceous shrubs, willows, and resprouting quaking aspen are common. Native grasses such as bluejoint grass (*Calamagrostis canadensis*) and Altai fescue (*Festuca altaica)* are common in places. Additionally, bermed areas adjacent to the runway shoulders appear to have been seeded with grasses, although little green vegetation was present in these

areas at the time of field surveys. Patches of tall willow also occur within the airport perimeter, particularly near the abandoned runway.

Fifteen survey periods totaling 417 survey minutes were conducted at 3 sites along the active runway at Ekwok airport (Appendix 1). During survey periods, a total of 62 bird overflights (1–3 birds each) were observed crossing the runway and adjacent approach areas (Table 1). Most overflights were by single birds, only 9 were flocks of 2 or more birds. The average estimated altitude of all flocks observed overflying the runway was 25 m.

During survey periods, 12 bird species were observed overflying the runway and adjacent approach areas. Of these, 2 were diurnal raptors, 3 were shorebirds, 3 were gulls, and 4 were passerines. Passerines were by far the most frequently observed species-group overflying the runway (42 flocks; 67.7% of all observations). Two of the 4 passerine species observed were corvids: Common Raven and Black-billed Magpie. Black-billed Magpie was the most frequently observed species overflying the runway (14 flocks; 22.6% of all observations). Several corvid overflights appeared to be on flight paths between the landfill and habitats in the village and adjacent river corridor.

Table 1. Number of flocks (1–3 birds) of birds observed overflying the runway and adjacent approach areas during survey periods (417 minutes of observation), 17–19 June 2009, Ekwok, Alaska.

	Flock Size			Total	Total
Species	1	2	3	flocks	birds
Bald Eagle	4			4	4
Merlin	1			1	1
Semipalmated Plover		1		1	2
Unidentified dowitcher	1			1	1
Wilson Snipe	1			1	1
Mew Gull	4			4	4
Herring Gull		1		1	2
Glaucous-winged Gull	6			6	6
Unidentified gull	1			1	1
Black-billed Magpie	11	3		14	17
Common Raven	6	1		7	8
Tree Swallow	7	2	1	10	14
Common Redpoll	11			11	11
Total	53	8	1	62	72

Several additional runway overflights by birds were recorded incidentally (see Appendix 1) and incidental observations included 2 additional species, Mallard (*Anas platyrhynchos*) and Black-bellied Plover (*Pluvialis squatarola*), that were overflying the runway between survey periods. Savannah Sparrows (*Passerculus sandwichensis*) and White-crowned Sparrows (*Zonotrichia leucophrys*) also were detected in vegetated habitats within the airport perimeter, but were never observed overflying the runway.

Incidental observations also included several concentrated piles of ptarmigan or grouse scat adjacent to the runway edge, suggesting use by roosting ptarmigan and grouse in the winter. Although no moose scat was observed during pedestrian searches, a cow moose with 2 calves subsequently was observed to cross the aircraft approach area immediately prior to the arrival of a regularly scheduled air taxi landing on the morning of 19 June (Figure 3).

The airport was previously surveyed for wildlife activity in late May 2003 (MACTEC 2003). Observations in 2003 were generally similar to those in 2009: small numbers of birds were observed crossing the runway in flocks of 1 or 2 individuals, large-bodied birds (including ravens, gulls, ducks, arctic tern [*Sterna paradisaea*]) crossed the runway at all hours of the day, and no distinct flight paths for birds were detected. A review of the FAA online database of wildlife strikes identified no records of wildlife strikes from the Ekwok Airport.

SEWAGE LAGOON

The sewage lagoon area is bermed and surrounded by fencing. Standing water is limited to a single, small pool (~100 m^2) in the southeast corner. Elsewhere the lagoon area is heavily vegetated with alder, willow, poplar, and bluejoint grass (Figure 2). The lagoon area is surrounded by white spruce woodland.

Five survey periods totaling 122 survey minutes were conducted at the sewage lagoon (Table 2). Wildlife observations comprised primarily small, male songbirds defending breeding territories in tall shrub and open forest habitats in and near the sewage lagoon. Common species included Gray-cheeked Thrush (*Catharus minimus*), Arctic Warbler (*Phylloscopus borealis*), Orange-crowned Warbler (*Vermivora celata*), Wilson's Warbler, Blackpoll Warbler (*Dendroica striata*), and White-crowned Sparrow. Corvids and raptors were only observed overflying the lagoon. A pair of Merlin (*Falco columbarius*), however, were frequently observed exhibiting defensive behavior, suggesting the presence of a nest in the vicinity. On no occasion were wildlife

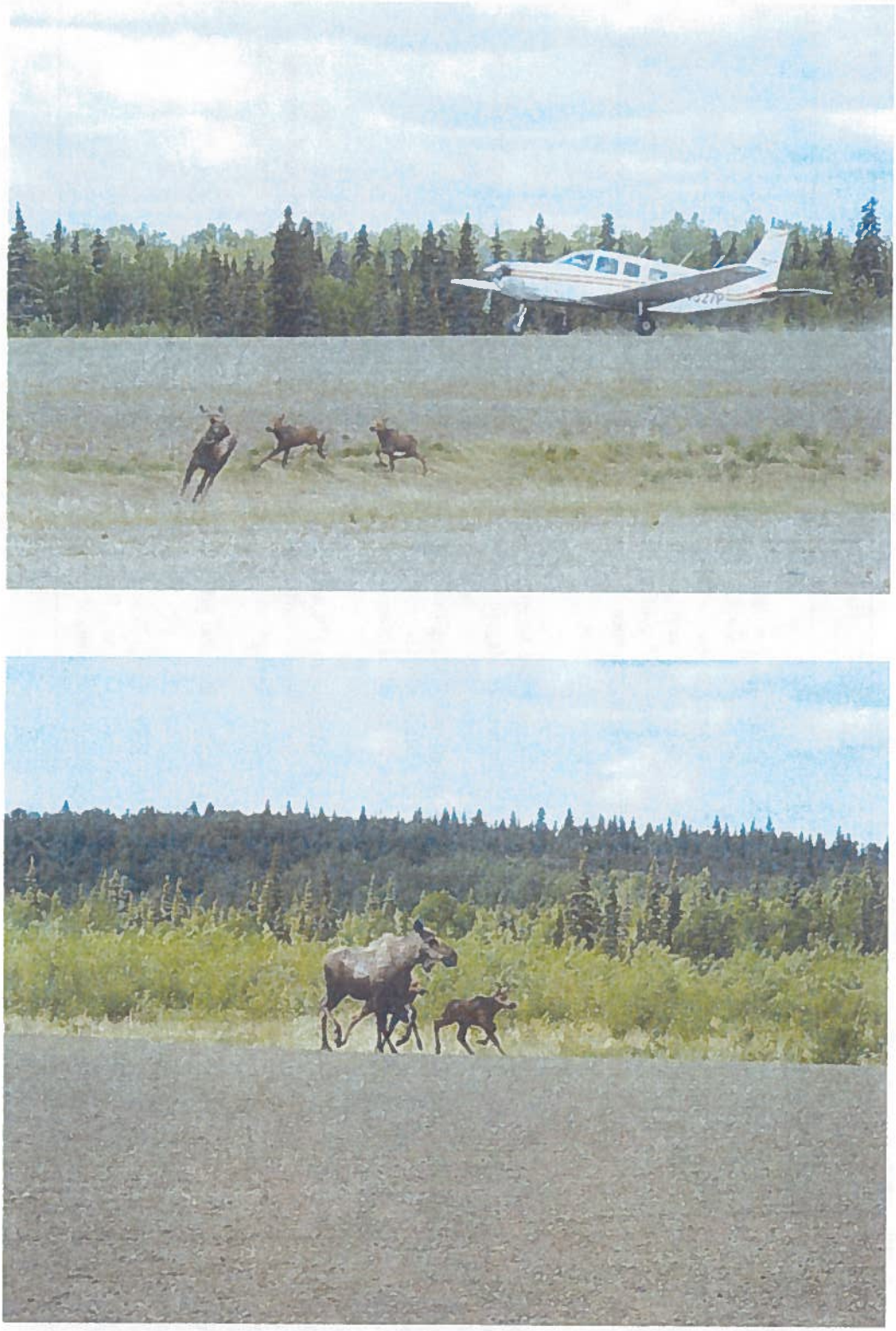


Figure 3. Cow moose and young calves within aircraft operations area during arrival of Pen Air PA-32, 19 June 2009, Ekwok, Alaska.

Table 2. Summary of wildlife observations at sewage lagoon, landfill, gravel pit, and pond north of the airport, 17–19 June 2009, Ekwok, Alaska.

Site Date	Start time	End time	Observations
Sewage Lagoon			
18 June	0602	0619	Use restricted to breeding songbirds; no corvid use observed; no wildlife use of small pond
18 June	1032	1047	Use restricted to breeding songbirds; no corvid use observed; no wildlife use of small pond
18 June	1630	1645	Use restricted to breeding songbirds; no corvid use observed; no wildlife use of small pond
19 June	0910	0925	Use restricted to breeding songbirds; no corvid use observed; no wildlife use of small pond
17 June	1341	1443	Use restricted to breeding songbirds; no corvid use observed; no wildlife use of small pond; a Merlin mobbed a Common Raven overflying the area; presence of second Merlin and repeated observations of territorial behavior suggest nesting near the village
Landfill			
18 June	0734	0749	~15 Common Ravens and 3 Black-billed Magpies flushed at beginning of survey
18 June	1230	1240	6 Common Ravens and 1 Black-billed Magpie flushed at beginning of survey; ~4 additional Common Ravens seen leaving landfill prior to survey
18 June	1455	1505	1 Common Raven and 2 Black-billed Magpies flushed at beginning of survey
18 June	2015	2025	~15 Common Ravens and 1 Black-billed Magpie flushed at beginning of survey
19 June	0735	0740	~18 Common Ravens and 1 Black-billed Magpie flushed at beginning of survey
Gravel Pit			
18 June	0705	0720	7 Greater Yellowlegs and 2 Semipalmated Plovers feeding in and near gravel pit pond; no waterfowl observed
18 June	1248	1258	3 Greater Yellowlegs and 1 Semipalmated Plover feeding in and near gravel pit pond; no waterfowl observed
18 June	2125	2135	3 Greater Yellowlegs, 2 Lesser Yellowlegs, and 1 Semipalmated Plover feeding in and near gravel pit pond; no waterfowl observed
19 June	0811	0821	2 Semipalmated Plovers feeding in and near gravel pit pond; no waterfowl observed
Pond N of Runway			
18 June	0835	0850	No use of pond; 2 Common Ravens and 3 Tree Swallows overflew the area
18 June	1440	1450	2 Greater Yellowlegs in wetland; 6 Common Ravens loafing in tussocks adjacent to wetland
19 June	0749	0759	1 Common Raven loafing in tussocks adjacent to wetland

observed using the small puddle within the sewage lagoon. In the event that the sewage lagoon was filled with water, it could attract large-bodied and flocking birds, such as waterfowl and shorebirds. However, the only waterfowl observed during 17–29 June 2009 was a high overflight of 1 flock of 4 Mallards.

No mammal sign was observed inside the fenced area of the lagoon. Moose sign was abundant, however, outside of the fenced area, including abundant scat and browsed vegetation.

The sewage lagoon area was previously surveyed in late May 2003 (MACTEC 2003). That survey similarly reported that no ravens, gulls, or waterfowl were observed using the area, but that sparrows and Tree Swallows were present.

LANDFILL

The landfill occurs in an upland area dominated by white spruce and quaking aspen. The landfill area itself is largely gravel with burnable trash deposited in a depression (Figure 4). Paper trash is burned in a large barrel at irregular intervals. Non-burnable trash is deposited at a location about 25 m from the burnables. Moose, fox, and dog carcasses of varying ages were present during the survey. Irregularly placed fencing and 55-gallon barrels line portions of the site, which is basically uncontained and windblown garbage is abundant at and near the site.

Five survey periods totaling 55 survey minutes were conducted at the Ekwok landfill (Table 2). Only corvids were observed using the immediate landfill area and corvids were observed at the landfill during every survey period. The maximum number of individuals observed was at least 18 Common Ravens and 1 Black-billed Magpie. Because corvids in the landfill were quick to flush on the approach of humans, counts were made immediately upon arrival at the landfill. No birds were observed returning to the landfill during the remainder of any survey period.

Incidental observations made at the landfill included a deceased dog that had been quilled by a porcupine (*Erethizon dorsatum*), thus confirming the presence of porcupines in the Ekwok area. Avian droppings were abundant and widespread at the site.

The landfill was previously surveyed during late May 2003 (MACTEC 2003). That survey reported only 1–2 ravens and up to 3 magpies present at any one time and also reported the presence of foraging American Robins during surveys. That report suggested that the landfill was not particularly attractive to birds, probably meaning that no large aggregations were observed, because daily use of the site by corvids and robins was documented. Interviews with local

Figure 4. Ekwok landfill, Ekwok, Alaska, June 2009. View is to southeast. Note abundance of avian feces on barrels in foreground. Common Ravens and Black-billed Magpies were observed here during every survey conducted at the landfill.

residents in 2003 indicated that ravens are more numerous at the landfill in the fall, when game carcasses are more abundant in the landfill, and no carcasses were noted during the 2003 survey.

GRAVEL PIT

The gravel pit area was expanded for airport improvements in 2005 and the site is almost entirely barren, with sparse vegetation occurring on piled overburden. A shallow pond is present at the southwest end of the gravel pit.

Four survey sessions totaling 45 survey minutes were conducted at the gravel pit pond (Table 2). Wildlife use of the gravel pit pond and pond shorelines was restricted to shorebirds and 2--9 shorebirds were recorded during each survey period.

During surveys in 2003 (MACTEC 2003), no gulls, ravens, or waterfowl were observed at the gravel pit.

NORTHEAST AIRPORT PONDS

The northeast airport ponds were undisturbed natural shallow ponds surrounded by sphagnum bog with sparse sedges, tussocks, and low ericaceous shrubs (Figure 5).

Three survey sessions totaling 35 survey minutes were conducted at the small pond complex located ~450 m north of the northeast end of the airstrip (Table 2). These surveys were conducted primarily to detect large-bodied, flocking waterfowl, to evaluate their presence/abundance in the area. The only wildlife observed at these ponds were 2 Greater Yellowlegs (*Tringa melanoleuca*). Common Ravens were also observed loafing in tussocks north of the pond complex during 2 survey sessions. Buck Williams, Ekwok resident and licensed guide-outfitter, commented that he very rarely sees waterfowl in the pond complex.

These ponds also were surveyed in late May 2003 (MACTEC 2003). No waterfowl, ravens, or gulls were observed.

OTHER HABITATS

Incidental observations were also made throughout Ekwok village and 2 other habitats located in the vicinity of the Ekwok Airport: the Nushagak River corridor and Klutuk Creek. Many birds of many species appeared to use flight paths in the Nushagak River corridor, and many of the large-bodied species observed there were not observed elsewhere (e.g., loons, American Wigeon [*Anas americana*], Red-breasted Merganser [*Mergus serrator*]). Although the

Figure 5. Wetlands and pond northeast of airport, Ekwok, Alaska, July 2009.

island in the Nushagak across from the Buck Williams Lodge could not be accessed, it appeared to support a nesting colony of ~15 Arctic Terns. A brief survey of Klutuk Creek did not reveal any large-bodied birds, although abundant moose sign was observed.

Previous wildlife surveys in late May 2003 included the island in the Nushagak River, which was accessible by foot due to low water at that time, but no nesting gulls, terns, or waterfowl were observed. Bald eagles and gulls were recorded using the river corridor and unidentified shorebirds also were recorded on the river shores.

INTERVIEWS

Brief, informal interviews were conducted with local residents of Ekwok, as well as the 2 pilots that flew field personnel to and from the village. The following are taken from notes of G. J. Frost, summarizing interviews he conducted during the 2009 field effort.

Wayne Alsworth, pilot

I asked Mr. Alsworth how long he had been flying into the Ekwok Airport and if he had ever had problems with birds in the vicinity of the airport. He responded that he had flown into Ekwok "for many years" and had never had any airstrikes or close calls with birds.

Buck Williams, Ekwok resident, licensed guide-outfitter

I asked Mr. Williams a number of questions regarding aircraft operations at the Ekwok airport, seasonal movements of birds and mammals in the area, and wildlife use of specific habitats in the vicinity of the airport. Mr. Williams commented that up to ~35 aircraft movements occur daily at Ekwok airport in peak season (mid-late summer), but that daily movements are reduced to half a dozen or less in winter. Mr. Williams mentioned that moose are by far the most abundant large mammal in the Ekwok area, but that large numbers of caribou, presumably of the Mulchatna herd, pass through the Ekwok area at infrequent intervals. The last such event occurred in April 2009 and involved "about 10,000" animals, some of which passed through the village itself. Additionally, he said that bears are occasionally seen in town. He had no recollection of any bird airstrikes at the Ekwok airport.

I asked Mr. Williams about seasonal movements of large-bodied, flocking species such as swans, geese, and Sandhill Cranes (*Grus canadensis*) in the Ekwok vicinity. He responded that such species regularly overfly the village at "high altitude" in spring and fall, but that he very rarely observed these species at low altitudes and never saw them using habitats in the Ekwok area itself. Mr. Williams mentioned that ravens, magpies, and gulls frequently feed at the Ekwok landfill, but added that the Nushagak River corridor supports the highest concentrations of birds. Mr. Williams knew of 2 Bald Eagle nest sites in the vicinity of the village, but he thought that both of these were well over 1 mile from the runway.

I asked Mr. Williams to characterize winter movements of large-bodied birds in the Ekwok area. He commented that gulls persist in the area until freeze-up of the Nushagak River, which can occur as late as November. He did not think that the number of Common Ravens and Black-billed

Magpies changes substantially from summer to winter. Bird species that he typically sees in winter that were not observed during field surveys were limited to ptarmigan and several species of small songbirds (e.g., Pine Grosbeak [*Pinicola enucleator*], chickadees [*Poecile* spp.]).

William Nelson, Ekwok resident

I asked Mr. Nelson if the number of corvids using the landfill changes substantially in the winter. He responded that their abundance remains more or less constant year-round. He also commented that gulls leave the Ekwok area after freeze-up, usually at the end of October. Mr. Nelson thought that the landfill was the only significant "bird issue" in the vicinity of the airport. He also thought that Bald Eagles can be a problem, particularly since certain individuals were "habituated" to people and sometimes scavenge in the village.

Robert, pilot

Robert piloted the aircraft shown in Figure 3. I asked him if he had ever had problems with birds in the Ekwok area. He responded that he had never come close to striking birds in the region, but that he had occasional problems with "mammals" in the aircraft operations area of the Ekwok airport (as on 19 June).

SUMMARY AND CONCLUSIONS

During mid-June 2009, 46 bird species and 3 mammal species, identified by direct sighting or by their songs or sign, were recorded at the Ekwok airport and in the vicinity, including the sewage lagoon, landfill, gravel pits (expanded by recent airport improvements), natural ponds near the airport, and along the Nushagak River and Klutok Creek (Table 3). Surveys focused on flying birds, and the most frequently recorded species among all of the survey areas and other sites visited were Black-billed Magpies, Tree Swallows, Common Redpolls, and Common Ravens. All observed overflights of the airport were by small flocks of between 1 and 3 birds. No large aggregations of birds were observed and no particular flight paths were apparent. The only apparent wildlife attractant among the sites visited appeared to be the landfill, where uncontained putrescible garbage was present and ravens and magpies were present at the initiation of all survey periods there (but flushed at the arrival of the observer and did not return for the duration of the site visit).

Table 3. Bird and mammal species observed in the vicinity of the airport, Ekwok, Alaska, 17–19 June 2009. (Asterisk indicates species observed within the airport perimeter.)

Common Name	Scientific name	Observed at airport
BIRDS		
Red-throated Loon	*Gavia stellata*	
Common Loon	*Gavia immer*	
Yellow-billed Loon	*Gavia adamsii*	
American Wigeon	*Anas americana*	
Mallard	*Anas platyrhynchos*	*
Red-breasted Merganser	*Mergus serrator*	
Bald Eagle	*Haliaeetus leucocephalus*	*
Merlin	*Falco columbarius*	*
Black-bellied Plover	*Pluvialis squatarola*	*
Semipalmated Plover	*Charadrius semipalmatus*	*
Greater Yellowlegs	*Tringa melanoleuca*	
Lesser Yellowlegs	*Tringa flavipes*	
Spotted Sandpiper	*Actitis macularius*	
Black Turnstone	*Arenaria melanocephala*	
Unidentified dowitcher	*Limnodromus* sp.	*
Wilson's Snipe	*Gallinago delicata*	*
Mew Gull	*Larus canus*	*
Herring Gull	*Larus argentatus*	*
Glaucous-winged Gull	*Larus glaucescens*	*
Arctic Tern	*Sterna paradisaea*	
Belted Kingfisher	*Ceryle alcyon*	
Alder Flycatcher	*Empidonax alnorum*	
Gray Jay	*Perisoreus canadensis*	
Black-billed Magpie	*Pica pica*	*
Common Raven	*Corvus corax*	*
Tree Swallow	*Tachycineta bicolor*	*
Arctic Warbler	*Phylloscopus borealis*	
Gray-cheeked Thrush	*Catharus minimus*	
Swainson's Thrush	*Catharus ustulatus*	
Hermit Thrush	*Catharus guttatus*	
American Robin	*Turdus migratorius*	
Varied Thrush	*Ixoreus naevius*	
Orange-crowned Warbler	*Vermivora celata*	
Yellow Warbler	*Dendroica petechia*	
Yellow-rumped Warbler	*Dendroica coronata*	
Blackpoll Warbler	*Dendroica striata*	
Northern Waterthrush	*Seiurus noveboracensis*	
Wilson's Warbler	*Wilsonia pusilla*	
American Tree Sparrow	*Spizella arborea*	
Savannah Sparrow	*Passerculus sandwichensis*	*
Fox Sparrow	*Passerella iliaca*	
Lincoln's Sparrow	*Melospiza lincolnii*	
White-crowned Sparrow	*Zonotrichia leucophrys*	*
Golden-crowned Sparrow	*Zonotrichia atricapilla*	
Dark-eyed Junco	*Junco hyemalis*	
Common Redpoll	*Carduelis flammea*	*
MAMMALS		
Moose	*Alces alces*	*
Porcupine	*Erethizon dorsatum*	
Red Squirrel	*Tamiasciurus hudsonicus*	

The observations of local pilots and residents confirm that Ekwok lies in the migration route for large flocks of swans, geese, and cranes and that these species typically migrate through the area at high altitudes. None of the interviewees, including 3 pilots, reported observations of swans, geese, or Sandhill Cranes using habitats in the Ekwok area and none reported having observed bird hazards or incidents with any bird species at the Ekwok airport.

In its current condition, the sewage lagoon area lacks a waterbody of any size, does not appear to represent an attractant to wildlife, and probably poses little hazard to aircraft at the nearby airport. Improvements planned for the sewage lagoon (i.e., the creation of a deep open waterbody) may result in the attraction of waterbirds, including ducks, gulls, terns, and shorebirds, all of which were documented during the surveys in the Ekwok airport area and all of which are known to be common and present during spring, summer, and fall in the region.

Design information on the improved sewage lagoon indicates an open waterbody, approximately 7 ft deep, approximately 1 acre surface area, without emergent vegetation, and without a littoral shoreline area. Brush will be cleared from the perimeter area a minimum of 30 ft, providing a buffer of low vegetation around the lagoon. Nutrients in the water will support algae and aquatic invertebrates, but rooted vegetation will be prevented by the liner. These observations suggest that the sewage lagoon will not be particularly attractive to most waterbirds, except as loafing habitat, and perhaps more attractive as loafing habitat for migrants than for locally breeding birds. The sewage lagoon could periodically attract larger numbers of migrating birds if it has open water earlier or freezes later than other local waterbodies. Because the sewage lagoon area is fenced, mammals are not likely to be attracted.

The 2003 and 2009 wildlife surveys each represent a snapshot of wildlife activity and wildlife sign at the specific season in which the surveys were conducted, late May in 2003 and mid-late June in 2009. Neither survey assessed local bird movements during migratory periods in spring and fall. Ekwok is near the Togiak National Wildlife Refuge, the Becharof National Wildlife Refuge, and the Yukon Delta National Wildlife Refuge, all of which attract large numbers of migrating and breeding birds. Most large migratory flocks of waterfowl, shorebirds, or cranes appear to overfly local habitats at Ekwok, but some use of open waterbodies by migrating birds occurs. The flooded sewage lagoon is unlikely to be particularly attractive to waterbirds during open water seasons when natural freshwater habitats are abundantly available in the Ekwok region. It is unlikely that the level of use during open water season would approach

that of natural waterbodies in the area. Unknown numbers of birds, primarily ducks, gulls, terns, and shorebirds, may be attracted to the improved sewage lagoon, particularly for resting during spring or fall migration, if the lagoon provides open water during periods when natural waterbodies are frozen.

LITERATURE CITED

MACTEC. 2003. Ekwok Airport Rehabilitation Wildlife Survey Report. Unpublished report by MACTEC, Anchorage, AK, for Alaska Department of Transportation and Public Facilities, Anchorage, AK.

PDC and ADOT&PF. 2003. Ekwok Airport Rehabilitation Environmental Assessment. Unpublished report by PDC, Inc., Consulting Engineers, Anchorage, AK, and Alaska Department of Transportation and Public Facilities, Anchorage, AK, for Federal Aviation Administration, Anchorage, AK.

Appendix 1. Summary of observations of birds overflying the runway and adjacent approach areas during survey periods, 17–19 June 2009, Ekwok, Alaska. Small songbirds detected in vegetated habitats within the airport perimeter, and incidental observations made in between formal survey periods, are not shown.

Date	Site	Time	Species	Flock size	Altitude (m)	Notes
17 June	walked airport perimeter	1527	(begin survey)	-	-	
17 June	walked airport perimeter	1530	Bald Eagle	1	30	
17 June	walked airport perimeter	1617	Common Raven	1	15	
17 June	walked airport perimeter	1627	Glaucous-winged Gull	1	50	
17 June	walked airport perimeter	1639	(end survey)	-	-	
18 June	Southwest end	0637	(begin survey)	-	-	
18 June	Southwest end	0641	Common Raven	1	20	
18 June	Southwest end	0647	Black-billed Magpie	1	20	
18 June	Southwest end	0649	Tree Swallow	1	50	
18 June	Southwest end	0651	unidentified dowitcher	1	75	
18 June	Southwest end	0652	(end survey)	-	-	
18 June	Northeast end	0803	(begin survey)	-	-	
18 June	Northeast end	0809	Tree Swallow	2	variable	erratic foraging flight
18 June	Northeast end	0810	Common Redpoll	1	30	
18 June	Northeast end	0814	Common Redpoll	1	30	
18 June	Northeast end	0815	Wilson Snipe	1	no data	aerial display in vicinity of runway
18 June	Northeast end	0818	(end survey)	-	-	
18 June	Middle	0908	(begin survey)	-	-	
18 June	Middle	0910	Common Raven	1	3	towards vicinity of landfill
18 June	Middle	0910	Common Redpoll	1	20	
18 June	Middle	0915	Bald Eagle	1	50	
18 June	Middle	0918	Black-billed Magpie	1	20	
18 June	Middle	0921	Common Redpoll	1	50	
18 June	Middle	0923	(end survey)	-	-	
18 June	Southwest end	1114	(begin survey)	-	-	
18 June	Southwest end	1114	Glaucous-winged Gull	1	30	

Appendix 1. Continued.

Date	Site	Time	Species	Flock size	Altitude (m)	Notes
18 June	Southwest end	1124	Tree Swallow	1	variable	erratic foraging flight
18 June	Southwest end	1137	Tree Swallow	3	variable	erratic foraging flight
18 June	Southwest end	1140	Glaucous-winged Gull	1	variable	circling southwest approach area
18 June	Southwest end	1144	(end survey)	-	-	
18 June	Middle	1152	(begin survey)	-	-	
18 June	Middle	1154	Tree Swallow	1	variable	
18 June	Middle	1157	Glaucous-winged Gull	1	30	
18 June	Middle	1200	Black-billed Magpie	1	20	from vicinity of landfill
18 June	Middle	1208	Bald Eagle	1	15	
18 June	Middle	1212	Common Redpoll	1	50	
18 June	Middle	1213	Black-billed Magpie	1	20	
18 June	Middle	1216	Common Raven	1	25	
18 June	Middle	1217	Common Raven	2	25	
18 June	Middle	1222	(end survey)	-	-	
18 June	Northeast end	1402	(begin survey)	-	-	no observations this survey period
18 June	Northeast end	1432	(end survey)	-	-	
18 June	Middle	1511	(begin survey)	-	-	
18 June	Middle	1517	Tree Swallow	2	variable	erratic foraging flight
18 June	Middle	1517	Bald Eagle	1	variable	soaring
18 June	Middle	1518	Black-billed Magpie	1	20	
18 June	Middle	1529	Common Redpoll	1	no data	
18 June	Middle	1532	Merlin	1	30	
18 June	Middle	1537	Common Redpoll	1	no data	
18 June	Middle	1541	(end survey)	-	-	
18 June	Southwest end	1549	(begin survey)	-	-	
18 June	Southwest end	1612	Tree Swallow	1	variable	
18 June	Southwest end	1615	Black-billed Magpie	1	25	
18 June	Southwest end	1619	(end survey)	-	-	

Appendix 1. Continued.

Date	Site	Time	Species	Flock size	Altitude (m)	Notes
18 June	Southwest end	1956	(begin survey)	-	-	
18 June	Southwest end	2001	Mew Gull	1	25	
18 June	Southwest end	2009	Mew Gull	1	1	
18 June	Southwest end	2012	Herring Gull	2	70	
18 June	Southwest end	2014	Glaucous-winged Gull	1	30	
18 June	Southwest end	2016	(end survey)	-	-	
18 June	Middle	2024	(begin survey)	-	-	
18 June	Middle	2038	Common Redpoll	1	no data	
18 June	Middle	2044	(end survey)	-	-	
18 June	Northeast end	2050	(begin survey)	-	-	
18 June	Northeast end	2101	Common Redpoll	1	no data	
18 June	Northeast end	2110	(end survey)	-	-	
19 June	Middle	0622	(begin survey)	-	-	
19 June	Middle	0646	Tree Swallow	1	variable	
19 June	Middle	0652	(end survey)	-	-	
19 June	Northeast end	0655	(begin survey)	-	-	
19 June	Northeast end	0657	Black-billed Magpie	1	20	from vicinity of landfill
19 June	Northeast end	0710	unidentified gull	1	25	
19 June	Northeast end	0711	Black-billed Magpie	2	10	
19 June	Northeast end	0712	Glaucous-winged Gull	1	25	
19 June	Northeast end	0713	Common Raven	1	10	towards vicinity of landfill
19 June	Northeast end	0714	Black-billed Magpie	2	10	towards vicinity of landfill
19 June	Northeast end	0718	Black-billed Magpie	1	20	
19 June	Northeast end	0721	Black-billed Magpie	1	10	
19 June	Northeast end	0722	Mew Gull	1	10	
19 June	Northeast end	0723	Black-billed Magpie	2	15	
19 June	Northeast end	0724	Black-billed Magpie	1	10	
19 June	Northeast end	0725	(end survey)	-	-	

Appendix 1. Continued.

Date	Site	Time	Species	Flock size	Altitude (m)	Notes
19 June	Southwest end	0827	(begin survey)	-	-	
19 June	Southwest end	0831	Common Redpoll	1	30	
19 June	Southwest end	0835	Tree Swallow	1	variable	
19 June	Southwest end	0836	Common Redpoll	1	no data	
19 June	Southwest end	0843	Common Raven	1	15	
19 June	Southwest end	0843	Black-billed Magpie	1	15	
19 June	Southwest end	0851	Mew Gull	1	30	
19 June	Southwest end	0852	Tree Swallow	1	10	
19 June	Southwest end	0857	Semipalmated Plover	2	35	
19 June	Southwest end	0857	(end survey)	-	-	

APPENDIX B

Well Logs

Bristol
ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION

Village Safe Water
City of Ekwok

Job No. 28060

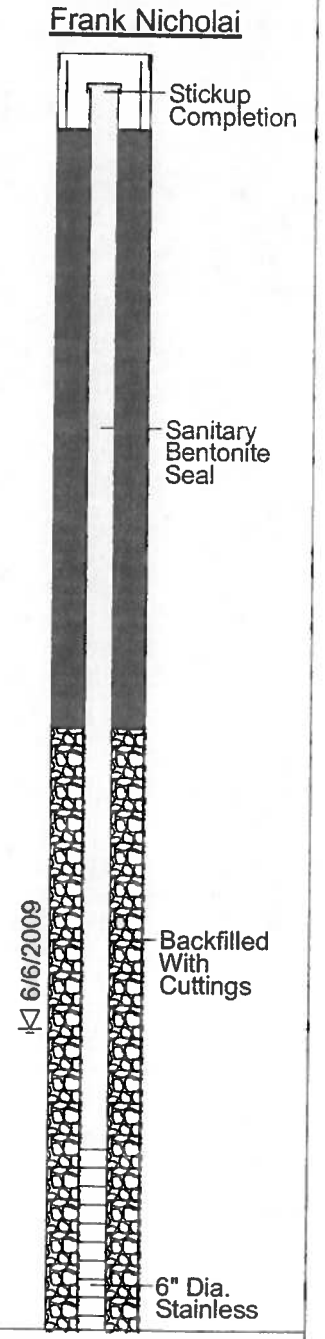
Frank Nicholai

Site Location: Ekwok, Alaska
Boring Location: Not Surveyed
Elevation: Not Surveyed
Total Depth: 22 feet

Logged By: Kyle Petersen
Drilled By: Curtis Hefty
Drilling Company: Hefty Drilling
Drilling Method: Rotary
Borehole Diameter: 6 inches

Date Started: 6/5/2009
Date Completed: 6/6/2009
Well Yield: 7 gpm

Depth (ft)	Sample Interval	Blow Count	Lab No.	Recovery (%)	PID (ppm)	Graphic Log	USCS	Lithology Description
0								Not sampled
							SM	SAND with SILT and GRAVEL, brown, dry
							GW	GRAVEL with SAND, grayish brown, dry
							GW	GRAVEL and SAND (50%), gray, dry
10							GW	GRAVEL to 1 inch, gray, dry
							GW	GRAVEL with SAND, grayish brown, dry
20								GRAVEL, wet



Notes:
% = percent
Dia. = diameter
ft = feet
ID = identification
No. = number
PVC = polyvinyl chloride
USCS = United Soil Classification System

Bristol
ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION

Village Safe Water
City of Ekwok

Job No. 28060

Frank Nicholai

Site Location: Ekwok, Alaska
Boring Location: Not Surveyed
Elevation: Not Surveyed
Total Depth: 22 feet

Logged By: Kyle Petersen
Drilled By: Curtis Hefty
Drilling Company: Hefty Drilling
Drilling Method: Rotary
Borehole Diameter: 6 inches

Date Started: 6/5/2009
Date Completed: 6/6/2009
Well Yield: 7 gpm

Depth (ft)	Sample Interval	Blow Count	Lab No.	Recovery (%)	PID (ppm)	Graphic Log	USCS	Lithology Description
20							GW	

Frank Nicholai

Steel Slotted Screen (0.020)

30

40

Notes:
% = percent
Dia. = diameter
ft = feet
ID = identification
No. = number
PVC = polyvinyl chloride
USCS = United Soil Classification System

Bristol
ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION

Village Safe Water
City of Ekwok

Job No. 28060

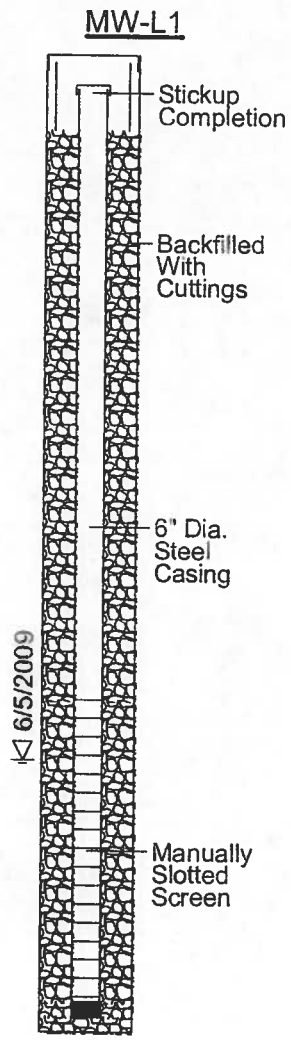
MW-L1

Site Location: Ekwok, Alaska
Boring Location: Not Surveyed
Elevation: Not Surveyed
Total Depth: 14.5 feet

Logged By: Kyle Petersen
Drilled By: Curtis Hefty
Drilling Company: Hefty Drilling
Drilling Method: Rotary
Borehole Diameter: 6 inches

Date Started: 6/4/2009
Date Completed: 6/5/2009
Well Yield: 7 gpm

Depth (ft)	Sample Interval	Blow Count	Lab No.	Recovery (%)	PID (ppm)	Graphic Log	USCS	Lithology Description
0								Not sampled
							GW	GRAVEL with SAND, dry, brown
							GW	GRAVEL to 0.5 inch with SAND, dry, brown
10							GW	GRAVEL to 1 inch, moist
							GW	GRAVEL to 1 inch, saturated
							GW	GRAVEL to 1 inch with SAND, saturated
							SW	SAND, saturated, brown
20								



Notes:
% = percent
Dia. = diameter
ft = feet
ID = identification
No. = number
PVC = polyvinyl chloride
USCS = United Soil Classification System

Bristol
ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION

Village Safe Water
City of Ekwok

Job No. 28060

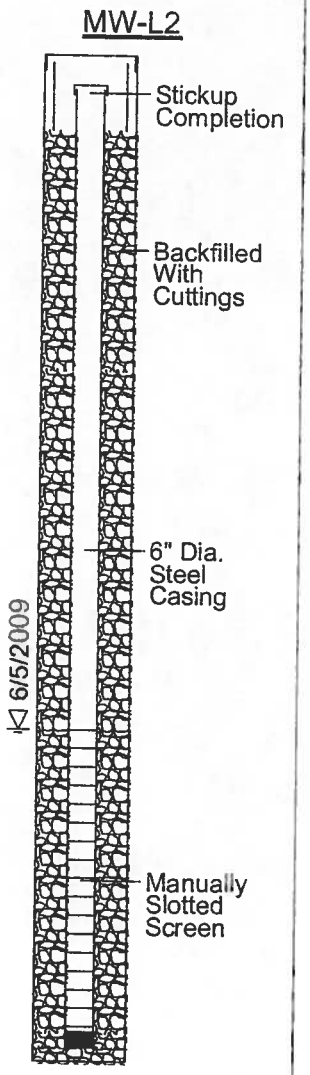
MW-L2

Site Location: Ekwok, Alaska
Boring Location: Not Surveyed
Elevation: Not Surveyed
Total Depth: 15 feet

Logged By: Kyle Petersen
Drilled By: Curtis Hefty
Drilling Company: Hefty Drilling
Drilling Method: Rotary
Borehole Diameter: 6 inches

Date Started: 6/5/2009
Date Completed: 6/5/2009
Well Yield: 10 gpm

Depth (ft)	Sample Interval	Blow Count	Lab No.	Recovery (%)	PID (ppm)	Graphic Log	USCS	Lithology Description
0								Not sampled
							GW	GRAVEL with SAND (5%), dry, brown
							GW	GRAVEL, dry, brown
							GW	GRAVEL with SAND (5%), dry, brown
							GW	GRAVEL, dry, grayish brown
10							GW	GRAVEL, saturated, grayish brown
							GW	GRAVEL, saturated, brown
20								



Notes:
% = percent
Dia. = diameter
ft = feet
ID = identification
No. = number
PVC = polyvinyl chloride
USCS = United Soil Classification System

Bristol
ENVIRONMENTAL & ENGINEERING SERVICES CORPORATION

Village Safe Water
City of Ekwok

Job No. 28060

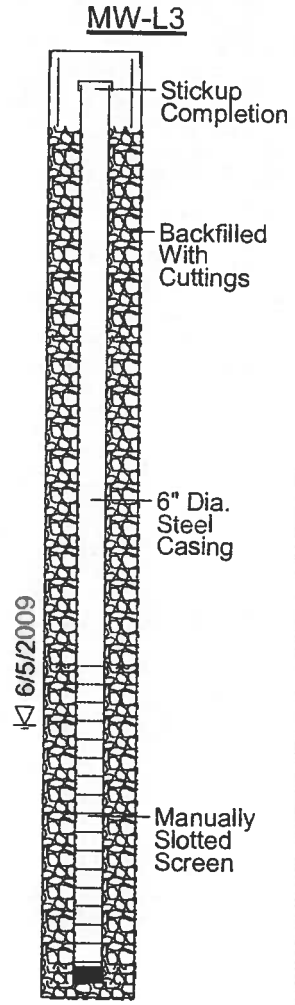
MW-L3

Site Location: Ekwok, Alaska
Boring Location: Not Surveyed
Elevation: Not Surveyed
Total Depth: 14 feet

Logged By: Kyle Petersen
Drilled By: Curtis Hefty
Drilling Company: Hefty Drilling
Drilling Method: Rotary
Borehole Diameter: 6 inches

Date Started: 6/5/2009
Date Completed: 6/5/2009
Well Yield: 4 gpm

Depth (ft)	Sample Interval	Blow Count	Lab No.	Recovery (%)	PID (ppm)	Graphic Log	USCS	Lithology Description
0								Not sampled
							ML	SILT with SAND, brown
							GW	GRAVEL with SAND, dry, brown
							GW	GRAVEL, saturated
10							GW	GRAVEL with SAND
20								



Notes:
% = percent
Dia. = diameter
ft = feet
ID = identification
No. = number
PVC = polyvinyl chloride
USCS = United Soil Classification System

APPENDIX C

Water Quality Data

SP-Analytica, Inc.-Anchorage
4307 Arctic Blvd.
Anchorage, AK 99503
907-258-2155
Fax: 907-258-6634

7/6/2009

Bristol Environmental
111 W. 16th Ave Suite 301
Anchorage, AK 99501-5109
Attn: Kyle Petersen

Work Order #: A0906066
Date: 7/6/2009
Work ID: Ekwok Residential Wells
Date Received: 6/8/2009

Sample Identification

Lab Sample Number	Client Description	Lab Sample Number	Client Description
A0906066-01	MW-L1	A0906066-02	MW-L2
A0906066-03	MW-L3	A0906066-04	Frank Nickolai
A0906066-05	Herman Acovak	A0906066-06	Albert Wallona
A0906066-07	Luki Akelkok		

Enclosed are the analytical results for the submitted sample(s). Please review the CASE NARRATIVE for a discussion of any data and/or quality control issues. Listings of data qualifiers, analytical codes, key dates, and QC relationships are provided at the end of the report.

Sincerely,

Kristen Stone
Project Manager

"The Science of Analysis, The Art of Service"

Case Narrative

Analytica Alaska Inc.
Work Order: A0906066

Samples were prepared and analyzed according to EPA or equivalent methods outlined in the following references:

Methods for the Determination of Metals in Environmental Samples, EPA/600/R-94/111, May 1994.

Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

Method AK101 For the Determination of Gasoline Range Organics, Revision 3.0, 01/31/96.

Method AK102 For the Determination of Diesel Range Organics, Revision 3.0, 01/31/96.

SAMPLE RECEIPT:
Seven (7) samples were received on 6/8/2009 9:15:00 AM, at a temperature of 4.5°C, at Analytica-Anchorage. The samples were received in good condition and in order per chain of custody.

The samples were transferred for metals GRO and DRO analysis to Analytica Environmental Laboratories (AEL), 12189 Pennsylvania St., Thornton, Colorado 80241, where they were received at a temperature of 2.0°C, in good condition and in order per chain of custody on 6/9/2009.

REVIEW FOR COMPLIANCE WITH ANALYTICA QA PLAN
A summary of our review is shown below.

All analytical results contained in this report have been reviewed under Analytica's internal quality assurance and quality control program. Any deviations in quality control parameters for specific analyses are noted in the following text. A complete quality assurance report, including laboratory control, matrix spike, and sample duplicate recoveries is kept on file in our office and is available upon request.

All method specifications were met for the following tests, unless otherwise noted:

Test Method: SM9223B-PA - Coliforms in DW - Aqueous
Test Method: 200.7 - Metals by ICP - Total/TR - Aqueous
Test Method: 200.8 - Metals by ICP/MS - Total/TR - Aqueous
Test Method: SM4500-NO3E - Nitrogen (Nitrate), Cadmium Reduction Method - Nitrate+Nitrite pres - Aqueous

Test Method: ADEC AK101 - GRO - Aqueous

MS/MSD and DUP OUTLIERS:
The target was recovered outside the acceptance limits in the Matrix Spike, as shown below. The target was recovered normally in the Matrix Spike Duplicate.

Type	Client Sample	LabSample	Analyte	Recovery	LCL	UCL	Parent	Spike
MS		A0906066-04E	Gasoline Range Organ	69.9	74	130	24.7	500

Case Narrative

Analytica Alaska Inc.
Work Order: A0906066
(continued)

Test Method: ADEC AK102 - DRO - Aqueous

SAMPLE PREPARATION ISSUES AND OBSERVATIONS:
Insufficient sample volume was provided to perform a matrix spike and matrix spike duplicate. The laboratory prepared an LCS/LCSD to demonstrate method accuracy and precision.

Test Method: SM9222D Fecal Coliform by MF - FC by Membrane Filter - Aqueous

HOLDING TIMES:
Per Standard Methods and 40 CFR Part 136.3 Table 2, fecal analysis should be performed within 6 hours after sampling. However, the ADEC grants a 24-hour holding time for this analysis, which was also not met for these samples. The client gave the laboratory permission to proceed with the analysis.

HOLD TIMES MISSED:
Sample ,A0906066-01A
Sampled: 6/7/2009 6:35:00 AM, Prepped: 6/8/2009 10:55:00 AM
Regulatory hold time: 6 Hrs
Sample ,A0906066-02A
Sampled: 6/7/2009 7:05:00 AM, Prepped: 6/8/2009 10:55:00 AM
Regulatory hold time: 6 Hrs
Sample ,A0906066-03A
Sampled: 6/7/2009 7:30:00 AM, Prepped: 6/8/2009 10:55:00 AM
Regulatory hold time: 6 Hrs
Sample ,A0906066-04A
Sampled: 6/7/2009 8:50:00 AM, Prepped: 6/8/2009 10:55:00 AM
Regulatory hold time: 6 Hrs
Sample ,A0906066-05A
Sampled: 6/7/2009 9:41:00 AM, Prepped: 6/8/2009 10:55:00 AM
Regulatory hold time: 6 Hrs
Sample ,A0906066-06A
Sampled: 6/7/2009 9:25:00 AM, Prepped: 6/8/2009 10:55:00 AM
Regulatory hold time: 6 Hrs
Sample ,A0906066-07A
Sampled: 6/7/2009 9:50:00 AM, Prepped: 6/8/2009 10:55:00 AM
Regulatory hold time: 6 Hrs

SP-Analytica, Inc.-Anchorage
4307 Arctic Blvd.
Anchorage, AK 99503
Phone: 907-258-2155
Fax: 907-258-6634

Bristol Environmental
Attn: Kyle Petersen
111 W. 16th Ave Suite 301
Anchorage, AK 99501-5109
907-743-9349
Fax: 907-563-6713

Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 6:35:00AM
Collected By: unknown

Client Sample ID: MW-L1
Sampling Location: **MW-L1**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0906066-01A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9222D/9222D (Aqueous) - FC by Membrane Filter					*Test was conducted by: Analytica - Anchorage*				
Fecal Coliform Bacteria by MF	<MRL	CFU/100mL		1.0		9222D	6/8/2009	6/8/2009	CW

Lab#: A0906066-01B

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9223B-PA (Aqueous) - Coliforms in DW					*Test was conducted by: Analytica - Anchorage*				
E. Coli	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW
Total Coliform	Fail	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW

Lab#: A0906066-01C

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	1.45	mg/L		1.3	*10*		6/10/2009	6/10/2009	JQ

SP-Analytica, Inc.-Anchorage
4307 Arctic Blvd.
Anchorage, AK 99503
Phone: 907-258-2155
Fax: 907-258-6634

Bristol Environmental
Attn: Kyle Petersen
111 W. 16th Ave Suite 301
Anchorage, AK 99501-5109
907-743-9349
Fax: 907-563-6713

Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 7:05:00AM
Collected By: unknown

Client Sample ID: MW-L2
Sampling Location: **MW-L2**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0906066-02A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9222D/9222D (Aqueous) - FC by Membrane Filter					*Test was conducted by: Analytica - Anchorage*				
Fecal Coliform Bacteria by MF	<MRL	CFU/100mL		1.0		9222D	6/8/2009	6/8/2009	CW

Lab#: A0906066-02B

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9223B-PA (Aqueous) - Coliforms in DW					*Test was conducted by: Analytica - Anchorage*				
E. Coli	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW
Total Coliform	Fail	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW

Lab#: A0906066-02C

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	0.102	mg/L		0.10	*10*		6/10/2009	6/10/2009	JQ

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Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 7:30:00AM
Collected By: unknown

Client Sample ID: MW-L3
Sampling Location: **MW-L3**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0906066-03A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9222D/9222D (Aqueous) - FC by Membrane Filter					*Test was conducted by: Analytica - Anchorage*				
Fecal Coliform Bacteria by MF	<MRL	CFU/100mL		1.0		9222D	6/8/2009	6/8/2009	CW

Lab#: A0906066-03B

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9223B-PA (Aqueous) - Coliforms in DW					*Test was conducted by: Analytica - Anchorage*				
E. Coli	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW
Total Coliform	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW

Lab#: A0906066-03C

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	0.388	mg/L		0.10	*10*		6/10/2009	6/10/2009	JQ

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Fax: 907-563-6713

Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 8:50:00AM
Collected By: unknown

Client Sample ID: Frank Nickolai
Sampling Location: **Frank Nickolai**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0906066-04A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9222D/9222D (Aqueous) - FC by Membrane Filter					*Test was conducted by: Analytica - Anchorage*				
Fecal Coliform Bacteria by MF	<MRL	CFU/100mL		1.0		9222D	6/8/2009	6/8/2009	CW

Lab#: A0906066-04B

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9223B-PA (Aqueous) - Coliforms in DW					*Test was conducted by: Analytica - Anchorage*				
E. Coli	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW
Total Coliform	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW

Lab#: A0906066-04C

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	0.490	mg/L		0.10	*10*		6/10/2009	6/10/2009	JQ

Lab#: A0906066-04D

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst

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Fax: 907-563-6713

Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 8:50:00AM
Collected By: unknown

Client Sample ID: Frank Nickolai
Sampling Location: **Frank Nickolai**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
200.8/200.8 (Aqueous) - Total/TR					*Test was conducted by: Analytica - Thornton*				
Arsenic	0.325	ug/L		0.15	***10***	200.8	6/11/2009	6/15/2009	GY
Manganese	72.3	ug/L	H	0.050	***50***	200.8	6/11/2009	6/11/2009	GY
200.7/200.7 (Aqueous) - Total/TR					*Test was conducted by: Analytica - Thornton*				
Iron	1.40	mg/L	H	0.050	***0.3***	200.7	6/19/2009	7/2/2009	RM

Lab#: A0906066-04E

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
AK101/5030B (Aqueous) - GRO					*Test was conducted by: Analytica - Thornton*				
Gasoline Range Organics	<MRL	ug/L		100		5030B	6/11/2009	6/12/2009	DL
Surrogate Recoveries	**% Rec**	**Limits**							
p-Bromofluorobenzene	**67.1**	(50-150)		1.5		5030B	6/11/2009	6/12/2009	DL

Lab#: A0906066-04F

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
AK102/3510C (Aqueous) - DRO					*Test was conducted by: Analytica - Thornton*				
Diesel Range Organics	<MRL	mg/L		0.11		3510C	6/13/2009	6/17/2009	JK

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Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 8:50:00AM
Collected By: unknown

Client Sample ID: Frank Nickolai
Sampling Location: **Frank Nickolai**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Analysis Method Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
AK102/3510C (Aqueous) - DRO						*Test was conducted by: Analytica - Thornton*			
Surrogate Recoveries	**% Rec**	**Limits**							
o-Terphenyl	**81.2**	(50-120)		0.00070		3510C	6/13/2009	6/17/2009	JK

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Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 9:41:00AM
Collected By: unknown

Client Sample ID: Herman Acovak
Sampling Location: **Herman Acovak**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0906066-05A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9222D/9222D (Aqueous) - FC by Membrane Filter					*Test was conducted by: Analytica - Anchorage*				
Fecal Coliform Bacteria by MF	<MRL	CFU/100mL		1.0		9222D	6/8/2009	6/8/2009	CW

Lab#: A0906066-05B

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9223B-PA (Aqueous) - Coliforms in DW					*Test was conducted by: Analytica - Anchorage*				
E. Coli	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW
Total Coliform	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW

Lab#: A0906066-05C

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	<MRL	mg/L		0.10	*10*		6/10/2009	6/10/2009	JQ

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907-743-9349
Fax: 907-563-6713

Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 9:25:00AM
Collected By: unknown

Client Sample ID: Albert Wallona
Sampling Location: **Albert Wallona**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0906066-06A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9222D/9222D (Aqueous) - FC by Membrane Filter					*Test was conducted by: Analytica - Anchorage*				
Fecal Coliform Bacteria by MF	<MRL	CFU/100mL		1.0		9222D	6/8/2009	6/8/2009	CW

Lab#: A0906066-06B

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9223B-PA (Aqueous) - Coliforms in DW					*Test was conducted by: Analytica - Anchorage*				
E. Coli	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW
Total Coliform	Fail	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW

Lab#: A0906066-06C

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	0.925	mg/L		0.10	***10***		6/10/2009	6/10/2009	JQ

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Fax: 907-563-6713

Report Date: 7/6/2009
Receipt Date: 6/8/2009
Sample Date: 6/7/2009
Sample Time: 9:50:00AM
Collected By: unknown

Client Sample ID: Luki Akelkok
Sampling Location: **Luki Akelkok**
Client Project: Ekwok Residential Wells
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0906066-07A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9222D/9222D (Aqueous) - FC by Membrane Filter					*Test was conducted by: Analytica - Anchorage*				
Fecal Coliform Bacteria by MF	<MRL	CFU/100mL		1.0		9222D	6/8/2009	6/8/2009	CW

Lab#: A0906066-07B

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
9223B-PA (Aqueous) - Coliforms in DW					*Test was conducted by: Analytica - Anchorage*				
E. Coli	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW
Total Coliform	Pass	PASS/FAIL		1.0	*1*		6/8/2009	6/8/2009	CW

Lab#: A0906066-07C

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	<MRL	mg/L		0.10	***10***		6/10/2009	6/10/2009	JQ

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9/18/2009

Bristol Environmental
111 W. 16th Ave Suite 301
Anchorage, AK 99501-5109
Attn: Kyle Petersen

Work Order #: A0909063
Date: 9/18/2009
Work ID: Ekwok Sewer
Date Received: 9/4/2009

Sample Identification

Lab Sample Number	Client Description	Lab Sample Number	Client Description
A0909063-01	EKL-1	A0909063-02	EKL-2
A0909063-03	EKL-3	A0909063-04	EK-1
A0909063-05	EK-2	A0909063-06	EK-3
A0909063-07	EK-4		

Enclosed are the analytical results for the submitted sample(s). Please review the CASE NARRATIVE for a discussion of any data and/or quality control issues. Listings of data qualifiers, analytical codes, key dates, and QC relationships are provided at the end of the report.

Sincerely,

Claire Toon
Project Manager

"The Science of Analysis, The Art of Service"

Case Narrative

Analytica Alaska Inc.

Work Order: A0909063

Samples were prepared and analyzed according to EPA or equivalent methods outlined in the following references:

Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

SAMPLE RECEIPT:
Seven (7) samples were received on 9/4/2009 9:55:00 AM, at Analytica-Anchorage. The samples were received in good condition and in order per chain of custody.

REVIEW FOR COMPLIANCE WITH ANALYTICA QA PLAN
A summary of our review is shown below.

All analytical results contained in this report have been reviewed under Analytica's internal quality assurance and quality control program. Any deviations in quality control parameters for specific analyses are noted in the following text. A complete quality assurance report, including laboratory control, matrix spike, and sample duplicate recoveries is kept on file in our office and is available upon request.

All method specifications were met for the following tests, unless otherwise noted:

Test Method: SM4500-NO3E - Nitrogen (Nitrate), Cadmium Reduction Method - Nitrate+Nitrite pres - Aqueous

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Report Date: 9/18/2009
Receipt Date: 9/4/2009
Sample Date: 9/3/2009
Sample Time: 9:50:00AM
Collected By: KP

Client Sample ID: EKL-1
Sampling Location: **EKL-1**
Client Project: Ekwok Sewer
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0909063-01A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	<MRL	mg/L		2.5	***10***		9/16/2009	9/16/2009	JQ

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Fax: 907-563-6713

Report Date: 9/18/2009
Receipt Date: 9/4/2009
Sample Date: 9/3/2009
Sample Time: 10:06:00AM
Collected By: KP

Client Sample ID: EKL-2
Sampling Location: **EKL-2**
Client Project: Ekwok Sewer
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0909063-02A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	<MRL	mg/L		0.10	*10*		9/16/2009	9/16/2009	JQ

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Report Date: 9/18/2009
Receipt Date: 9/4/2009
Sample Date: 9/3/2009
Sample Time: 9:25:00AM
Collected By: KP

Client Sample ID: EKL-3
Sampling Location: **EKL-3**
Client Project: Ekwok Sewer
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0909063-03A

Analysis Method Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	0.234	mg/L		0.10	*10*		9/16/2009	9/16/2009	JQ

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Report Date: 9/18/2009
Receipt Date: 9/4/2009
Sample Date: 9/3/2009
Sample Time: 10:17:00AM
Collected By: KP

Client Sample ID: EK-1
Sampling Location: **EK-1**
Client Project: Ekwok Sewer
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0909063-04A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	0.710	mg/L		0.10	*10*		9/16/2009	9/16/2009	JQ

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Bristol Environmental
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111 W. 16th Ave Suite 301
Anchorage, AK 99501-5109
907-743-9349
Fax: 907-563-6713

Report Date: 9/18/2009
Receipt Date: 9/4/2009
Sample Date: 9/3/2009
Sample Time: 10:26:00AM
Collected By: KP

Client Sample ID: EK-2
Sampling Location: **EK-2**
Client Project: Ekwok Sewer
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0909063-05A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	<MRL	mg/L		0.10	*10*		9/16/2009	9/16/2009	JQ

SP-Analytica, Inc.-Anchorage
4307 Arctic Blvd.
Anchorage, AK 99503
Phone: 907-258-2155
Fax: 907-258-6634

Bristol Environmental
Attn: Kyle Petersen
111 W. 16th Ave Suite 301
Anchorage, AK 99501-5109
907-743-9349
Fax: 907-563-6713

Report Date: 9/18/2009
Receipt Date: 9/4/2009
Sample Date: 9/3/2009
Sample Time: 10:33:00AM
Collected By: KP

Client Sample ID: EK-3
Sampling Location: **EK-3**
Client Project: Ekwok Sewer
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0909063-06A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	<MRL	mg/L		0.10	*10*		9/16/2009	9/16/2009	JQ

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4307 Arctic Blvd.
Anchorage, AK 99503
Phone: 907-258-2155
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Bristol Environmental
Attn: Kyle Petersen
111 W. 16th Ave Suite 301
Anchorage, AK 99501-5109
907-743-9349
Fax: 907-563-6713

Report Date: 9/18/2009
Receipt Date: 9/4/2009
Sample Date: 9/3/2009
Sample Time: 10:43:00AM
Collected By: KP

Client Sample ID: EK-4
Sampling Location: **EK-4**
Client Project: Ekwok Sewer
Sample Matrix: Aqueous
COC #:
PWS#:
Residual Chlorine:
Comments:

Flag Definitions:
MRL = Method Reporting Limit
MCL = Maximum Contaminant Limit
B = Present also in Method Blank
H = Exceeds Regulatory Limit
M = Matrix Interference
J = Estimated Value
D = Lost to Dilution
** = RL higher than MCL; target not detected
TNC = Too Numerous to Count - result rejected
CF = Confluent Growth - result rejected
TCNG = Turbid Culture No Growth - rejected

Lab#: A0909063-07A

Analysis Method / Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate+Nitrite pres					*Test was conducted by: Analytica - Anchorage*				
Nitrate-Nitrite as Nitrogen	0.155	mg/L		0.10	***10***		9/16/2009	9/16/2009	JQ

APPENDIX D

Percolation Tests

TP-1 PERCOLATION RESULTS

Richard & Lorraine King

SUMMARY TABLE

Test Number	Test Time Start (min.)	Initial Depth (feet)	Test Time Finish (min.)	Final Depth (feet)	Net Drop (feet)	Min/inch
1	0.00	0.5	20.53	0.03	0.47	3.64
2	0.00	0.5	20.00	0.077	0.423	3.94
3	0.00	0.5	20.00	0.114	0.386	4.32
4	0.00	0.5	20.00	0.146	0.354	4.71

FINAL RESULT:

BACKUP DATA

Test 1

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
2.50	0.385	1.81
5.00	0.31	2.78
7.50	0.249	3.42
10.00	0.218	6.72
12.50	0.149	3.02
15.00	0.112	5.63
17.50	0.079	6.31
20.00	0.054	8.33
20.53	0.038	2.78

Test 2

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
2.50	0.402	2.13
5.00	0.34	3.36
7.50	0.286	3.86
10.00	0.241	4.63
12.50	0.222	10.96
15.00	0.142	2.60
17.50	0.092	4.17
20.00	0.077	13.89

Test 3

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
10.00	0.268	3.59
20.00	0.114	5.41

Test 4

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
10.00	0.295	4.07
20.00	0.146	5.59

TP-4 PERCOLATION RESULTS

Peter Walcott

SUMMARY TABLE

Test Number	Test Time Start (min.)	Initial Depth (feet)	Test Time Finish (min.)	Final Depth (feet)	Net Drop (feet)	Min/inch
1	0.00	0.5	2.23	0	0.5	0.37
2	0.00	0.5	2.25	0	0.5	0.38
3	0.00	0.5	2.43	0	0.5	0.41
4	0.00	0.5	2.48	0	0.5	0.41
5	0.00	0.5	2.67	0	0.5	0.45
6	0.00	0.5	2.50	0	0.5	0.42

FINAL RESULT:

BACKUP DATA

Test 1

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
2.23	0	0.37

Test 2

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
2.25	0	0.38

Test 3

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
2.43	0	0.41

Test 4

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
2.48	0	0.41

Test 5

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
2.67	0	0.44

Test 6

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
2.50	0	0.42

TP-5 PERCOLATION RESULTS

Julia & Billy Brandon

SUMMARY TABLE

Test Number	Test Time Start (min.)	Initial Depth (feet)	Test Time Finish (min.)	Final Depth (feet)	Net Drop (feet)	Min/inch
1	0.00	0.5	27.33	0	0.5	4.56
2	0.00	0.5	20.00	0.152	0.348	4.79
3	0.00	0.5	20.00	0.135	0.365	4.57
4	0.00	0.5	20.00	0.127	0.373	4.47

FINAL RESULT:

BACKUP DATA

Test 1

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
5.00	0.35	2.78
10.00	0.247	4.05
15.00	0.158	4.68
20.00	0.084	5.63
25.00	0.052	13.02
27.33	0	3.73

Test 2

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
10.00	0.27	3.62
20.00	0.152	7.06

Test 3

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
10.00	0.296	4.08
20.00	0.135	5.18

Test 4

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
10.00	0.3	4.17
20.00	0.127	4.82

TP-6 PERCOLATION RESULTS

Sandra Stermer

SUMMARY TABLE

Test Number	Test Time Start (min.)	Initial Depth (feet)	Test Time Finish (min.)	Final Depth (feet)	Net Drop (feet)	Min/inch
1	0.00	0.5	13.50	0	0.5	2.25
2	0.00	0.5	10.00	0.151	0.349	2.39
3	0.00	0.5	10.00	0.15	0.35	2.38
4	0.00	0.5	10.00	0.17	0.33	2.53
5	0.00	0.5	10.00	0.17	0.33	2.53
6	0.00	0.5	10.00	0.18	0.32	2.60

FINAL RESULT:

BACKUP DATA

Test 1

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
5.00	0.245	1.63
10.00	0.08	2.53
13.50	0	3.65

Test 2

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
5.00	0.279	1.89
10.00	0.151	3.26

Test 3

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
5.00	0.29	1.98
10.00	0.15	2.98

Test 4

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
5.00	0.29	1.98
10.00	0.17	3.47

Test 5

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
5.00	0.3	2.08
10.00	0.17	3.21

Test 6

Time Minute	WL (ft)	minutes/inch
0.00	0.5	
5.00	0.31	2.19
10.00	0.18	3.21

APPENDIX E

Photo Log

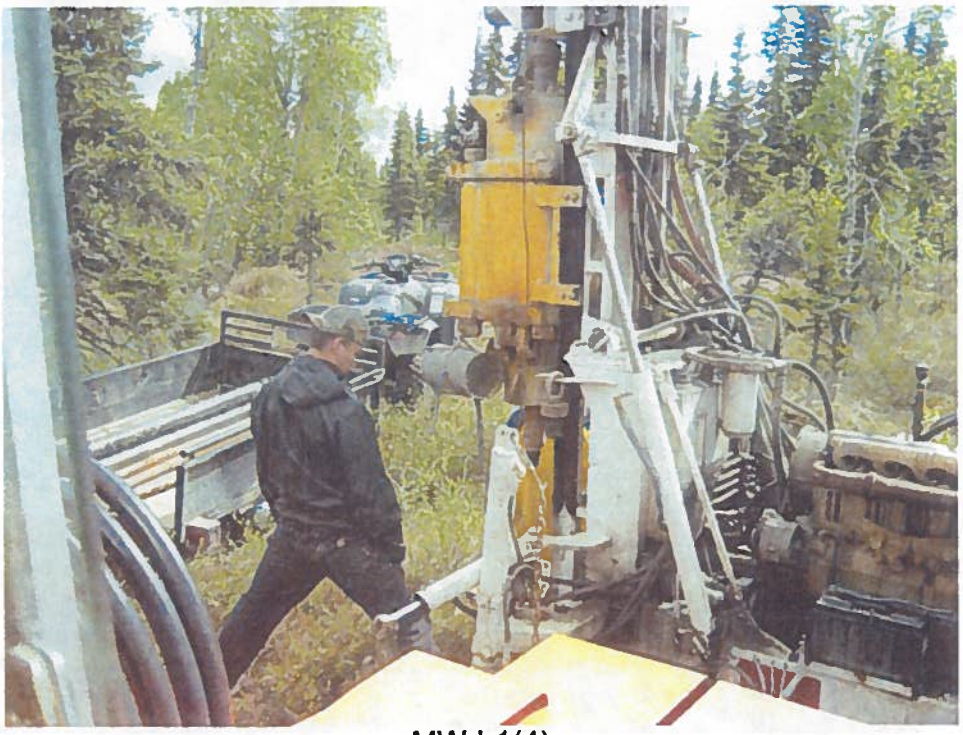
Ekwok Sewer System
Photo Log 6-29-09

MW-L1

MW-L1(2)

Ekwok Sewer System
Photo Log 6-29-09

MW-L1(3)



MW-L1(4)

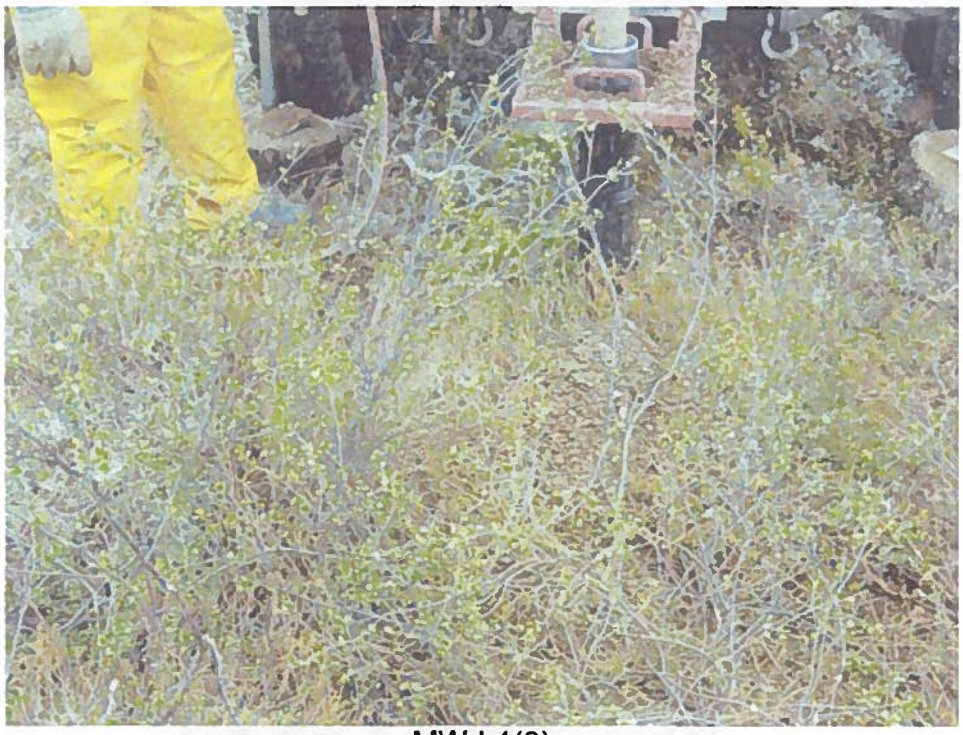
Ekwok Sewer System
Photo Log 6-29-09

MW-L1(5)

MW-L1(6)

Ekwok Sewer System
Photo Log 6-29-09

MW-L1(7)



MW-L1(8)

Ekwok Sewer System
Photo Log 6-29-09

MW-L1(9)

MW-L1(10)

Ekwok Sewer System
Photo Log 6-29-09

MW-L1(11)

MW-L1(12)

Ekwok Sewer System
Photo Log 6-29-09

MW-L2

MW-L2(2)

Ekwok Sewer System
Photo Log 6-29-09

MW-L2(3)

MW-L3

Ekwok Sewer System
Photo Log 6-29-09

MW-L3(2)

MW-L3(3)

Ekwok Sewer System
Photo Log 6-29-09

MW-L3(4)

Frank Nicholai

Ekwok Sewer System
Photo Log 6-29-09

Location at MH-1

Looking into MH-1

Ekwok Sewer System
Photo Log 6-29-09

Location at MH-1(2)

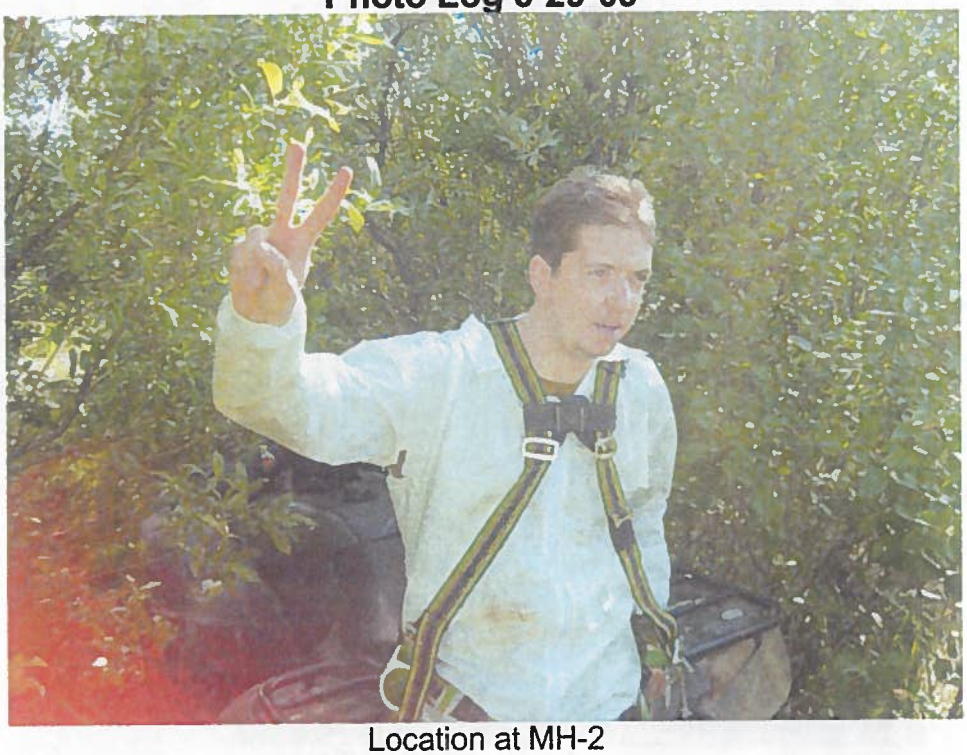
Closer view of MH-1

Ekwok Sewer System
Photo Log 6-29-09

Interior of MH-1(2)

Interior of MH-1

Ekwok Sewer System
Photo Log 6-29-09



Location at MH-2

Side view of MH-2

Ekwok Sewer System
Photo Log 6-29-09

Looking into MH-2

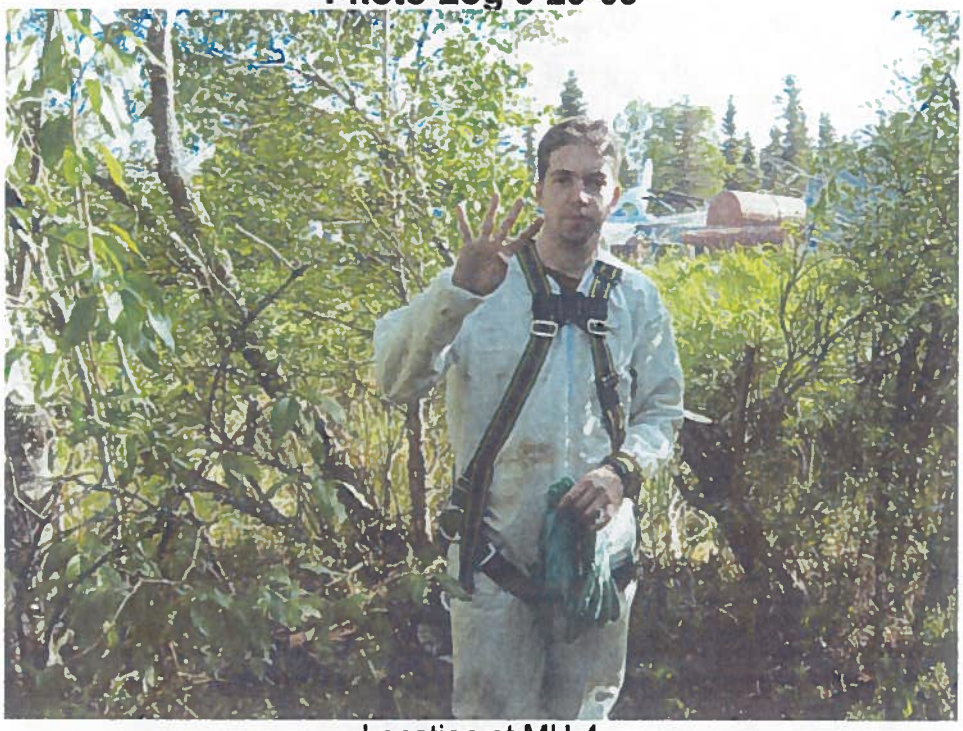
Closer view inside MH-2

Ekwok Sewer System
Photo Log 6-29-09

Pre-entry set-up at MH-12

Pre-entry set-up at MH-12(2)

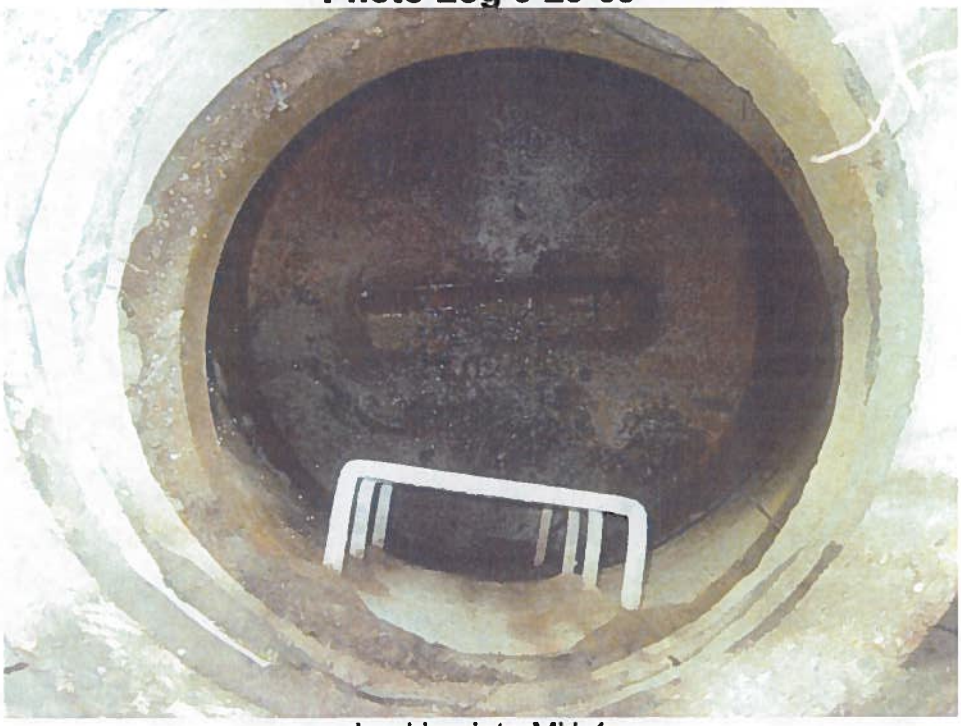
Ekwok Sewer System
Photo Log 6-29-09



Location at MH-4

Side view of MH-4

Ekwok Sewer System
Photo Log 6-29-09



Looking into MH-4

Close view into MH-4

Ekwok Sewer System
Photo Log 6-29-09

Location at MH-5

Looking into MH-5

Ekwok Sewer System
Photo Log 6-29-09

Looking down MH-5

Looking down stair treads in MH-5

Ekwok Sewer System
Photo Log 6-29-09

Stair treads in MH-5

Close view in MH-5

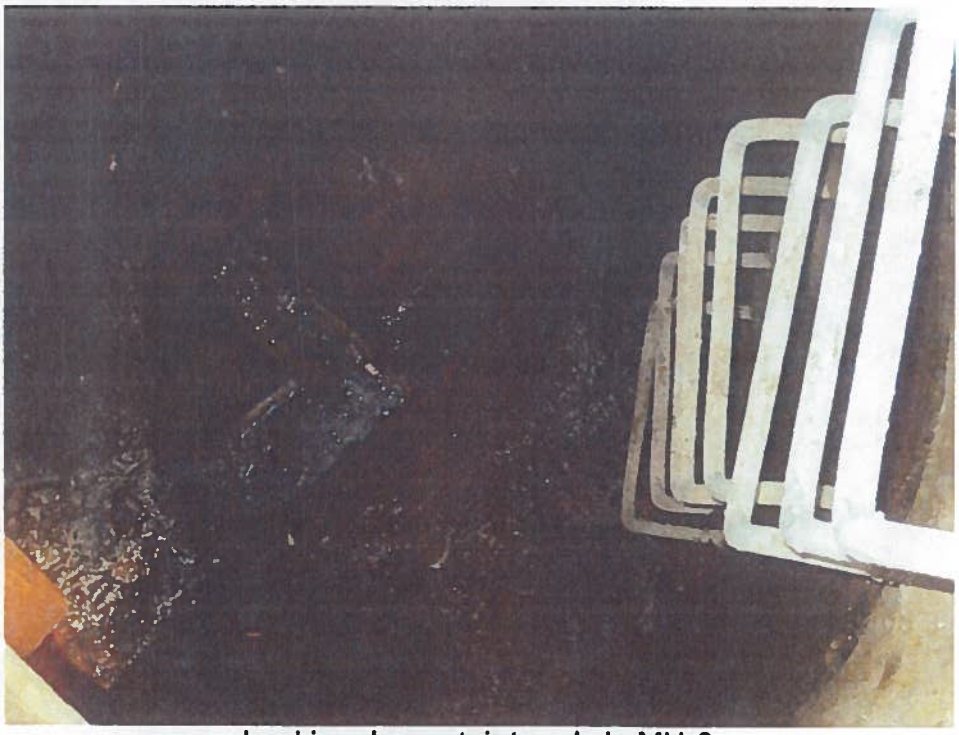
Ekwok Sewer System
Photo Log 6-29-09

Location at MH-6

Looking into MH-6

Ekwok Sewer System
Photo Log 6-29-09

Looking into MH-6(2)



Looking down stair treads in MH-6

Ekwok Sewer System
Photo Log 6-29-09

Close view of MH-6

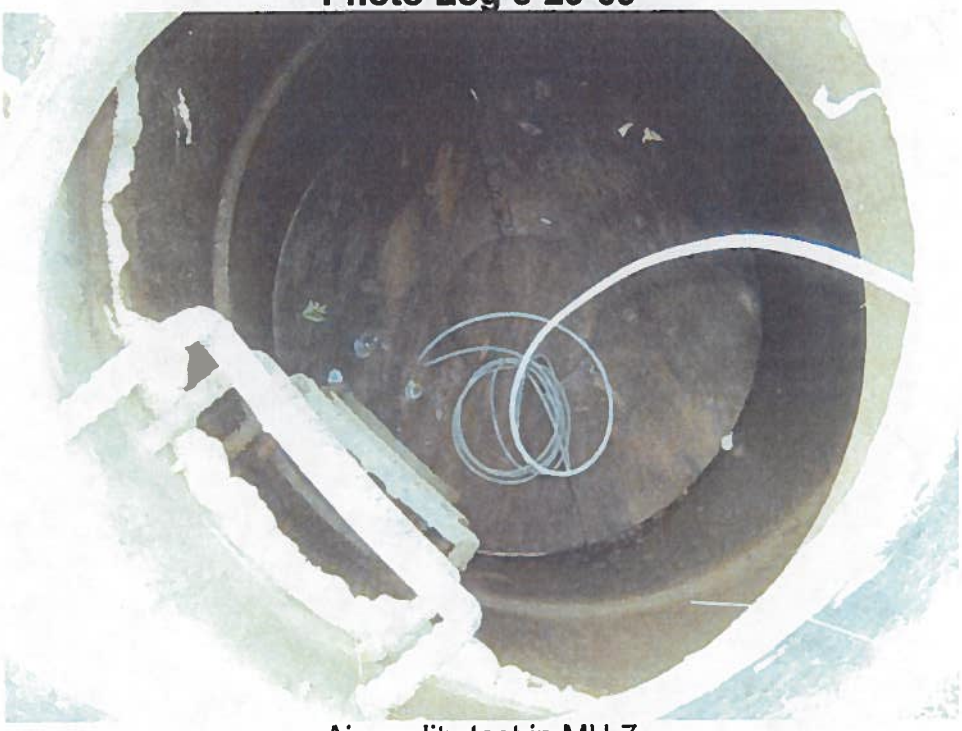
Location at MH-7

Ekwok Sewer System
Photo Log 6-29-09

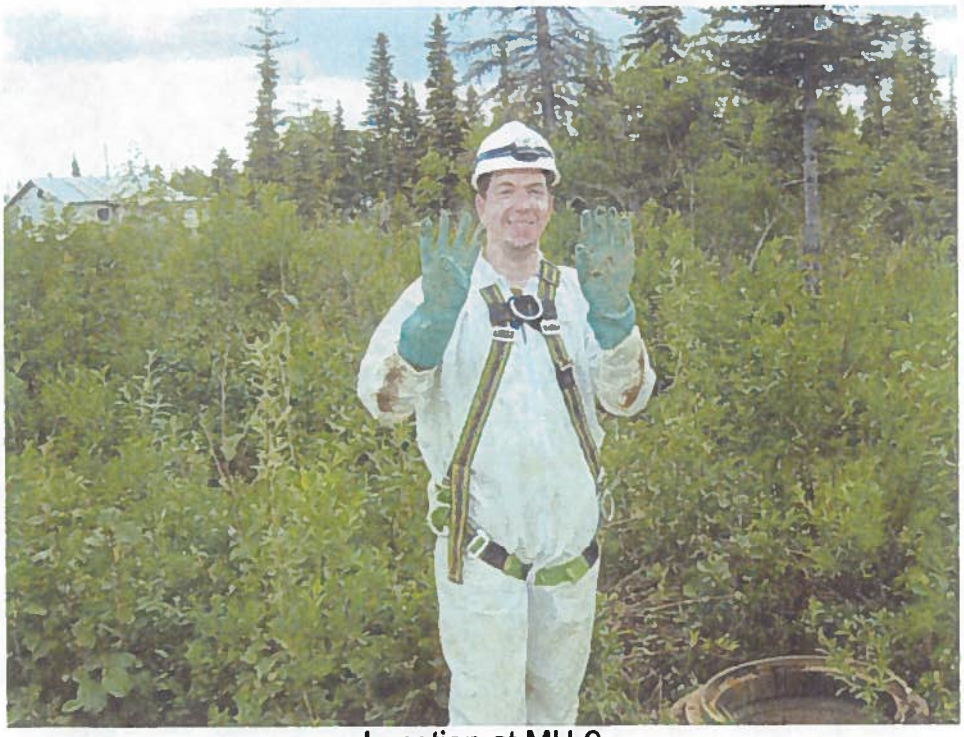
Looking into MH-7

Looking into MH-7(2)

Ekwok Sewer System
Photo Log 6-29-09



Air quality test in MH-7



Location at MH-9

Ekwok Sewer System
Photo Log 6-29-09

From stair treads of MH-9

Interior of MH-9(2)

Ekwok Sewer System
Photo Log 6-29-09

Interior of MH-9(3)

Interior of MH-9(4)

Ekwok Sewer System
Photo Log 6-29-09

Interior of MH-9

Pre-entry set-up at MH-10

Ekwok Sewer System
Photo Log 6-29-09

Interior of MH-10

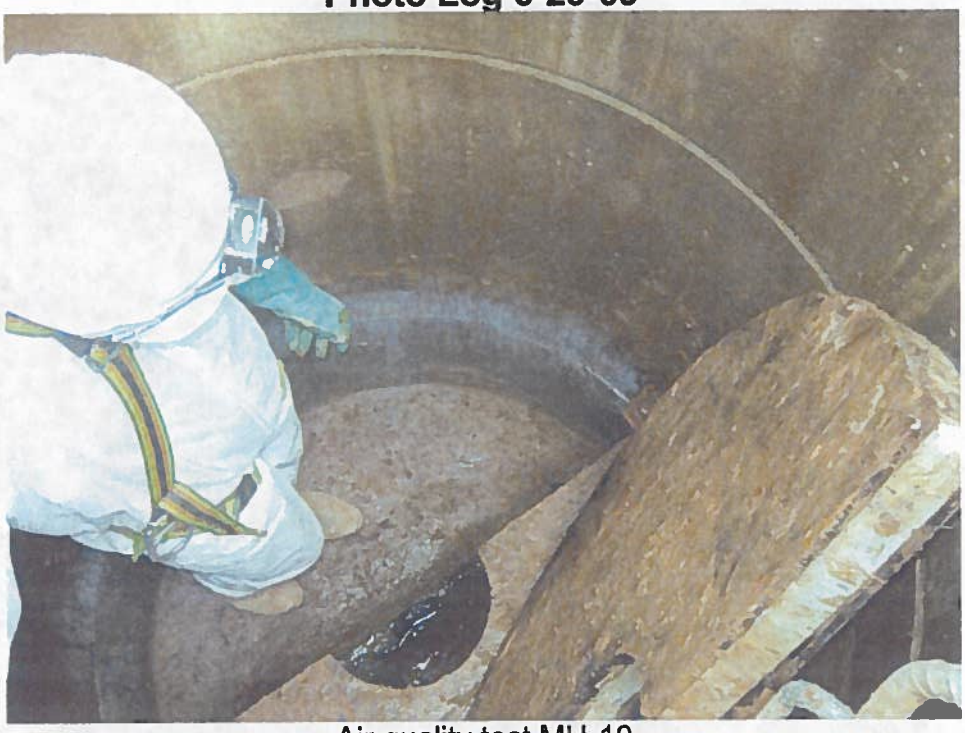
Air quality test looking into MH-10

Ekwok Sewer System
Photo Log 6-29-09

Air quality test MH-10(2)

Top view of air quality test in MH-10

Ekwok Sewer System
Photo Log 6-29-09

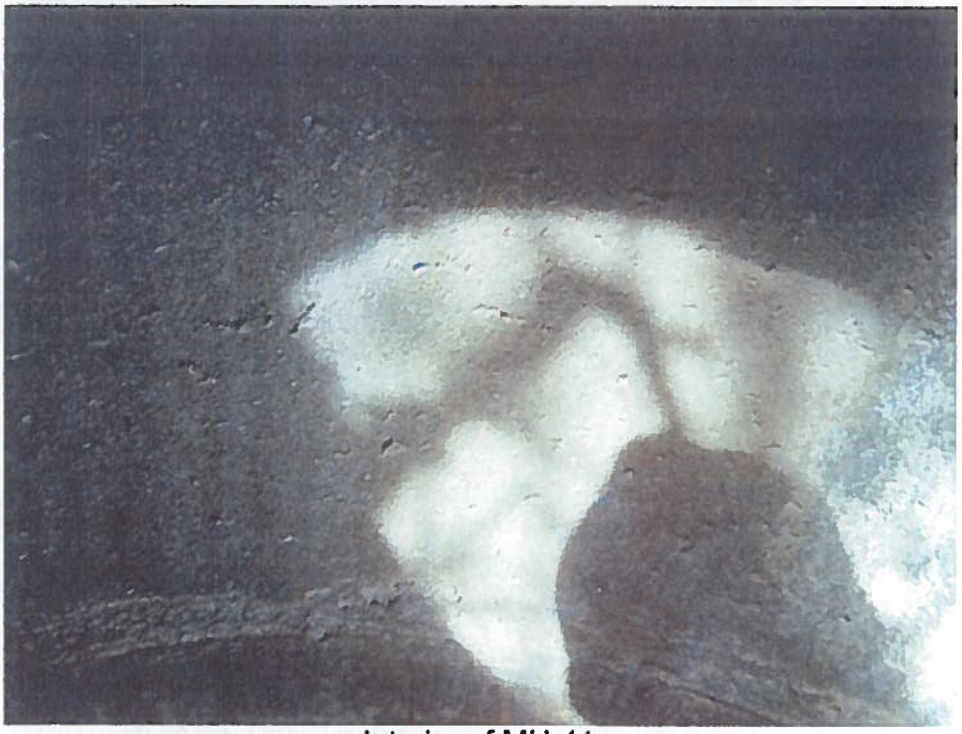


Air quality test MH-10

Pre-entry set-up at MH-11

Ekwok Sewer System
Photo Log 6-29-09

Pre-entry set-up at MH-11(2)



Interior of MH-11

Ekwok Sewer System
Photo Log 6-29-09

Close view of air quality test in MH-11

Close view of air quality test in MH-11(2)

Ekwok Sewer System
Photo Log 6-29-09

Air quality test in MH-11

Pre-entry set-up at MH-11A

Ekwok Sewer System
Photo Log 6-29-09

Looking into MH-11A

Pre-entry set-up of MH-13A

Ekwok Sewer System
Photo Log 6-29-09

Pre-entry set-up of MH-13A(2)

Excavating to location MH-13

Ekwok Sewer System
Photo Log 6-29-09

Excavating to location MH-13 (2)

Pre-entry air quality inspection MH-13

Ekwok Sewer System
Photo Log 6-29-09

Pre-entry air quality inspection at MH-13(2)

Interior condition of MH-13

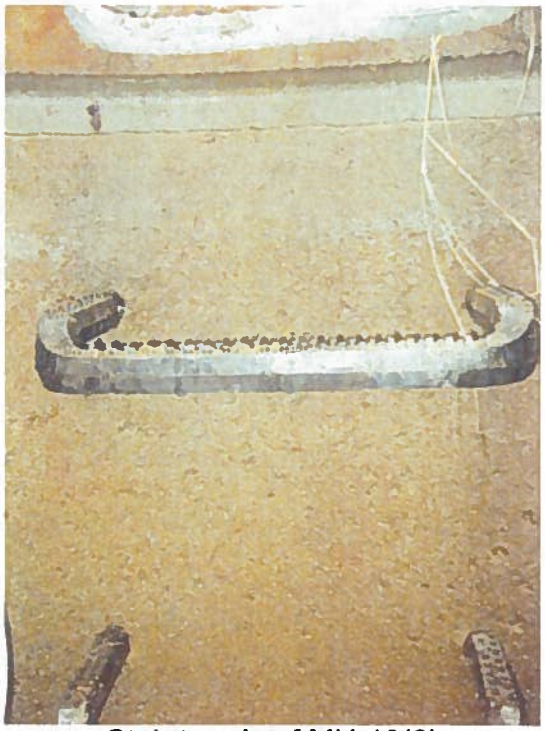
Ekwok Sewer System
Photo Log 6-29-09

Interior condition of MH-13(2)

Interior condition of MH-13(3)

Ekwok Sewer System
Photo Log 6-29-09

Stair treads of MH-13



Stair treads of MH-13(2)

Ekwok Sewer System
Photo Log 6-29-09

Hole from stair treads in MH-13

Site location in MH-3 buried in the 4th street(2)

Ekwok Sewer System
Photo Log 6-29-09

Site location of MH-3 buried in 4th street

Richard and Lorraine King, TP-1

Ekwok Sewer System
Photo Log 6-29-09

Richard and Lorraine King, TP-1(2)

Peter Walcott, TP-1 with frost 2 feet below surface

Ekwok Sewer System
Photo Log 6-29-09

TP-1 soil matrix

TP-1 soil matrix(2)

Ekwok Sewer System
Photo Log 6-29-09

TP-1 soil matrix(3)

Soil from TP-1

Ekwok Sewer System
Photo Log 6-29-09

Richard and Lorraine King, perc. test TP-1

Richard and Lorraine, perc. test TP-1(2)

Ekwok Sewer System
Photo Log 6-29-09

Peter Walcott TP-3

Peter Walcott, TP-3

Ekwok Sewer System
Photo Log 6-29-09

Peter Walcott, TP-4

Peter Walcott, excavation for TP-4

Ekwok Sewer System
Photo Log 6-29-09

Julia and Billy Branden, excavation for TP-5

Soil matrix for TP-5

Ekwok Sewer System
Photo Log 6-29-09

Soil matrix for TP-5(2)

Soil matrix for TP-6

Ekwok Sewer System
Photo Log 6-29-09

Soil matrix for TP-6(2)

Sandra Stermer, TP-6

Ekwok Sewer System
Photo Log 6-29-09

Sandra Stermer, excavation for TP-6

Julia and Billy Brandon, monitoring well

Ekwok Sewer System
Photo Log 6-29-09

Peter Walcott, monitoring well

Richard and Lorraine King, monitoring well

Ekwok Sewer System
Photo Log 6-29-09

Richard and Lorraine, monitoring well

Sandra Stermer, monitoring well

Ekwok Sewer System
Photo Log 6-29-09

Peter Walcott existing leach field

Peter Walcott existing leach field(2)

Ekwok Sewer System
Photo Log 6-29-09

Peter Walcott leach field with surface sewage present

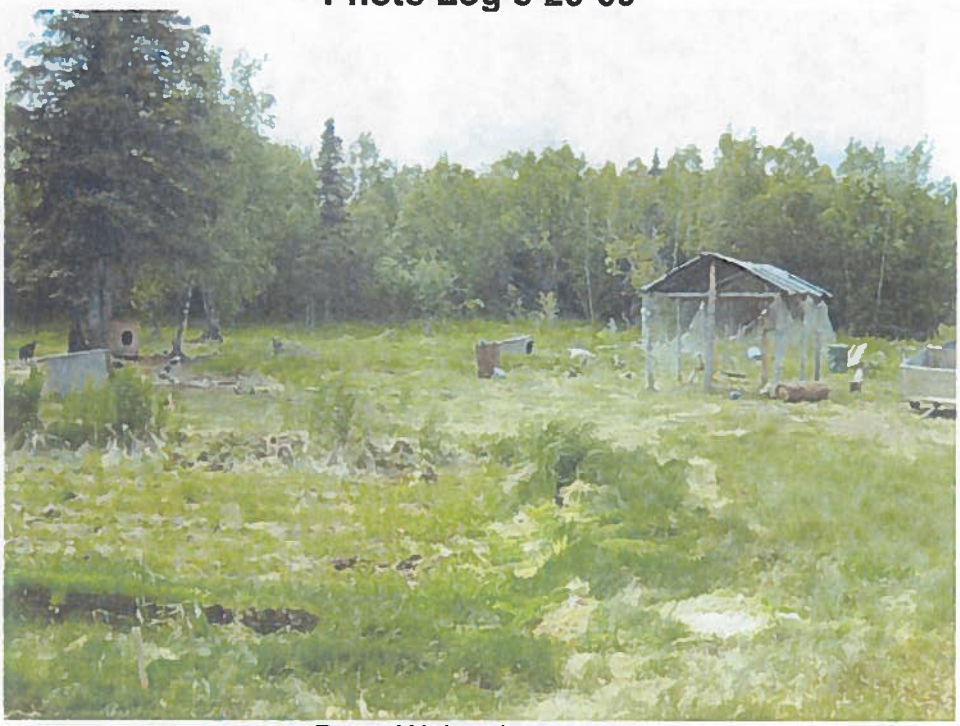
Peter Walcott leach field with surface sewage present(2)

Ekwok Sewer System
Photo Log 6-29-09

Richard and Lorraine King's existing leach field

Sandra Stermer, septic tank and leach field

Ekwok Sewer System
Photo Log 6-29-09



Peter Walcott's property

Peter Walcott's property(2)

Ekwok Sewer System
Photo Log 6-29-09

Peter Walcott's property(3)