

PLANNING DEPARTMENT STAFF ANALYSIS REZONING

DATE: June 12, 2017

CASE NO.: 2017-0072

APPLICANT: Todd Brownson, Big Country Enterprises, LLC

REQUEST: A request to rezone from R-8 to R-6 SL

LOCATION: N ½ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska excepting the NW ¼ of the NW ¼ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska, and Lots 1 and 2 of Vergason-Jones Subdivision per Plat 98-178

COMMUNITY COUNCIL: Hillside

ATTACHMENTS:

1. Departmental and Public Comments
2. Affidavit of Posting and Historical Information
3. Application

RECOMMENDATION SUMMARY: Approval

SITE

Acres: ±77 acres

Vegetation: Birch, spruce, and undergrowth

Current Zoning: R-8, low-density residential (4 acres) district

Topography: Approximate average slope of 12% from NE to SW

Utilities: Private well and on-site septic system

COMPREHENSIVE PLAN

Classification:

- “Limited Intensity, 0 – 1 dua” per the 2010 *Hillside District Plan* Land Use Plan Map
- Not identified in the 2001 *Anchorage 2020* Land Use Policy Map
- “Large Lot Residential” in the public hearing draft of the *Anchorage 2040 Land Use Plan*

SURROUNDING AREA

	NORTH	EAST	SOUTH	WEST
Zoning:	R-6, R-8, R-9	R-8	R-8	R-6, R-9
Land Use:	Single-family residential	Single-family residential	Undeveloped	Single-family residential

PROPOSAL

Big Country Enterprises, LLC is requesting to rezone three parcels of land totaling 77 acres from R-8 (low-density residential, 4 acre district) to R-6 SL (low-density, 1 acre district). The petitioner offers two special limitations that limit the district to 30 residential lots and require the use of advanced on-site septic systems. If the rezone is approved by the Assembly, then a public hearing Platting Board review of a subdivision would still be required.

PROPERTY HISTORY

On July 6, 2014, the Planning and Zoning Commission recommended denial of a similar rezone to R-6 for 72.66 acres reviewed under the “Old Code.” That case did not include Lot 1, Vergason-Jones Subdivision, nor did the original application include any proposed special limitations. Subsequent to the Commission’s recommendation of denial, the Assembly postponed indefinitely the case on April 26, 2016. The Commission’s findings stated that:

- 1) Although Anchorage needs more housing, there was an oversupply of large lot zoned land for single-family residential development;
- 2) The On-Site Water and Wastewater Services Division commented that some soils will not be able to support on-site septic systems;
- 3) Further research was needed on the dry drainage to determine if there is surface water, as septic tanks and drain fields are required to be at least 100 feet from surface water;
- 4) The rezone was inconsistent with Policy 1-C of the 2010 *Hillside District Plan*;
- 5) It is not necessarily good to expand low-density sprawl on the Hillside, when more compact development concentrated near employment centers is needed;
- 6) Adding more housing and street paving on the Hillside is a risk to groundwater and the flow into Rabbit Creek;
- 7) Other property in the area has similar lot size to the R-6 district, but those are nonconforming lots which were subdivided prior to current zoning; and
- 8) The R-8 district is less likely to create problems in a fragile environment and is the most appropriate district for this property.

The documents relating to Case 2014-0219 are attached, including the Assembly documents, the Planning and Zoning Commission resolution, minutes, and the Planning Department staff analysis.

DEPARTMENTAL COMMENTS

The comments from State and Municipal reviewing agencies are attached. None of the reviewing agencies object to the rezone. The On-Site Water and Wastewater Services Division recommends a minor rewording of the special limitation governing advanced on-site septic systems to allow for future regulation changes and technological advances.

COMMUNITY COMMENTS

One-hundred and forty-four nine public hearing notices were mailed on May 12, 2017. As of this writing, 22 public comments were received, of which 11 opposed the rezone and 11 supported the rezone. All of the comments are attached.

The site is located within the Hillside Community Council. The president of the community council provided a comment opposing the rezone, which is attached. The Rabbit Creek and the Huffman/O'Malley Community Councils also commented.

FINDINGS

21.03.160 Rezoning (Zoning Map Amendments)

Pre-Application Conference

A pre-application conference was held on September 21, 2016, in accordance with 21.03.020B.

Community Meeting

A community meeting was held with the Hillside East Community Council on October 25, 2016, in accordance with 21.03.020C. A summary of the meeting is included.

21.03.160E. Approval Criteria

The planning and zoning commission may recommend approval, and the assembly may approve a rezoning, if the rezoning meets all of the following criteria:

- 1. The rezoning shall be in the best interest of the citizens of Anchorage and shall promote the public health, safety, and general welfare.**

The standard is met.

This rezone with special limitations restricting the number of residential lots to 30 and requiring advanced septic systems appears to be in the best interest of the citizens of Anchorage. The R-8 district requires four-acre lots with widths of 300 feet. This is a residential density of 0.25 dwelling units per acre. The R-6 district requires one-acre lots with widths of 150 feet. The special limitation restricting the property to 30 residential lots would restrict the site to 0.39 dwelling units per acre, which is only a slight increase in density (0.25 dua to 0.39 dua). Whether developed under the R-8 district or the R-6 SL district, the gross residential density will be less than one house for two acres of land.

A subdivision review by the Platting Board will determine whether the property may be subdivided. This rezone application provides strong evidence that the environmental concerns described in the previous case (Case 2014-0219) do not preclude the development 30 residential lots on this 77-acre site.

This rezone is in the best interest of the community as a whole because of the housing shortage faced by the city. It will allow a slight increase in residential density from approximately 0.25 dua to 0.39 dua. While this is a very small increase in the number of housing units, the 2014 *Housing Market Analysis (HMA)* found that the city faces a critical shortage of housing in every category, except large lot single family. (The latest data projects a surplus of 836 units in the large lot single-family category.) Overall, there is still a shortage of 3,581 single-family homes. Solving the housing shortage cannot be placed on this property, but every upzoning and new dwelling unit helps with the housing deficit. The *HMA* states: "Without increasing the current level of housing density and increasing the rate of redevelopment, the Anchorage Bowl will lack

land for 8,900 of the projected new housing units, or about half of the expected demand.” The *HMA* concludes: “Demand for approximately 18,200 new dwellings in the Anchorage Bowl and 3,300 new dwellings in Chugiak – Eagle River over the next 20 years is expected.” As home-buyers move up the ladder it will relieve pressure on higher density housing.

2. The rezoning complies with and conforms to the comprehensive plan, including the comprehensive plan map(s).

The standard is met.

The 2010 *Hillside District Plan* Land Use Plan Map identifies the site as “limited density, 0 – 1 dwelling unit per acre.” The public hearing draft of the *Anchorage 2040 Land Use Plan* shows the site as “Large Lot Residential.”

There are several policies in *Anchorage 2020* that are relevant to this rezoning:

- *General Land Use Policy 5: Rezones and variances shall be compatible in scale with adjacent uses and consistent with the goals and policies of Anchorage 2020.*

The R-6 zone is compatible with the adjoining lots on all sides. The subdivisions to the north and east of this site are developed at roughly the R-6 density. While an acre is 43,560 SF, the lots to the north and east have approximately 49,000 SF and 47,000 respectively. The subdivision to the west has lots with approximately 16,000 SF.

- *General Land Use Policy 7: Avoid incompatible uses adjoining one another.*

The R-6 district is similar to the R-8 district, except that the R-8 district requires larger and wider lots. Both districts are suburban large lot zoning districts. This rezone would allow 30 lots on 77 acres which is an increase in residential density from the R-8 district, but it is still far below one dwelling unit per acre. The property is bounded by streets on three sides. The site has direct access to Upper DeArmoun Road, which is a paved neighborhood collector.

The following is a list of applicable policies in the *Hillside District Plan*:

- *Hillside as a Whole Policy 1-A: Encourage a greater proportion of future Hillside growth to occur in the lower Hillside, in areas located closer to existing services and infrastructure; to a limited degree reduce the amount of future development in the southeast Hillside.*

Both the R-6 and R-8 districts are low-density large lot zoning districts. The R-6 district requires a minimum of one-acre lots and the R-8 district requires four-acre lots. The suburban and rural character of the Hillside is maintained with both of these zoning districts. One of the special limitation offered by the petitioner limits density to 0.39 dwelling units per acre, which

is within the range allowed by the Land Use Plan Map (“Limited Density Residential, 0 – 1 dwelling units per acre.” This rezone to R-6 SL does not substantially increase residential density in the Southeast Hillside.

- *Southeast Hillside Residential Policy 1-B: Maintain policies for the amount of development as adopted under current land use designations. Shift the current boundary of the Maximum Perimeter of Public Sewerage in the Upper Potter Valley area west of Greece Drive, south of England Avenue.*

The land use designation for this site is “Limited Intensity Residential, 0 – 1 dwelling unit per acre.” The Plan identifies the R-6, R-8, R-9, and R-10 to implement this land use designation on page 2-17. The rezone application complies with the current land use designation.

When the property is subdivided, portions of the petition site will become open space tracts where no development is permitted. This does not suggest that the residential density is higher than 0.39 dwelling units per acre. The Plan states:

“The residential density ranges are generalized descriptions of the type of development considered appropriate for a broadly defined area. The measure of housing units per gross acre is based on area-wide densities rather than specific densities for individual parcels. This allows the Land Use Plan Map to indicate the intended overall distribution of population and housing units for entire contiguous geographic areas of the Hillside community. The measure of housing units per gross acre includes streets, open spaces, leftover or unusable lands and small nonresidential uses within a residentially designated area on the Land Use Plan Map. It is not intended to be applied directly as the measure of how many housing units may be allowed on each lot or development site. The Title 21 Land Use Regulations and Official Zoning Map will determine how many housing units may be allowed on each lot or development site.”

3. The rezoning is generally consistent with the zoning district purpose in the requested zone, and the purpose of this title.

The standard is met.

This rezone is consistent with the purpose of the R-6 zoning district. The petitioner is seeking to subdivide 77 acres into 30 single-family lots with additional wetlands tracts, which is a residential density of 0.39 dwelling units per acre. That can only occur under the R-6 zoning. The natural features of the property do not preclude R-6 zoning. The application proves with scientific evidence that the land can sustain 30 residential lots. The R-6 district is intended:

“... primarily for single- and two-family large-lot residential areas, with gross densities of up to one dwelling unit per acre. The R-6 is designed to encourage low-density residential development.

This district is intended to protect and enhance those physical and environmental features that add to the desirability of large-lot residential living. The availability of infrastructure and municipal services is varied.”

The R-8 district is intended:

“... primarily for single- and two-family large-lot residential areas with gross densities less than one dwelling unit per four acres, where topographic or other natural conditions are such that higher-density development would be unfeasible. In addition to topography, some of the natural conditions which could exist to render land desirable for the densities proposed in this zone are wind hazards, marginal soils, landslide susceptibility, potential for groundwater pollution, and groundwater availability.”

4. **The rezoning is compatible with surrounding zoning and development, and protects areas designated for specific uses on the zoning map from incompatible land uses or development intensities.**

The standard is met.

The R-6 SL district with a special limitation to not exceed 30 residential lots on 77 acres is compatible with surrounding zoning and development. There is a mix of large lot zoning districts around the property with the largest lot zoning uphill from the petition site and downhill in the Rabbit Creek valley. North of the petition site is zoned R-6, R-8, and R-9. East and south of the petition site is zoned R-8. West of the petition site is zoned R-6 and R-9. A future subdivision of the site will require a public hearing and approval by the Platting Board. This is where actual lot sizes will be determined.

5. **Facilities and services (including roads and transportation, water, gas, electricity, police and fire protection, and sewage and waste disposal, as applicable) are capable of supporting the uses allowed by the zone or will be capable by the time development is complete, while maintaining adequate levels of service to existing development.**

The standard is met.

The petition site is located within the Glenn Alps Rural Road Service Area. The property adjoins Upper DeArmoun Road, Canyon Road, and Messina Street. Upper DeArmoun Road and Canyon Road are “Neighborhood Collectors.” Upper DeArmoun Road is a paved street. The Canyon Road Improvement Project will pave Canyon Road this summer. Messina Street is an unpaved “Local Road.”

Kinney Engineering LLC found that the rezone would increase expected traffic generation from 190 trips per day to 286 trips per day, which results in an average annual daily traffic (AADT) of 1,075 on Upper DeArmoun Road. This is less than the range of a neighborhood collector, which is 2,000 to 10,000

AADT. The Traffic Department concurs with these findings. This rezone will have an insignificant increase in traffic generation. Furthermore, Triad Engineering found that the addition of 286 trips per day would not significantly impact the current road condition on Upper Huffman Road.

Natural gas and electricity are available to this property. Properties in this area use on-site septic systems and private wells.

The site is located within the Building Safety, Police, and Parks and Recreation Service Areas. The property is within the Fire and EMS Service Areas and is served by Fire Stations 8 and 10.

Private Development has no objection to the rezone. The petitioner provided a drainage analysis and calculations showing that this rezone creates minimal change in peak runoff which can be managed by sizing drainage ways and culverts accordingly.

6. The rezoning is not likely to result in significant adverse impacts upon the natural environment, including air, water, noise, storm water management, wildlife, and vegetation, or such impacts shall be substantially mitigated.

The standard is met.

The proposed rezone with special limitations will have no discernible impact to the natural environment greater than surrounding residential developments, as evidenced by the following scientific reports:

- Geotechnical Soils Report for Lewis and Clark Subdivision for S4 Group by Northrim Engineering
- Groundwater Resources Evaluation of the Proposed Lewis and Clark Subdivision by Terrasat, Inc.
- Evaluation of the Distribution of Nitrates in Local Water Wells Surrounding Lewis and Clark Subdivision by Terrasat, Inc.
- Preliminary Drainage Impact Analysis by Triad Engineering
- Preliminary Determination of Wetlands and Waters by Hemlock Scientific, LLC

7. The proposed rezoning is not likely to result in significant adverse impacts upon adjacent land uses, or such impacts shall be mitigated through stipulations.

The standard is met.

Rezoning to R-6 with a limit of 30 residential lots is not likely to result in adverse impacts adjacent land uses. The residential density of this zoning is

comparable to or less than surrounding subdivisions. This is a large tract of land that is currently undeveloped. Thirty residential lots with a required minimum lot area of one acre and a minimum width of 150 feet is not out of character with this subarea of the Hillside.

8. The rezone does not extend or exacerbate a land use pattern that is inconsistent with the comprehensive plan.

The standard is met.

The Hillside District Plan *Land Use Plan Map* identifies this site as "Limited intensity, 0 – 1 dua." Thirty residential lots on 77 acres has a residential density of 0.39 dwelling units per acre, which is in the range called for in the Plan.

9. The rezoning shall not result in a split-zoned lot.

The standard is met.


The rezoning will not create a split-zoned lot.

DEPARTMENT RECOMMENDATION

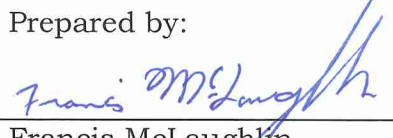
The Department finds that all nine approval criteria for a rezone are met. The Department recommends APPROVAL of the rezoning from R-8 to R-6 SL with special limitations stating:

- 1) The maximum number of developable lots for housing shall be 30, excluding wetlands, open space, and greenbelt tracts.
- 2) On-site septic systems shall meet or exceed category III nitrate reducing standards.

Reviewed by:


Hal H. Hart, AICP
Director

Prepared by:


Francis McLaughlin
Senior Planner

Submitted by: Chair Traini at the Request
of the Mayor
Prepared by: Planning Department
For Reading:

ANCHORAGE, ALASKA

AO No. 2017-__

1 **AN ORDINANCE AMENDING THE ZONING MAP AND APPROVING THE**
2 **REZONING OF APPROXIMATELY 77 ACRES FROM R-8 (LOW DENSITY**
3 **RESIDENTIAL 4 ACRE DISTRICT) TO R-6 SL (LOW DENSITY RESIDENTIAL 1**
4 **ACRE DISTRICT) WITH SPECIAL LIMITATIONS FOR N ½ OF THE SE ¼ OF**
5 **SECTION 25, T12N, R3W, S.M., ALASKA EXCEPTING THE NW ¼ OF THE NW ¼**
6 **OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA, AND LOTS 1 AND 2**
7 **OF VERGASON-JONES SUBDIVISION PER PLAT 98-178; GENERALLY**
8 **LOCATED SOUTH OF UPPER DEARMOUN ROAD, WEST OF CANYON ROAD,**
9 **AND WEST OF MESSINIA STREET, IN ANCHORAGE.**

10
11 (Hillside Community Council) (Planning and Zoning Commission Case 2017-0072)
12

13 **THE ANCHORAGE ASSEMBLY ORDAINS:**
14

15 **Section 1.** The zoning map shall be amended by designating the N ½ of the SE ¼
16 of Section 25, T12N, R3W, S.M., Alaska excepting the NW ¼ of the NW ¼ of the SE
17 ¼ of Section 25, T12N, R3W, S.M., Alaska, and Lots 1 and 2 of Vergason-Jones
18 Subdivision per Plat 98-178, as R-6 SL, low density residential 1 acre district with
19 special limitations.
20

21 The property described above is shown on Exhibit "A," attached.
22

23 **Section 2.** This zoning map amendment is subject to the following special
24 limitations:
25

26 A) The maximum number of developable lots for housing shall be 30, excluding
27 wetlands, open space, and greenbelt tracts.
28

29 B) On-site septic systems shall meet or exceed category III nitrate reducing
30 standards.
31

32 **Section 3.** This ordinance shall become effective 10 days after the Director of the
33 Planning Department has received the written consent of at least 51 percent of the
34 owners of the property within the area described in Section 1 above to any special
35 limitations contained herein. The rezone approval contained herein shall
36 automatically expire, and be null and void, if the written consent is not received
37 within 120 days after the date on which this ordinance is passed and approved. In

1 the event no special limitations are contained herein, this ordinance is effective
2 immediately upon passage and approval. The Director of the Planning Department
3 shall change the zoning map accordingly.

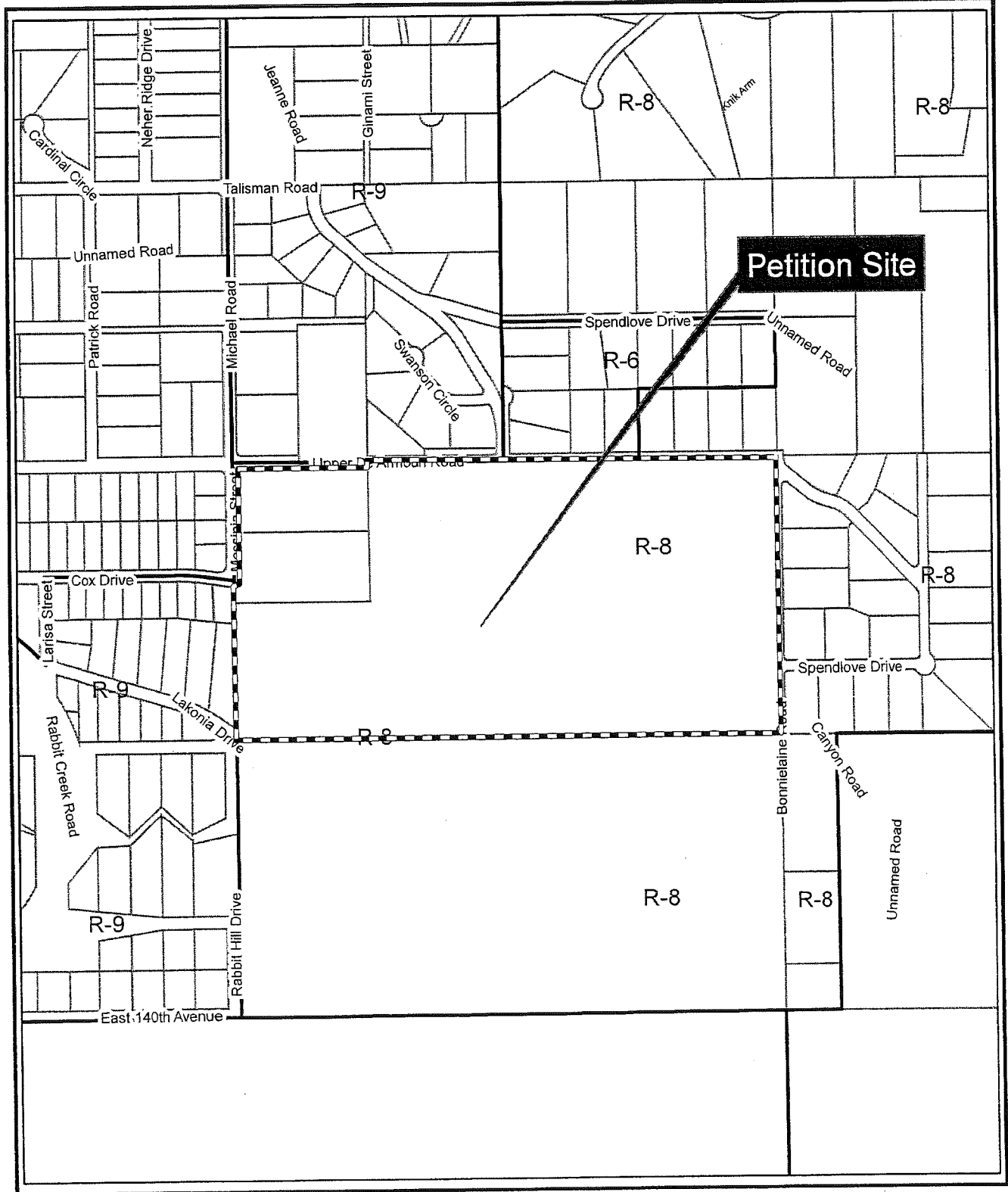
4
5 PASSED AND APPROVED by the Anchorage Assembly this _____ day
6 of _____ 2017.

7
8
9 _____
10 Chair of the Assembly

11
12
13 ATTEST:

14
15
16 _____
17 Municipal Clerk

18
19 (Case 2017-0072)

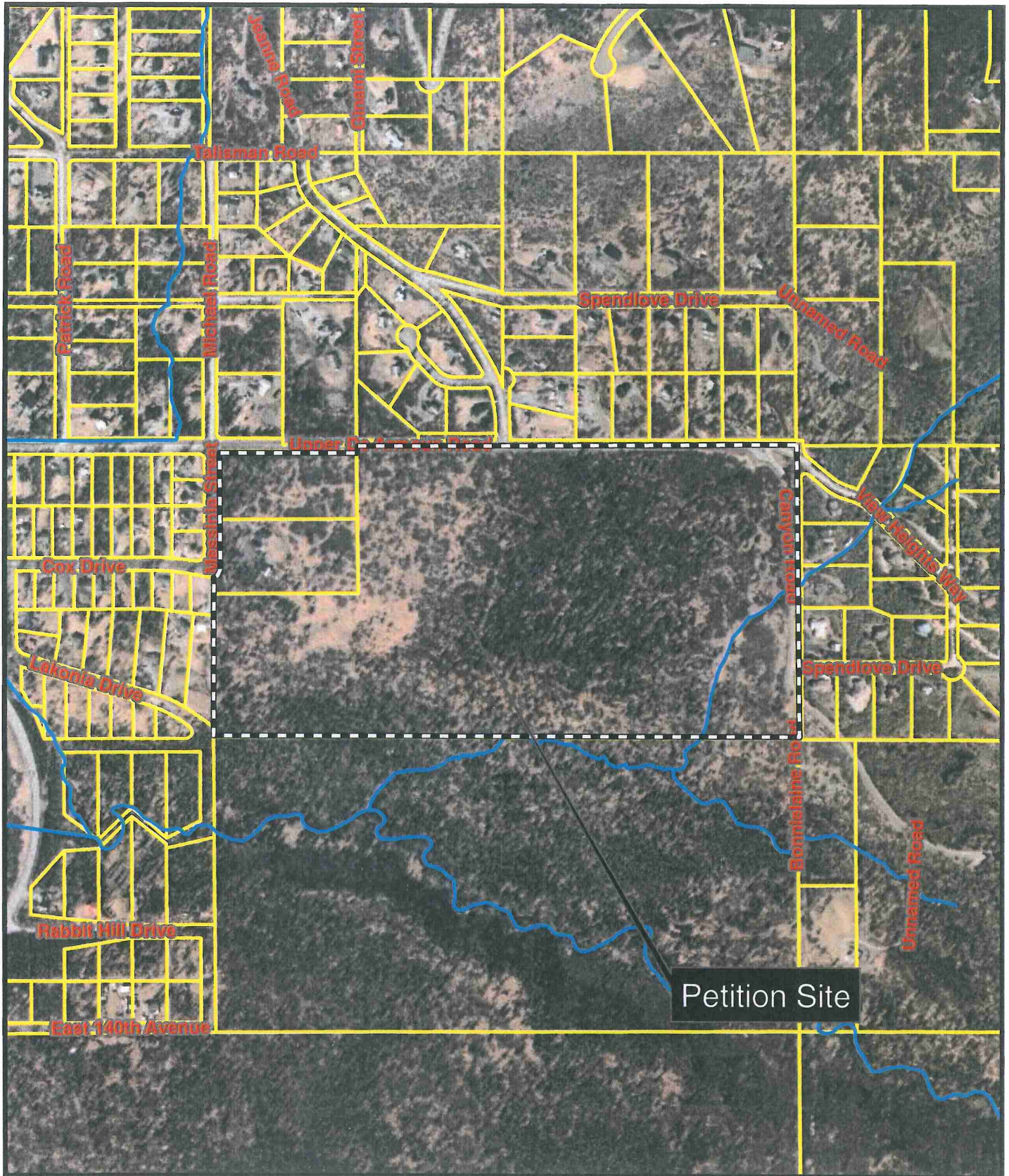


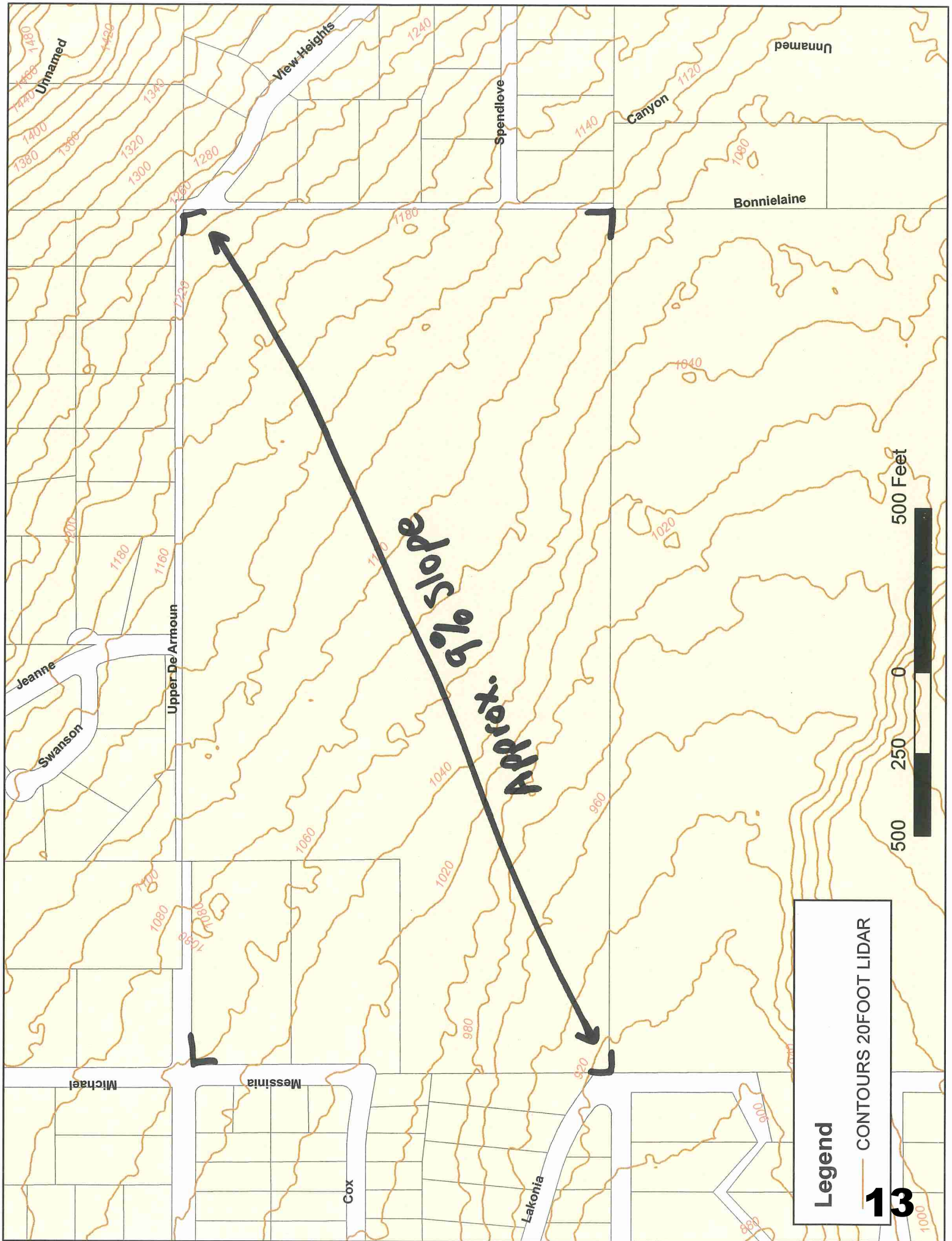
Municipality of Anchorage
Planning Department

Date: April 24, 2017



2017-0072





Legend

CONTOURS 20FOOT LIDAR

Departmental and Public Comments

Municipality of Anchorage

MEMORANDUM

Date: May 4, 2017

To: Francis McLaughlin, Senior Planner, Current Planning Section
Corliss Kimmel, Office Associate, Current Planning Section

From: Jon Cecil, Senior Planner, Long-Range Planning

Subject: Case 2017-0072, Rezone from R-8 District to R-6SL District (X-Ref: 2014-0219) – Lewis & Clark Subdivision

The Long-Range Planning Section has reviewed the Zoning Map Amendment packet for a proposed rezone under Title 21 for property located at Upper DeArmoun Road and Canyon Road from R-8 Low Density Residential (4 acres) District to R-6SL Low-Density Residential (1 acre) District. The addition of special limitations will limit development to 30 lots and include installation of advanced category III nitrogen reducing septic systems. This approximately 80-acre parcel currently consists of one vacant lot in the Southeast Hillside area. The Hillside District Plan (HDP, 2010) is the applicable comprehensive plan.

The *Anchorage Bowl – Anchorage 2020 Plan* is the overarching comprehensive plan.

Applicable policies from *Anchorage 2020 – Anchorage Bowl Comprehensive Plan* applicable to the rezone change include:

- Policy #1** The Land Use Policy Map shall guide land use decisions until such time as other strategies are adopted that provide more specific guidance.
- Policy #5** Rezones and variance shall be compatible in scale with adjacent uses and consistent with the goals and policies of Anchorage 2020.
- Policy #6** Areas designated for specific uses on the Zoning Map shall be protected from encroachment by incompatible land uses.
- Policy #7** Avoid incompatible uses adjoining one another.
- Policy #13** New rural residential subdivisions shall be designated to:
- a) Maintain the rural character of the area;
 - b) Link to existing adjacent road and trail systems;
 - c) Protect, maintain, or avoid sensitive environmental areas (wetlands, steep slopes, drainageways, unsuitable soils, geohazard areas); and
 - d) Incorporate wildland fire safety design standards
- Policy #14** Conservation of residential lands for housing is a high community priority. New residential development at densities less than identified in the Neighborhood or District Plans is discouraged. No regulatory action under Title 21 shall result in a conversion of dwelling units or residentially zoned

property into commercial or industrial unless consistent with an adopted plan.

- Policy #46** The unique appeal of individual residential neighborhoods shall be protected and enhanced in accordance with applicable goals, policies, and strategies.
- Policy #48** Subdivision plats and site development plans shall be designed to enhance or preserve scenic views and other significant natural features in accordance with applicable goals, policies, and strategies.
- Policy #49** Site plan layout and building design for new development shall consider the character of adjacent development. The Municipality may require layouts and designs to incorporate the functional and aesthetic character of adjacent development.
- Policy #50** Healthy, mature trees and forested areas shall be retained as much as possible.
- Policy #67** Critical fish and wildlife habitats, high-value wetlands, and riparian corridors shall be protected as natural open space, wherever possible.
- Policy #69** The Municipality shall preserve the functions and values of important wetlands, and manage the proper use of low-value wetlands with General Permits, as delineated in the Anchorage Wetlands Management Plan.

The Generalized Land Use Plan (1982), which is the currently adopted land use plan for the Municipality, designates this area as “Residential.” At the time of this writing an update to the 1982 land use plan map is under review by the Planning and Zoning Commission. The draft LUP designates the subject area as “Large Lot Residential” which is described as “single-family residences on lots that are generally one acre or larger, in rural and semi-rural environments. These areas are served by private wells and septic systems” (p. 26). In addition, the *Hillside District Plan* addresses the appropriate designation for the area on page 26 of the plan stating: “Where delineated in the *Hillside District Plan*, this designation also includes subdivisions with half-acre or larger sized lots with flexibility for slightly smaller size lot, at densities up to three units per gross acre. Appropriate zoning includes R-1A, R-6, R-7, and R-3SL districts”. Location-specific criteria in the HDP include areas with established large-lot rural development patterns, areas outside of water/wastewater service boundaries, areas furthest away from jobs and urban services, areas with limited road access, and, areas with topography and other natural constraints to more intensive use.

The proposed rezone is consistent with the Draft Land Use Plan Map update (pending). However, the LUP is not an officially adopted land use plan map and it would be premature to make a determination about the merits of the proposed rezone application based on a plan that has yet to be adopted by the Assembly.

Hillside District Plan (HDP)

The subject property is located within an area identified as the “Southeast” Hillside in the HDP, which is an adopted element of the comprehensive plan. Interpretation of the boundaries of the three areas contained within the Hillside (Southeast, Central and Lower) have potentially caused confusion due to a lack of a map that precisely delineates the area boundaries. Text about the boundaries is poorly worded.

A legal analysis prepared on behalf of the Applicant clarified the location of the three Hillside regions as well as the appropriate HDP policies that are relevant to this rezone case. HDP Policy 1-B is the applicable policy to be followed in this rezoning.

Policy 1-B states:

Maintain policies for the amount of development as allowed under current land use designations...

The HDP describes the Southeast Hillside as an area with a large amount of vacant land that has limited amounts of land much of which is “physically unsuited for development.” Physical constraints include: “steep slopes, shallow water tables, high winds, and other environmental constraints.” Prior development patterns have created additional challenges such as drainage, traffic, and in some areas poorly performing on-site wastewater systems (p. 2-10). Each of these issues were cited in the prior rezone attempt for this property under Case #2014-0219.

The HDP discusses “Land Use Plan Designations” on Page 2-16 and states, “These [land use designations] provide the rationale for where each [land use] is recommended to be located. The location criteria for each designation apply in combination rather than individually. However, it is not necessary that all criteria be achieved in every location” (emphasis added). The Location Criteria for Limited Intensity Residential 0-1 DUA is found on Page 2-17 of the HDP and includes the following five factors:

- Areas with established large-lot, rural development pattern;
- Areas outside of the water/wastewater service boundaries;
- Areas further from employment and services, where higher density development would impact traffic congestion on local roads and generate higher vehicle mileage citywide;
- Areas constrained by limited road access; and
- Areas where environmental constraints preclude more intense site development.

The subject site meets all of the relevant Location Criteria cited above.

Rezone

The proposed R-6SL land use zoning designation would allow for single and two-family large-lot residential areas with gross densities of up to one dwelling per acre. The R-6 is designed to encourage low-density residential development. This district is intended to protect and enhance those physical and environmental features that add to the desirability of large-lot residential living. The availability of infrastructure and municipal services is varied.

The R-6SL zoning is compatible with properties located to the north and west of the current site that are currently zoned R-6. Properties to the north, south, and east are zoned R-8. Other low density residential property is located to the north and west and is zoned R-9. Each of these residential zoning designations fall under the “Limited Intensity, 0-1 DUA”.

The Applicant has included documentation to address the following concerns: (1) soil permeability for well installation, (2) on-site septic system compatibility, (3) number of permissible lots, (4) management of surface water run-off, (5) traffic volumes, and (6) compatibility of rezone too the HDP, particularly Policy 1-C. Each of these concerns are discussed below.

Physical and Environmental Features — To address concerns about the physical and environmental impact to the surrounding area the applicant proposes two special limitations to the zoning which would a) limit the number of individual lots to 30; and, b) require advanced high tech septic systems (Advantex), or “Category III Nitrogen Reducing Wastewater Systems”. A category III nitrogen reducing septic system goes beyond existing requirements for wastewater treatment in areas with poor soils and environment constraints.

Private Utilities — Lack of municipal water and wastewater services would not preclude the type of land use contemplated under this rezone application. The Applicant has provided the Planning Department with supporting documentation, including a geotechnical soils report prepared by NorthRim Engineering, and a ground water resource evaluation prepared by Terrasat, Inc. Environmental Services. Terrasat also prepared an evaluation of the distribution of Nitrates in local water wells surrounding the proposed Lewis and Clark Subdivision. Triad Engineering prepared a preliminary drainage impact analysis. Each of these reports’ findings have determined that environmental impacts to the site and general area are found to be consistent with MOA requirements and fall within (or below) MOA and State ADEC regulatory thresholds.

Traffic Analysis / Impacts — The Applicant provided an analysis of proposed traffic impacts from the addition of 30 single-family residences on Upper DeArmoun Road, accessible from two cul de sacs. Based on an analysis prepared by Kinney Engineering the expected increase of traffic on DeArmoun Road would be an extra 286 trips which is below the Average Annual Daily Traffic (AADT) of 1,075 “which is well below the appropriate volumes for a neighborhood collector.” The engineers acknowledge the generally poor state of DeArmoun Road. The addition of an additional 96 residential trips per day, however, is not expected to make a significant contribution to the existing roadway conditions that are attributable to older pavements that suffer from seasonal movement and cracking. Furthermore, Triad Engineering provided an assessment of Upper DeArmoun Road after reviewing the Kinney Engineering report noted above. Triad Engineering concluded the analysis by Kinney “fairly represented the road conditions and road maintenance responsibilities that fall on the local road service area, not a future developer”. The addition of 286 trips per day from the proposed subdivision “would not significantly impact the current condition of the road.”

Wetlands / Preliminary Jurisdiction — Long-Range Planning Staff previously commented on a rezone case associated with this parcel.¹ Staff noted the lack of a preliminary determination of wetlands from the U.S. Army Corps of Engineers. The Report, prepared by Hemlock Scientific, LLC, dated Dec. 22, 2014, appears to have met that recommendation. The Report noted that “Potential jurisdictional wetlands were found within the property, as determined by a detailed evaluation of vegetation, soils, and hydrology at established determination points and supported with observations throughout the area.” The presence of streams were also noted on the subject property. The two identified wetlands totaling 17 acres will be placed into two separate tracts. A legal analysis concluded that a rezoning from R-8 to R-6SL would allow a “more proactive approach to preserving sensitive lands. ... The separate wetlands tract is significant not just visually and to improve the neighborhood feel ... but also because these wetlands serve as an important buffer for drainage that continues down the Valley to Rabbit Creek”.

Legal Analysis / Rezoning — The Applicant retained the legal services of the law firm of Ashburn & Mason P.C. to analyze the language found in the HDP on rezoning. In sum, the legal analysis concludes that HDP Policy 1-C (or Policy 1-B) “does not impair the deliberative bodies from considering a rezone on R-6SL if they determine, after weighing all of the facts in light of the goals and policies of the HDP that a rezone better serves the goals of the comprehensive plan” (p. 13, Correspondence from Rebecca E. Lipson, Ashburn & Mason, P.C. to Terry Schoenthal, (former) Current Planning Manager, “Conformity of Proposed Rezoning to Anchorage 2020”, dated February 23, 2017). Given the overall shortage of residentially-zoned land available in the Anchorage Bowl Long-Range Planning has no objection to the proposed rezone from R-8 to R-6SL.

Summary

The proposed rezone meets policy direction as provided by *Anchorage 2020* and the *Hillside District Plan*, and is consistent with the Draft Land Use Plan. Furthermore, the applicant has demonstrated that the assumed environmental constraints are either not present or can be adequately mitigated to avoid impacts on surrounding property.

Recommendation

Long-Range Planning supports the rezone with special limitations as submitted and recommends approval.

Thank you for the opportunity to review and comment.

Cc: Carol Wong, Planning Supervisor, Long-Range Planning

¹ See Case 2014-0219, comments from Jon Cecil, AICP, Senior Planner, Long-Range Planning to Margaret O'Brien, Senior Planner, Current Planning, dated 1/23/2015).



**Municipality of Anchorage
Development Services Department
Building Safety Division**



MEMORANDUM

DATE: May 23, 2017
TO: Francis McLaughlin, Acting Manager, Current Planning Section
FROM: Rebecca Carroll, P.E., On-Site Water and Wastewater Program
SUBJECT: Comments on Cases due May 15, 2017

The On-Site Water & Wastewater Program has reviewed the following cases and has these comments:

2017-0072 Rezone for proposed Lewis and Clark Subdivision

1. A Special Limitation has been proposed to require the Advantex system to be used in the design of the wastewater disposal systems for each lot. A specific product should not be designated, please use "On-Site Septic Systems shall meet or exceed Category III Nitrate Reducing standards".
2. FYI: With the proposed Special Limitation, the existing development on Vergason-Jones Subdivision Lot 2 will be required to upgrade their system to a Category III, Nitrate Reducing System.



MUNICIPALITY OF ANCHORAGE

Development Services Division

Right of Way Section

Phone: (907) 343-8240 Fax: (907) 343-8250

DATE: May 22, 2017

RECEIVED

TO: Planning Division, Current Planning Section

MAY 22 2017

THRU: Jack L. Frost, Jr., Right of Way Supervisor

PLANNING DEPARTMENT

FROM: Lynn McGee, Senior Plan Reviewer

SUBJ: Comments on Planning and Zoning Commission case(s) for June 12, 2017.

Right of Way Section has reviewed the following case(s) due May 15, 2017.

2017-0072 Vergason-Jones, Lots 1 & 2, grid SW2941.

(Rezone from R-8 to R-6SL)

Right of Way Section has no objection to the proposed action.

Review time 15 minutes.

MUNICIPALITY OF ANCHORAGE



Development Services Department

Private Development Section

Mayor Ethan Berkowitz

MEMORANDUM

Comments to Planning and Zoning Commission Applications/Petitions

DATE: May 22, 2017
TO: Dave Whitfield, Acting Planning Section Supervisor
FROM: Brandon Telford, Plan Review Engineer
SUBJECT: Comments for Planning and Zoning Commission
Public Hearing date: June 12, 2017

RECEIVED

MAY 22 2017

PLANNING DEPARTMENT

Case 2017-0038 – Major Site Plan Review for Bird Treatment and Learning Center

Drainage:

The petitioner is alerted to the pending requirement to provide project specific full drainage analysis and calculations to Private Development under land use and/or building permit processes. An analysis will be required to address storm runoff as a result of the proposed changes to infrastructure and to permeable / impermeable surface treatments. Final plans with appropriate details will be required prior to approval of building plans. The analysis and plans shall present and illustrate respectively how drainage from this facility is being managed in relation to peripheral properties and right of way; demonstrate that post development drainage will not adversely impact adjacent properties or rights of way; and, measures to be taken in the event that excavation associated with the build-out of the property exposes subsurface flows. Drainage analysis and design shall conform to the Municipality of Anchorage Design Criteria Manual (DCM) and the Drainage Design Guidelines (DDG).

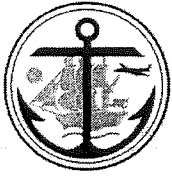
Department Recommendations:

The Private Development Section has no objection to the Major Site Plan Review.

Case 2017-0072 – Request to Rezone approximately 80 acres from R-8 Low-Density Residential (4 acres) District to R-6SL Low-Density Residential (1 acre) District with Special Limitations.

Department Recommendations:

The Private Development Section has no objection to the Request to Rezone.



Municipality of Anchorage
Project Management and Engineering
MEMORANDUM



DATE: May 16, 2017

TO: Dave Whitfield

FROM: Steven Ellis

SUBJECT: Comments from Watershed Management Services

RECEIVED

MAY 16 2017

PLANNING DEPARTMENT

Watershed Management Services (WMS) has the following comments for the Jun 12, 2017, Planning and Zoning Commission Meeting.

2017-0072, Request to rezone approximately 80 acres from R-8 to R-6SL. WMS has the following comments.

WMS has no objection to this rezone.

Advisory Comment: The stream and waterbody mapping provided in this rezone application is slightly different from the WMS waterbody database. We request the applicant resolve this with WMS prior to plat submittal.

MUNICIPALITY OF ANCHORAGE



Planning & Development Services Dept.
Development Services Division

Building Safety

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MAY 12 2017

MEMORANDUM

Comments to Miscellaneous Planning and Zoning Applications **PLANNING DEPARTMENT**

DATE: May 12, 2017

TO: Dave Whitfield, Acting Manager, Current Planning

FROM: Ron Wilde, P.E.
Structural Plan Reviewer
Building Safety
343-8371

SUBJECT: Comments for Case 2017-0072
Rezone about 80 acres

No Comment.



THE STATE
of **ALASKA**
GOVERNOR BILL WALKER

Department of Transportation and
Public Facilities

DIVISION of PROGRAM DEVELOPMENT
Anchorage Field Office

4111 Aviation Avenue
P.O. Box 196900
Anchorage, Alaska 99519-6900
Main Phone: (907)269-0520
Fax: (907)269-0521
Web site: dot.state.ak.us

May 3, 2017

David Whitfield, Senior Planner
MOA, Community Development Department
Planning Division
P.O. Box 196650
Anchorage, Alaska 99519-6650

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MAY 04 2017

PLANNING DEPARTMENT

RE: MOA Zoning Review

Dear Mr. Whitfield:

The Alaska Department of Transportation and Public Facilities (DOT&PF), Central Region Platting Review Board has no comments on the following zoning case:

- **2017-0035: 365 Cortina Road**

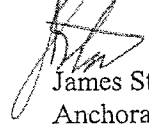
The DOT&PF Central Region Platting Review Board has comments on the following zoning cases:

- **2017-0038: 15510 Old Seward Highway**
 - Apply for driveway permits from DOT&PF.
 - Drainage will need to be re-established between driveways.
 - Ensure landscaping does not impede on DOT&PF Right of Way.
- **2017-0066: Tract A, Odom Industrial Park Subdivision**
 - Westbound International Airport Road is inaccessible from Electron Drive. Consider altering route to go east onto Arctic Boulevard and south to Raspberry Road to avoid left turns, particularly at Minnesota off ramp and International Airport Road.
 - Property Tax Number on application is for 6300 Changepoint Drive. Correct number should be 012-02-211-000.
- **2017-0070: T12N R3W SEC 18 Lot 5 REM**
 - No direct access to C Street will be granted.
- **2017-0072: 13301 Messinia Street**
 - Recommend approval of rezone if the following conditions are met:
 - Provide two points of access for fire safety reasons in accordance with Hillside District Plan, Goal 9.
 - Access development from Messinia Street, Canyon Road or DeArmoun Road. DeArmoun access must align with Jeanne Road.
 - Two cul-du-sacs from DeArmoun Road will not be acceptable.

The DOT&PF Planning Division has a comment on the following zoning case:

- **2017-0075: PTN of N ½ of Government Lot 1, Section 2, T14N R2W, Seward Meridian**
 - Downzoning this parcel will reduce the number of housing units allowed on this parcel and may exacerbate the difficulties in meeting the housing goals of the Chugiak-Eagle River Comprehensive Plan.

Sincerely,



James Starzec
Anchorage Area Planner

Cc: Tucker Hurn, Right of Way Agent, Right of Way, DOT&PF
Morris Beckwith, Right of Way Agent II, Right of Way, DOT&PF
Scott Thomas, P.E., Regional Traffic Engineer, Traffic Safety and Utilities, DOT&PF
Jim Amundsen, P.E., Highway Design Group Chief, DOT&PF



MUNICIPALITY OF ANCHORAGE

Traffic Department



MEMORANDUM

RECEIVED

DATE: May 9, 2017

MAY 09 2017

TO: Current Planning Division Supervisor.
Planning Department

PLANNING DEPARTMENT

THRU: Kristen A. Langley, Traffic Safety Section Supervisor,
Traffic Department

FROM: Randy Ribble, Assistant Traffic Engineer

SUBJECT: 2017-0072 Request to rezone approximately 80 acres from R-8 Low Density
to R-6SL Low Density.

Traffic has no objection to rezoning these parcels.

RECEIVED

MAY 22 2017

----- Forwarded Message -----

From: "Lance Powell" <lpowell1@juno.com>

To: lpowell1@juno.com

Subject: Hillside Community Council-Case #2017-0072

Date: Fri, 19 May 2017 05:06:53 GMT

PLANNING DEPARTMENT

The Hillside Community Council(HCC) met on May 16,2017 to vote on a resolution concerning the above case which pertains to the rezone from R-8 to R-6 of approximately 80 acres in the Upper DeArmoun Road area;the rezone falls within the boundaries of formerly Hillside East Community Council that has become the HCC;there was approximately 35 people present. Both the applicant and what appeared to be existing residents in proposed area were allowed to present the case for and not for a rezone.However, there was not a quorum present for the passage of a HCC Resolution; I am sending the MOA Planning and Zoning Commission(P&Z) this email to communicate to the P&Z that the HCC was and will be involved in Case #2017-0072 and that the majority of HCC members present participated in a "straw pole"(that is NOT an HCC position) that showed they were against the rezone.....thank you for your time and consideration.

Lance Powell,President, Hillside Community Council

To: Municipality of Anchorage Planning Department
CC: Planning and Zoning Commission
Anchorage Assembly
From: Huffman/O'Malley Community Council
Re: Case 2017-072
Date: May 20, 2017

RECEIVED

MAY 22 2017

PLANNING DEPARTMENT

WHEREAS the Huffman/O'Malley Community Council, hereinafter referred to as HOCC, is charged with representing the interests of residents, and

WHEREAS members of HOCC were among the originators of the Hillside District Plan "HDP", and worked tirelessly on behalf of the entire Hillside community to ensure that the HDP met the long range needs of the community and ensured responsible development, and

WHEREAS the HDP promotes healthy land use choices and protects both the rights of land ownership and the responsibility of appropriate stewardship of the land, and

WHEREAS the R-8 designation is defined in Municipal Code Title 21.04.020.M states: "R-8: Low-Density Residential (4 acres) District 1. Purpose The R-8 district is intended primarily for single- and two-family large-lot residential areas with gross densities less than one dwelling unit per four acres, where topographic or other natural conditions are such that higher-density development would be unfeasible. In addition to topography, some of the natural conditions which could exist to render land desirable for the densities proposed in this zone are wind hazards, marginal soils, landslide susceptibility, potential for groundwater pollution, and groundwater availability."

WHEREAS the Lewis and Clark subdivision is an ideal example of the description written in Code, with both topographical and other natural conditions including wetlands and extremely high water tables that will forever impede responsible development at any higher density, and

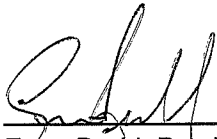
WHEREAS a large portion of the Lewis and Clark subdivision is unsuitable for any development due to high water tables, drainage issues, and the headwaters of Rabbit Creek, and

WHEREAS Policy #13 of the 2020 Comprehensive Plan states that "New rural residential subdivisions shall be designed to: a) maintain the rural character of the area"... and "c) Protect, maintain or avoid sensitive environmental areas (wetlands, steep slopes, drainageways, unsuitable soils, geohazard areas)..." and the proposed Lewis and Clark subdivision rezoning does not meet this goal, and

WHEREAS in 2014 the purchase of the Lewis and Clark subdivision was consummated in full knowledge of the underlying zoning district and the extreme wetlands contained therein, and

WHEREAS the proposed rezoning of the Lewis and Clark subdivision has already been denied twice by the Planning and Zoning Commission with good reason and justifications for those denials are still valid,

NOW THEREFORE LET IT BE RESOLVED that the Huffman/O'Malley Community Council respectfully requests that the original R-8 Zoning designation of the Lewis and Clark subdivision be maintained and the proposed rezone of Case 2017-072 be denied.

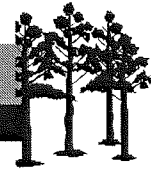
A handwritten signature in black ink, appearing to read 'E. Budd', is written over a horizontal line.

Evan Budd, President
Huffman/O'Malley Community Council



Rabbit Creek Community Council

1057 West Fireweed Lane, Suite 100, Anchorage AK 99503



May 24, 2017

MOA Planning and Zoning Commissioners
Francis McLaughlin, Senior Planner
Hal Hart, Director of Planning
Planning Department
P.O. Box 196650
Anchorage, AK 99519-6650

RE: Case 2017-0072, Lewis and Clark Subdivision request to rezone approximately 73 acres from R-8 (minimum lot size of 4 acres) to R-6 SL (minimum lot size of 1 acre) with special limitations

Dear Commissioners and Municipal planning staff:

At our Council's meeting on May 13, the general membership of Rabbit Creek Community Council (RCCC) voted unanimously to oppose the rezone of 80 acres in Lewis and Clark Subdivision, and to submit the following findings.

Importance of this case to our Community Council

1. This case is a major test of the Hillside District Plan (HDP). This application attempts to override several policies of the HDP, as well as the clearly stated intent for low-density residential development of the southeast Hillside.
2. Denser development impacts our water supply. Our neighborhoods, located downslope from this subdivision, mostly rely on well water. Run-off patterns and leaching from 50-percent higher density would affect our groundwater. In addition, it is hard to ensure well water supply in an area with multiple interconnected aquifers.
3. Denser development impacts Rabbit Creek and Potter Marsh. Rabbit Creek Greenbelt and Potter Marsh would be negatively affected by the increased level of development proposed. Potter Marsh is within the Rabbit Creek Community Council Area. The proposed 50% increase in the number of houses would increase sewage effluent. In addition, the increase in impervious surface and removal of natural vegetation would cause faster, dirtier run-off into Rabbit Creek and less recharge and filtration of the ground water. Erosion and flooding would likely increase downstream.

Lack of need and justification for this rezoning

1. There is no community need for this rezoning. The 2012 Housing Study found that there was "an oversupply of large lots zoned for single-family residential development." There is a need for small lot development served by public utilities and services, but not more R-6 lots at this time.

2. The implication of affordably-priced home lots is deceptive. The Application Narrative offers no evidence that the rezone would ensure reduced development costs. Possibly, the rezone would reduce the developer's costs: but this could result in increased profits and not reduced housing prices. The developer's statement that R-8 lots would not be "within reach financially of most home buyers" may or may not be true. However, there is no pledge that that R-6 lots would be priced within reach of most home buyers either.
3. The soils report shows marginal to impermeable soils, as further discussed below.
4. Drainage concerns. The calculations of future impervious surface are dubious. *We need a third party to use realistic figures for impervious surface both on this parcel and in the upstream drainage area that channels run-off across this parcel.*

Compliance with Title 21 (AMC 211.03.160) rezoning requirements.

1. 21.03.160E.1 – Does not comply because it does not "serve the best interests of the citizens of Anchorage" . Rezoning for increased lots is not needed given the current oversupply of large lots. This rezoning perpetuates an inefficient sprawl pattern with more vehicle travel, instead of the infill and centralized infrastructure investment called for in the Anchorage 2020 Comprehensive Plan (Comp Plan) and reiterated in HDP Policy 1-A.
2. 21.03.160E.2 – Does not comply. Does not conform to the zoning of the relevant map in the HDP. The applicant's lawyer states that Comp Plan Policy 5, compatible scale with adjacent uses, is met. However, R6 zoning borders less than 10 percent of this tract. R8 and R9 borders 90 percent of the lot, and much of it was zoned decades ago with substandard size lots for the zone. HDP kept the R8 zoning: the intent of the HDP's zoning is to promote 4-acre lots.
3. 21.03.160E.5 & 6 – Compliance is debatable. The increased density of houses, driveways and yards will create more rapid stormwater runoff and greater disturbance to natural recharge of wetlands and Rabbit Creek, as well as disturbance to wildlife, and vegetation.
4. RCCC has specific concerns about the soils and percolation test results.
 - a. Many of the percolation tests appear to have been done at very shallow depths, sometimes even 1 to 2 feet. Many of them were done in the 3 to 6 foot depth range. Septic systems are generally installed deeper than just a few feet beneath the surface, which means these results may not be helpful in determining actual septic system performance. Additionally, in some of the borings, the data shows that the soils become "denser" the further down you go, which would slow percolation. If that is the case, percolation tests should be done at depths of proposed septic installation.
 - b. Several of the percolation tests show either very slow percolation or no percolation at all. In some cases, these tests were performed a second time in the same location at much shallower depths with improved results. I am not familiar with the proposed "Advantix" type systems, but I do not expect septic systems would be installed at such shallow depths.

- c. The method used to complete the actual percolation tests isn't provided (that we found). Was the testing done using a standard method and following standard test procedures? Testing is also provided from two different companies. Was the same method used by both?
 - d. Several of the percolation tests were done in January of 2015 at fairly shallow depths. Were the soils frozen?
 - e. The drainage analysis includes a discussion of potential icing and states that icing is concern for this development as it is for developments across much of the hillside. The proposed mitigation for icing is to over-excavate in areas where shallow groundwater is encountered and line the excavation with rock. It is not clear how this would provide insulation of the shallow groundwater. Would other methods for dealing with icing be considered during design, such subdrains below the ditches? Would the proposed roadway design account for shallow groundwater as needed to ensure stability of the road? Icing can be of particular concern in areas of cut slopes. Both roadway design and surrounding cut embankments should account for potential icing.
 - f. The drainage analysis was completed assuming that any type of development (R6 or R8) would leave a substantial portion of the area as trees or dense vegetation. Is that a good assumption? Is there any way to ensure that homeowners wouldn't fully or mostly clear their lots?
 - g. The drainage analysis assumed Type B and C soils. Based on the provided soils data, would Type D soils be more appropriate in parts of the basin?
5. 600 percent increase in potential lot coverage. Increased lot coverage decreases percolation and filtration, and creates higher peak run-off. This increases the likelihood of erosion, flooding, sedimentation, and poor water quality entering Rabbit Creek and Potter Marsh, as well as the aquifer(s) that supplies neighborhoods downstream. The proposed R6 rezoning allows 30 percent coverage of each one-acre lot, or about 13,500 s.f. of structural footprint per acre. R8 lots allow 5 percent lot coverage on each 4-acre lot, which averages out to 2,250 s.f. of structural footprint per acre. That is a 600 percent increase in potential lot coverage.

In addition, the accessory hard surfaces for a single family home, such as lawns and parking, are likely to take up a larger percentage of a 1-acre lot than a 4-acre lot. The applicants' lawyers claim that the change from R8 to R6 zoning creates a minimal change in impervious area, from 3.3% to 6.1%, and peak run-off increase of about only 3 to 7%. The lawyers' letter based this on an assumption that 80 percent of the parcel will remain vegetated: this is unfounded and misleading.

The applicant's narrative on page 7 makes an unsupportable claim that "over 80 percent of the parcel {is} predicted to remain as heavily vegetated brush and trees." That claim can be fulfilled only through further Special Limitations, such as further reserve tracts, coupled with plat requirements to retain natural vegetation on those tracts as well as platted disturbance limits on individual lots. Otherwise, the Municipal Title 21 has NO REQUIREMENT to retain any vegetation on R-6 lots except along permanent streams.

- 6. 21.03.160.7. The proposed rezone does not comply. The rezone "extends or exacerbates a land use pattern that is inconsistent with the comprehensive plan." This

tract is surrounded on approximately 90 percent of its borders by R8 or R9. Some of that R-8 and R-9 was subdivided into half-acre lots decades before, prior to the 4-acre minimum lot requirement. These undersized lots have a well-documented history of drainage and septic issues. Downsizing of lots in the current R8 zone exacerbates this problem and sets a precedent contrary to the HDP: it could be used to justify downzoning of other tracts on the upper Hillside.

Non-Compliance with other Title 21 requirements and Comp Plan policies

The plat lacks protection for one north-south drainage_way across six lots. 21.08.030C requires protection of drainage_ways.

B Street is a long sloping cul-de-sac that should have a pedestrian connection to Canyon Road, which leads to municipal parkland and Chugach State Park. This complies with Comp Plan Policy 55 and HDP Policy 10-A explanation, "There are local trails that may be needed within or between adjoining neighborhoods: these are not shown on the trails map. Such trails, which serve a more localized function than either regional or district trails, may be identified at the time of development."

The applicants' lawyers erroneously cite Policy 14, conservation of residential lands for housing. Policy 14 does not apply to this rezone. Policy 14 discourages reducing the residential densities identified in the Neighborhood or District Plan, but does not promote densities greater than the zoning of the District Plan. The lawyers' statement that "...properties must be developed at what they can reasonably and responsibly be constructed[sic]" is only lobbyists' word_craft, not Comp Plan policy.

Non-Compliance with Hillside District Plan (HDP)

1. Policy 1-A. The proposed rezone does not comply with Policy 1-A of the HDP, which calls for "a greater proportion of future Hillside growth to occur in the lower Hillside, in areas located closer to existing services and infrastructure" to reduce driving and improve the efficiency of public services.. This policy further states that "land use patterns on the Hillside are largely established. While the area will continue to grow, dramatic changes from these patterns are neither desirable nor practical". The proposed rezoning of this large tract, to enable at least 50 percent more lots under R-6SL than under R-8, sets the wrong precedent for other large undeveloped tracts in the upper Hillside.
2. Policy 1-B is misinterpreted by the applicant's narrative on page 4. Policy 1-B states "This plan maintains existing residential land use designations and zoning in the southeast Hillside." The applicant's narrative on page 4 extrapolates this to "not limit zoning changes", but Policy 1-B text says to ***maintain*** existing zoning. The lawyer's letter contradicts itself by arguing that the whole text of the HDP must be considered (we agree), and then trying to focus just on Policy 1-B without the supporting text (we disagree—the Policy 1-B text must not be disregarded, and it says to "maintain existing residential land use designations and zoning in the southeast Hillside").
3. Policy 1-C. The proposed rezone does not comply with Policy 1-C of the HDP, which clearly commits to the zoning shown on Map 1.2. Policy 1-C states, "Maintain the same land use designations and zoning in this area as were established prior to the beginning of this plan."

4. Policy 1-B of the HDP cannot be used to override Policy 1-C. Policy 1-B states, “Maintain policies for the amount of development as allowed under current land use designations.” Land use designations are more general than zoning and do not override zoning: zoning is the label that determines maximum density. The HDP text further explains that only 1,700 acres of the 6,000 private vacant acres in the Southeast Hillside are physically suitable for development. The text supports less-dense development on the Southeast Hillside because of environmental constraints.
5. Land Use Map 2.1 defers to the HDP Zoning Map. The applicant’s narrative (page 3) claims that the rezone conforms with the density levels shown on the HDP Land Use Plan Map 2.1, but this is a distraction because Map 2.1 is an overview map that defers to the zoning map. Map 2.1 is accompanied by disclaimers that it does NOT depict density at the site level.
 - a. The HDP Land Use Plan Map 2.1 is defined explicitly on page 2-15 as not a zoning map (emphasis added).
 - b. HDP page 2-16: “The measure of housing units per gross acre [on the LUPM] “is not intended to be applied directly as the measure of how many housing units may be allowed on each lot or development site. The Title 21 Land Use Regulations and Official Zoning Map will determine how many housing units may be allowed on each lot or development site.” (emphasis added).
6. The draft 2040 Land Use Planning Map (LUPM) does not override the existing zoning. The LUPM has not been adopted. Furthermore, in its draft form, the 2040 LUPM defers to the Hillside District Plan through map notes. The precise zoning for the Hillside is not depicted on the LUPM because of the scale of the map.
7. The conservation subdivision model in the HDP allows a density increase of 5 to 20 percent, not 50 percent (Policy 14-L, pages 6-35 & 36). Regarding flexibility for increasing the number of lots, the Hillside Development Plan offers the developer the option of slightly-increased density of 5 to 20 percent more lots, and lower development costs through clustering, via the Hillside Conservation Subdivision (Policy 14-L). These bonuses are awarded if the developer commits to specific high-value conservation features that protect natural hydrology beyond the normal standards of Title 21, and provide high public value. This applicant has not chosen to use that approach.

Other erroneous information presented as need and justification for the rezone

1. Development costs should not be a determining factor. The applicant’s letter states on page 1 that the rezone will allow them to subdivide “with reduced development costs”. Reduced development costs are not demonstrated anywhere in the application: and it is not a criterion for allowing zoning map amendments per AMC 21.03.160.

Rezoning is not intended to serve individual financial interests: in fact, small lot rezoning for individual benefit is considered “spot zoning” and is illegal.

The applicant has already benefited from a windfall allowed by the change in definition of R-8 (minimum lot size of 4 acres instead of 5 acres) in the recent the revision of Title 21, gaining 4 additional lots on the 80 acres compared to the earlier Title 21.

2. The Lawyers' letter offers many distractions. We address the most egregious.

- a. Lawyers' item #4: Legal Standard. "The authority tasked with reviewing a proposed land action must consider whether the proposed action is in accordance with the applicable Comprehensive Plan.
- b. The 2020 Comprehensive Plan specifically (page 3) "outlines general patterns of development". The emphasis is on infill and re-development in the central parts of the bowl, and lower density on the perimeter. Specific goals include improving efficiency of service delivery and reducing vehicle dependency and total vehicle miles. This rezone does not comply.
- c. The Hillside District Plan, in its totality, emphasizes lower densities on the upper Hillside and holds to the existing zoning except for conservation subdivisions that meet specific design standards of conservation. This proposed development does not.
- d. Lawyers' item #5: "A rezone to R6SL more fully furthers the goals and policies of the HDP than R-8 development." The opposite is true.
 - o Rezoning to 50 percent higher density on the Upper Hillside creates a damaging precedent to maintaining the hillside's existing low-density rural residential character.
 - o The existing higher densities to the west are non-conforming, grandfathered densities, and drainage and water and septic issues have been problematic.
 - o Delineating the wetlands into a tract can be accomplished within R8 zoning as easily as within R6.
 - o The cumulative and long-term effects on well-water capacity have not been modeled.
 - o The test holes are mostly shallow: in fact, the "improved" test results compared to earlier hydrology tests may be attributed to shallower test holes.
 - o There is no well-water protection program: the potential 600-fold increase in impervious surface and the increase from 20 to 30 potential homes increases stress on the well water resources..
 - o There is nothing innovative about this development. Claims such as "reducing the need for pedestrian activity along DeArmoun" and "increasing green space and trails within the development itself" are false. There are no protections for vegetation, and no trails shown on the preliminary plats.

3. Feasibility of development is not the only determinant of density. R-8 zoning was applied to areas with "natural conditions are such that higher development density would be infeasible". However, there are other factors cited in the HDP for avoiding dramatic changes in the density pattern, represented by the 50 percent leap in density proposed

in this rezone. As cited in Policy 1-A, these include efficient transportation patterns and efficient provision of public services. In addition, the Comp 2020 Plan emphasizes infill and redevelopment.

Conditions for any rezone or plat approval

1. Depict a pedestrian path and commit to construction of this path along Upper DeArmoun Road and Canyon Road, per the HDP Trails Map (Map 4.1). This is currently lacking.
2. Require additional protection of existing contours and natural vegetation retention to maintain natural rates of recharge and runoff.

Conclusion

This proposed rezone would override several policies of the HDP, as well as the clearly stated intent for low-density residential development of the southeast Hillside.

The resulting pattern of denser sprawl in sensitive environmental conditions would create lasting physical impacts to downstream watersheds and neighborhoods. In addition, the scale and intensity of the proposed rezone-- approximately 50 percent housing density above current zoning, and an allowable increase of up to 600 percent greater lot coverage--sets a dangerous precedent for overriding the Hillside District Plan.

Between the intense opposition of our council area and the directly affected residents as well as the clear lack of conformity with municipal code, planning documents, and area plans, as we have demonstrated, it is clear that this rezone should not be approved.

Sincerely,

Adam S. Lees

Adam S. Lees, Chair

Mark Goodman

mcgoodak@gmail.com

907 440-0215

5/31/2017 7:25:10 PM

3126 E. 88th Avenu
Anchorage, Ak 99507

I have lived in Anchorage for fifty plus years and have seen a lot of growth in our city. Anchorage is running out of land to build on. When I heard that my friends were trying to develop property on the hillside my first thought was, great!

I am all for changing the zoning from R-8 to R-6. The more lots available, the better. I have heard the soil is poor, (that is true in a lot of place that have been developed in Anchorage). I think the engineers can figure out the proper drainage and sewage system.

A positive for the city is there will be 30 more houses to add to the tax-base instead of just taxes on undeveloped land.

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MAY 31 2017

PLANNING DEPARTMENT

THOMAS E. MEACHAM
ATTORNEY AT LAW

9500 PROSPECT DRIVE
ANCHORAGE, ALASKA
DENA 00500-5024

ALASKA BAR NO. 711030
1971

TELEPHONE 907/246-1077
FAX NUMBER 907/246-1078
tmeacham@ig.net

May 30, 2017

Municipality of Anchorage, Planning Dept.
Attn: Francis McLaughlin
4700 Elmore Road
Anchorage, Alaska 99507

RECEIVED

MAY 30 2017

PLANNING DEPARTMENT

Re: Lewis & Clark Subdivision, File No. 2017-0072

Dear Mr. McLaughlin:

I have been retained by a number of adjacent and neighboring homeowners, to analyze one aspect of the effort by the applicant Big Country Enterprises, LLC, and its counsel Ashburn & Mason, to find some support in the Municipality's adopted 2010 Hillside District Plan (the "HDP" or the "Plan") for their rezone application number 2017-0072.

The authors of the Ashburn & Mason letter (the "Ashburn letter"), dated December 30, 2016, are attorneys Donald McClintock and Rebecca Lipson. They have used an analysis of claimed differences in certain geographic descriptions and policy narratives contained in that Plan, as support for their claim that a part of the Plan actually contemplates and authorizes the Planning and Zoning Commission (the "Commission") to approve re-zoning changes to smaller lots, and yet remain in conformity with the Plan.

After a close reading of applicable portions of the HDP, I have found no support in the Plan for their contention.

The Ashburn letter reads the HDP to argue that the subject property (the 80-acre Lewis & Clark Subdivision tract) actually lies in the Plan's "Southeast Hillside Residential District," rather than in the Plan's "Central Hillside Residential District." If this tract were found to properly be in the Southeast District, then they believe that some of the language in the HDP's adopted policies goals would give them support for approval of their proposed re-zoning by the Commission.

A. The Ashburn letter's premises. The subdivider's counsel is pursuing its particular arguments because the Plan's adopted Policy 1-C for the Central Hillside District requires that this District "maintain the same land use designations *and zoning* in this area as were established prior to the beginning of this plan." HDP, p. 2-11 [emphasis

supplied]. The adopted policy for the Southeast District, however, states the following at Policy 1-B, in relevant part:

Maintain policies for the amount of development as allowed under current land use designations.....

HDP, p. 2-9. The Ashburn argument is that in the Southeast District, the absence of the particular words “and zoning” from Policy 1-B (in contrast to HDP Policy 1-C) means that if the subdivider’s property is found to be in the Southeast District, then the Commission has the freedom to consider smaller-lot “zoning changes” from the zoning existing at the time the Plan was adopted. In other words, the letter argues that adopted policies and goals of the HDP for the Southeast District would permit the requested rezone, but by contrast, the corresponding policies for the Central Hillside District would not. This claimed distinction is not supported by a close examination of the HDP.

B. The draft map (Ashburn’s Exhibit 3) was never adopted. As the pretext for its argument, the Ashburn letter relies on a map that was never adopted as a part of the HDP. During the development of the HDP, the materials for public discussion included a map that purported to depict the dividing lines between each of the three geographic areas of the Plan (“Lower,” “Central” and “Southeast” Hillside areas, respectively). This map was attached to the Ashburn letter as its Exhibit 3.

The uncontested fact is that the final, adopted HDP did not incorporate this map (*or any other map*) that specifically delineated the dividing lines between each of its three Hillside districts. Instead, the final HDP adopted narrative geographic descriptions for the three districts. *See* HDP, pages 2-9 through 2-12. Neither the generalized map in the draft Plan (nor in any later version of the Plan) was ever adopted in the final HDP. In short, the map that is the Ashburn letter’s centerpiece has no authority.

The geographic narrative description of the Central Hillside District (HDP, p. 2-11) encompasses the location of the subdivider’s proposed Lewis & Clark Subdivision. The final Plan used narrative descriptions, and not a map, to delineate the Districts. It would therefore be error on the Commission’s part to conclude that the subject tract does not lie in the Central Hillside District, based on a map that was in the draft HDP, but which was never adopted as a definitive delineation of the three Hillside districts in the final, adopted Plan.

C. The un-adopted map does not aid the subdivider's argument. Even if the draft map depicted the Lewis & Clark tract as being in the Southeast Hillside District (rather than in the Central Hillside District), the result would make no difference regarding the Plan's policy directions to "maintain existing land used designations" and "maintain existing zoning" in the two districts. The Ashburn letter argues that if the Lewis & Clark tract were determined to be in the Southeast District, the HDP's policy of "maintaining existing zoning" would not be applicable – and thus the Commission would be free to consider re-zoning the Lewis & Clark parcel to a higher density (*i. e.*, smaller lots), while still maintaining that District's "existing land use designations."

Taken as a whole, the relevant text of the HDP does not support this argument. The central question is whether there is actually a significant, intended difference between the Central and Southeast Districts regarding the policy of "maintaining existing zoning," which is clear and definite enough to give the Commission a green light to change existing zoning in the Southeast District, but not in the Central District. The overriding consideration must be whether the proposed rezoning (in whichever District) is consistent with the goals and policies of the Municipality's adopted comprehensive plan for the area in question – which in this case is the 2010 Hillside District Plan. *Griswold v. City of Homer*, 186 P.3d 558, 562-64 (Alaska 2008).

After examining the policies and background statements pertaining to the two districts, I have found no relevant legal distinctions between them that involve the Plan's requirement to "maintain existing zoning." The only difference between the two is that in the Central District, its one-sentence Policy 1-C contains the requirement to "maintain the same land use designations and zoning." The Southeast's Policy 1-B does not specifically mention "zoning" in its one-sentence policy statement that requires a policy to "maintain policies for the amount of development allowed under current land use designations." HDP, p. 2-9.

However, the more expansive, explanatory "Background" text describing the Southeast Residential District states clearly,

This plan maintains existing residential land use designations *and zoning* in the southeast Hillside.

HDP, p. 2-10 [Emphasis supplied]. Therefore, it is not possible to draw any meaningful, intentional policy direction about "existing zoning" from the Southeast Hillside District

policies that would permit changes from “existing zoning” in that District, where comparable zoning changes would *not* be permitted in the Central District.

The “Background” statements for both the Southeast District and the Central District (HDP pages 2-9 through 2-11) describe in detail the similar topographical and resource challenges that had compelled the HDP to decide that unless specifically authorized, the pre-existing zoning was to be maintained in both Districts. The stated words of Policy 1-B cannot be seen as conclusive in isolation, because the background statement that the HDP “maintains existing zoning in the Southeast Hillside” would, as a result, be rendered meaningless.

Policy B-1 cannot be read without considering its more explanatory “Background” statement, which clearly *requires* the maintenance of existing zoning, as well as its existing residential land use designations. The two subjects go hand-in-hand, just as they do also in Policy C-1 and the Background for the Central Hillside District where, in its “Background” paragraphs, the statement is made that “no changes in zoning are proposed;” HDP, p. 2-11.

If the absence of the words “existing zoning” from Policy 1-B were intended by the Plan to signify an important broadening of the Commission’s latitude to change zoning in the Southeast Hillside District, the adoption of such an important policy direction would have been highlighted and explained in the Background of Policy 1-B.¹ However, there is nothing of the sort in the Background for Policy 1-B. Instead, that Background statement contradicts any presumed approval for zoning changes (as advocated in the Ashburn letter), and this Background statement only alters the existing *status quo* in the matter of a public sewerage boundary involving one discrete sub-area of the Southeast District.

¹ A likely reason that the Policy Statement for the Southeast Hillside District did not contain the specific words, “maintain existing zoning,” is that in one discrete area of this District (the Greece Drive area), the Policy recommended a westward shift of the Maximum Perimeter of Public Sewerage boundary. This shift would require that the existing zoning (R-1A) in the area affected would need to be changed to a less-dense zoning that requires sufficiently large lots to permit on-site water and sewer installations. HDP, pp. 2-10 – 2-11; Map 2.2. This boundary change is explained in the “Background” for Southeast Hillside District Policy 1-B. Aside from this boundary adjustment, the “Background” for Policy 1-B makes clear that this District’s Policy “maintains existing residential land use designations *and zoning* in the southeast Hillside,” HDP, p. 2-10. [Emphasis supplied].

D. Conclusions. After reviewing the draft district map that was not adopted in the final Hillside District Plan, I have concluded that it does not support the requested determination that the subject Lewis & Clark parcel lies in the Southeast Hillside District, rather than in the Central Hillside District. The narrative descriptions of the Districts that are contained in the adopted Plan must control over a map depiction (and a methodology for describing the Districts) that appeared in the draft of the Plan, but that were not carried over into the final, adopted Plan.

After reviewing the Policies and the "Background" statements for both the Southeast Hillside District and the Central Hillside District, I have concluded that the Policy and the related "Background" for each of these Districts clearly requires that "existing zoning be maintained," except in the Greece Drive area of the Southeast Hillside District. The fact that the HDP was adopted as a comprehensive plan by the Assembly in 2010 must significantly constrain the Commission's discretion to consider any change to "existing zoning" in the proposed Lewis & Clark re-zone application, File No. 2017-0072, without exceeding its administrative authority.

Therefore, from the standpoint of the Commission's lack of freedom to change the zoning in either of the districts without violating the Hillside District Plan, it would make no practical difference whether the subject Lewis & Clark Subdivision is correctly located in either the Southeast Hillside District, or the Central Hillside District. Under the Plan, neither District's goals permit the change of zoning from that which existed when the Plan was developed and adopted.

Thank you for taking these observations into account, when the Planning and Zoning Commission considers re-zone application 2017-0072.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Thomas E. Meacham". The signature is fluid and cursive, with a long horizontal stroke at the end.

Thomas E. Meacham

2017-0072

Jamie DuPaul-Ferguson jferguson@gracechristianalaska.org 907-770-1411 5/27/2017 12:19:34 PM
13331 Brant Way
Anchorage, AK 99515

My name is Jamie DuPaul-Ferguson. I was raised in Alaska since I was 2 years old. I have lived in Anchorage for over 20 years. I love the hillside and have often wanted to purchase there but it was always too expensive. I have read the proposal and I believe that this is a great opportunity for our community. They have put a lot of thought into this project and have had extensive studies on the land. I hope you allow this project to go further.

John Ferguson john.ferguson@alaska.gov 907-770-1411 5/27/2017 12:25:36 PM
13331 Brant way
Anchorage, AK 99515

My name is John Ferguson. I have lived in Anchorage since 1988. I am a court service officer and work for the Troopers. I have hiked the hillside for many years and approve of this rezone as proposed. My wife and I have looked at property on hillside in the past years and have been very discouraged at the available lots. The majority of the remaining lots on hillside are way too expensive for us. The lot available are either too steep, bad soil, or as stated, too expensive. I hope you approve of this project. 1.5-2 acre lots would be affordable and would further benefit our community.

Angela LeBoeuf ericleb@alaska.net 907-830-3487 5/27/2017 3:37:12 PM
PO Box 110982
Anchorage, AK 99511

I am a 23 yr Anchorage resident and have had the pleasure of enjoying recreational activities around the hillside throughout the years. I have seen this property myself and it is very beautiful with outstanding views of the inlet. This expanse of land can easily accommodate the 30 lots requested for rezoning and each family can still feel secluded, but not alone. I, personally, would not be interested in 4-5 acre lots, as the upkeep could get overwhelming. Any person that wanted that amount of land could purchase 2 lots together to meet that goal if they desired.

I personally know the families seeking rezoning and they are long time residents here (30+ years), and truly love Anchorage and Alaska. They are not lent to hap-hazard building, and are not in that line of work outside of this area. They seek only to establish a well thought-out community for themselves and other families to relax and enjoy all that hillside living offers, and a beautiful area to call home, as many hillside families currently enjoy. Please rezone for 30 lots as requested.

Frank Pugh, Jr. steamboat_000@aol.com 5/28/2017 1:27:07 PM
Anchorage, AK 99516

We moved to Anchorage in 2006 for work and found that nice affordable homes with even a small amount of land are very difficult to find even on higher than average financial earnings. I have also heard that Anchorage is in short supply of buildable land, a situation that could be alleviated somewhat with better potable water and sewerage handling techniques and technologies to at least slightly increase development density. I believe the focus of the evaluation should be based more on technical aspects and feasibility than it seems to be based on opinion, innuendo, and desire to limit development. Hopefully, this application will be handled in an open, fair, and unbiased manner by the Municipality.

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MAY 26 2017

PLANNING DEPARTMENT

2017-0072

Chris Gionet

11334 Tulin Park Loop
Anchorage, AK 99516

cgionet@gracechristianalaska.org (907) 562-5802 5/25/2017 2:58:12 PM

My name is Chris Gionet and I moved to Alaska in 1996. I have lived in Anchorage and have enjoyed the Hillside in many capacities as a resident, coach and father. I have witnessed many neighborhoods go up over the years with some good and some not so good planning schemes. I have reviewed the plans, reports and studies and I am impressed with this Lewis and Clark Rezone.

This group of developers have certainly done their research in the areas of environmental, socioeconomic and transportation impacts. Our great city is growing and this plan fits the needs of positive community building.

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MAY 25 2017

PLANNING DEPARTMENT

FLATTOP TECHNICAL SERVICES

CIVIL & ENVIRONMENTAL ENGINEERING * ENERGY CONSERVATION & ANALYSIS

TED MOORE, P.E.
PH./FAX: (907)345-1355
E-Mail: tgmoore@gci.net

14530 ECHO CANYON ROAD
ANCHORAGE, AK 99516

May 24, 2017

Francis McLaughlin
M.O.A Planning Department
4700 Elmore Road – P.O. Box 196650
Anchorage, AK 99519-6650

Re: Lewis and Clark Subdivision Application – File # 2017-0072

Dear Mr. McLaughlin:

I have reviewed the information pertaining to soils suitability for septic systems that was provided by the developer of the proposed Lewis and Clark Subdivision, and wish to offer the following comments.

By way of background, I am a registered professional civil engineer with over 25 years of experience conducting soils tests for septic systems, focused primarily on the Anchorage Hillside area.

A careful review of the report and 2016 soils data submitted by the developer's consultant reveals numerous errors, inconsistencies and improbable data, which raise red flags regarding the overall validity of this analysis. Several of these discrepancies are itemized as follows:

(1) Each of the 2016 test hole soils logs shows virtually identical soil stratification, with exactly the same silty sand and silt with gravel material underlying the surface organic layer. In my experience, the soil stratification in most test holes dug anywhere on the Hillside tends to vary significantly within a short distance, so the chance that nearly identical soils would be encountered in 21 consecutive test holes dug on this parcel seems highly unlikely, to say the least. In fact, the soils test logs included in this report which were prepared by other engineers reveal significantly different soil stratifications including several instances of soils unsuitable for septic systems.

(2) The percolation test data reported for every test hole states that the observed percolation rate was identical for each of the three required measurement intervals. In my experience this rarely happens; the apparent percolation rate usually tends to vary somewhat over each measurement interval.

(3) In numerous instances, the description of the location of the test hole on the lot does not correspond with the location plotted on the site plan.

(4) Soils data for 5 of the apparent 26 test holes is not included in the report.

(5) It appears that the reported date of 10/22/10 shown in the lower right corner of each test hole log is probably incorrect.

The foregoing discrepancies are troubling in that they cast doubt on the overall professionalism of the petitioner's soils analysis. In my opinion, it would be appropriate for the Municipality to require 3rd party verification of the accuracy of these findings. It would also be appropriate for the Municipality to insist upon independent determination of this spring's seasonal high water table measurements in each of the test hole monitor tubes.

Sincerely,


Ted Moore, P.E.

2017-0072

Janet Roberts

notoak@gmail.com

907-240-9331

5/25/2017 10:55:44 AM

4020 65Th Ave
Anchorage, AK 99507

My husband and I are life-long Alaskans and love Anchorage and the ambiance it portrays with both rural and smaller sub-divisions throughout. Upon arriving in 1968 and going to school at Service and East there was lots of room for everyone to spread upwards and outwards, but as I have had children and grandchildren graduate, those choices are limiting. The next generation is looking for acre size dreams not so often being able to afford four plus acreage like a few of us years ago. I have to let you know that I have looked at this proposal and clearly see that having a nice community for 30 families makes a lot more sense than a exclusive 4-5 acre parcel neighborhood for 15. We could never afford the large parcels on Upper Dearmoun, but with this new plan, my children and grandchildren actually have a chance at an Anchorage Hillside dream.

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MAY 25 2017

PLANNING DEPARTMENT

May 24, 2017

Francis McLaughlin
Senior Planner / Planning Division
Community Development Department
Municipality of Anchorage
4700 Elmore Road
Anchorage, AK 99516 – 6650

Dear Mr. McLaughlin,

I am writing on behalf of myself and my husband, Mark Morrison, regarding the Lewis & Clark subdivision and their R-8 to R-6 rezone application. We live at 8600 Spendlove Dr. – about 350 feet directly north of the proposed L&C subdivision. We strongly object to this rezone request for the following reasons:

1. The rezone does not comply with the Hillside District Plan (HDP)
 - a. It is not compatible with adjacent development because many lots were developed before the HDP and would not be allowed today.
 - b. The HDP, Policy 1-C and Map 1.2 give clear guidance to maintain current zoning for the Central Hillside Residential Sub-Area.
 - c. The new 2040 LUPM has not been adopted and can't be used to justify R6. It will not override existing zoning and it refers readers to the HDP text for clarification.
 - d. The developer's use of a map (p.53/434) from the Public Hearing draft of the HDP was NOT adopted in the final version and should not be used to adjudicate this case.
2. L&C wants to be compatible with its surrounding neighbors regarding zoning.
 - a. I am all for this! 95% of the surrounding zoning is R-8, R-9, or R10. These are the zones they should be compatible with – and retaining their current R-8 zone. Please see attached Zoning Map.
 - b. HDP Policy 1-B and Map 1.2 for the SE Hillside Residential Sub-Area also promote maintaining the current zoning as in 1-C. See HDP p.2-10, 3rd paragraph, "This plan maintains existing residential land use designations and zoning in southeast Hillside."
3. Environmental
 - a. Soils
 - i. There is a large discrepancy between where the S4 Group mapped their testhole locations and where I geotagged their locations. Please see attached Testhole Map.
 - ii. Ted Moore, PE, also notes this discrepancy.
 - iii. Some testholes show multiple digs – am assuming to find a testhole that will provide acceptable perc values. Is it right to dig perc holes until a company finds a perc that will work?
 - b. Poor land stewardship.
 - i. The developer has repeatedly spoken of their constant care of the land and of how they will be such great land stewards. We have found this to be far

from it. Large, old trees are now stumps. Several of the roads are deeply rutted. A stream was never protected. I couldn't find the drainage areas as there was no protection of them. Please see attached Environmental Map.

c. Water

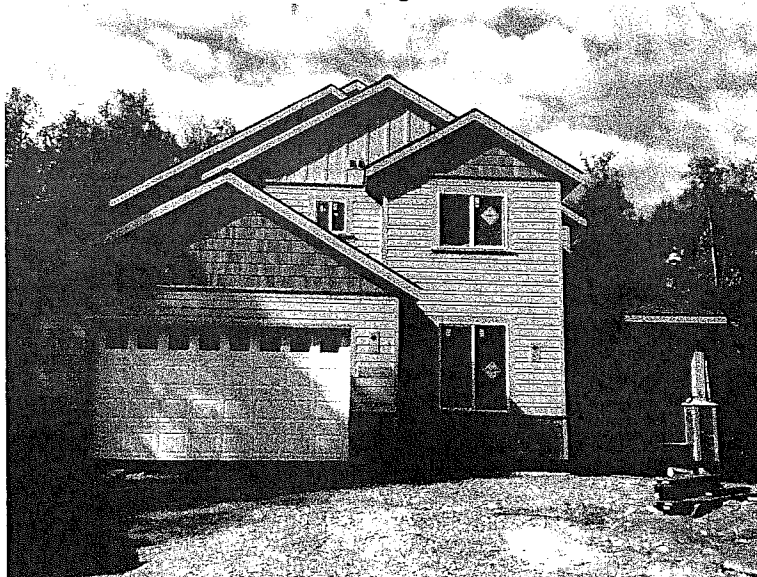
- i. They allowed a well to leak over 250,000 gallons of water. They knew the well was leaking and chose to do nothing about it. Only when a group of us walked the land – and were seen on their game camera – did they do anything about this well. It was properly capped the following day. They knowingly wasted over 250,000 gallons of water. There are many people in this neck of the woods with very shall wells. Please see the attached Environmental Map.

d. 80% Native Vegetation – highly unlikely

- i. We find it highly unlikely that 80% of the native vegetation will be preserved. If you walk this property as it is now, you will see that about 20% has already been removed. Add 30 large homes (3,000 – 5,000 sq ft) with attached garages and other miscellaneous buildings such as shops, horse barns, RV garages, etc., and there will be about 20% native vegetation left.

4. Dense Housing

- a. My husband and I purchased our land and built our home on our lot. This is our dream lot and our dream home. It is so peaceful up here. And we love our eclectic neighborhood where everyone's home reflects their personality. We like the look and feel of our neighborhood. We don't want to live in a cookie-cutter neighborhood. The developer's last business partner was Hulquist. Again, we don't want it to lose our neighborhood charm by having what we consider dense housing with these types of houses. It would permanently and irrevocably change the look and feel of our neighborhood.



- b. Please see attached House Footprints Map.

- c. The developer can easily make millions of dollars on an R8 property. All he has to do is "be the bank." Build a house, sell it, roll the profits back into building another house. Build it, sell it. Wash, Rinse, Repeat. Pretty soon – maybe 6 or 7

houses – they are free and clear. Houses built from now on are pure profit. So, this whole rezone comes down to greed – at the neighborhood's expense.

5. Road

- a. The MOA has referred to Upper Dearmoun as a substandard road. They got this right! In one particular spot, I must drive only 25 mph in order to keep my 2 giant Alaska malamutes from bouncing around, hitting their head on the top of the car. (speed limit is 40 mph) There are other spots in the road where I must slow down to 30 mph.
- b. There are so many tar snakes on our road that when I ride my motorcycle down the road on a rainy day, I clench my teeth. The wet tar snakes cause my motorcycle to slip all over the road.
- c. Additional traffic of 286 cars each day – per the developer – is an exorbitant amount of additional cars on our substandard road. And there is no money to fix or upgrade this road. You can be sure that the developer will do everything in their power to keep from paying anything to support our road system.
- d. At one assembly meeting they tried to appease the neighbors by stating they would put in a bike path to keep us from being hit by the additional cars. This has not been sketched in on their latest & greatest plat submittal. As always, when questioned by the neighbors, the developer always says “oh, this is just a concept plat. It's not what things will really look like.” There aren't even 30 lots on the “concept plat”.

6. Well & Septic

- a. Septic - The developer has decided to use advanced systems - Advantex. We know two people in this area who have this system. For the past 2 years they have tried to link their system to the monitoring company's system in the Lower 48. They have not yet been successful.
- b. Well – Developer seems to be going for a community well. We all know that community wells have massive problems. My friend lived in Potter Marsh and I have friends that still live there. They are always having issues with their community well – lack of water, lack of water pressure, chipping in additional monies for repairs and other well issues. I also understand that the MOA is not too keen on community wells, either.

7. Drainage

- a. This is a tough one. This area is so wet already. Very little topsoil covering silt and other impermeable or semi-impermeable soils. I sure wouldn't want a driveway that points uphill! Please see attached House Footprints with Contours Map.

Thank you for your time, Francis. Call me or email me should you have any questions.

Kind Regards,



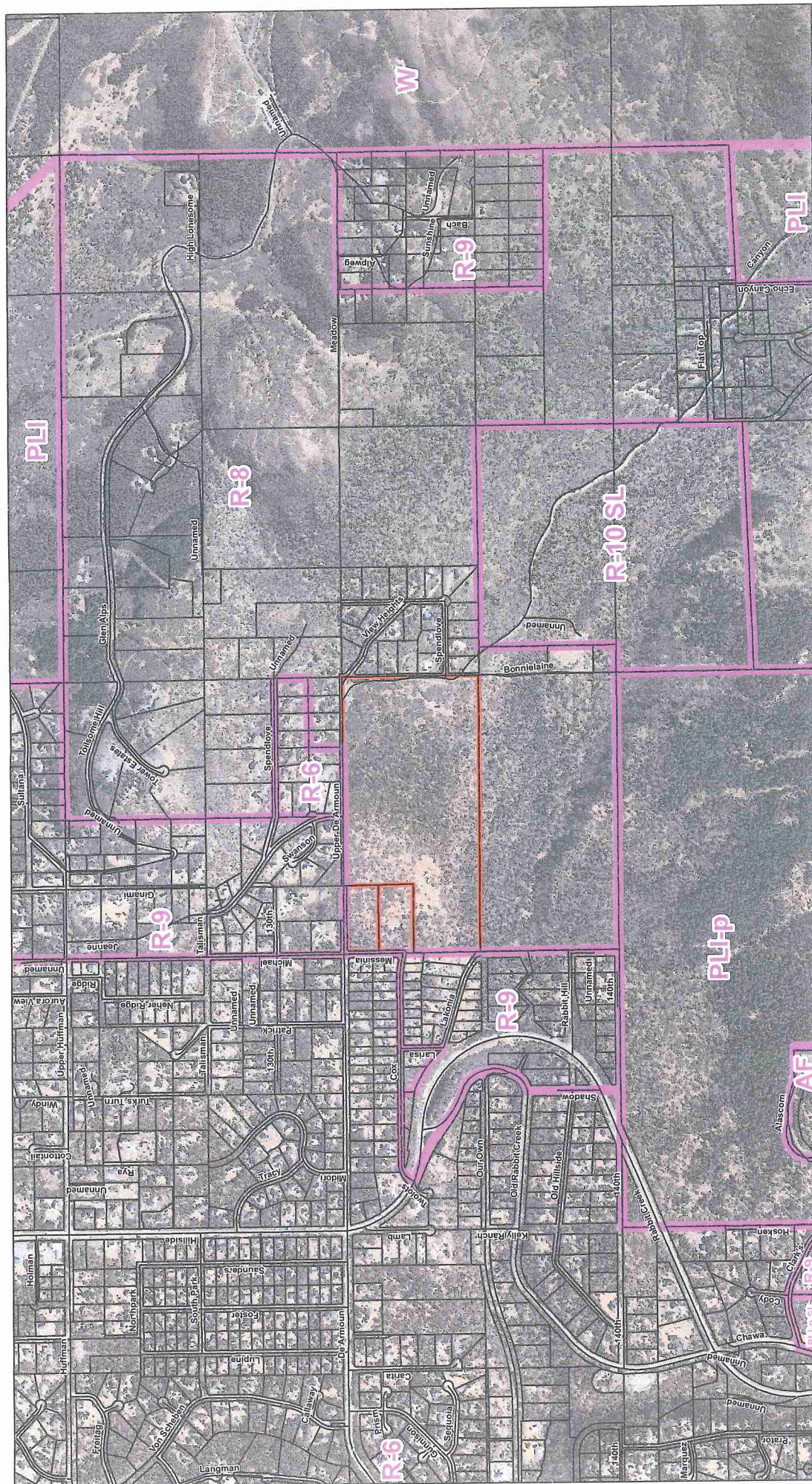
Gail & Mark Morrison

8600 Spendlove Dr.

Anchorage, AK 99615

v. 907.333.2750

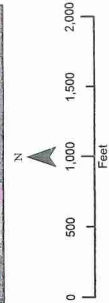
gmorrison@alliedgis.com



- Proposed Redevelopment Parcel
- Zoning Boundary
- Parcel
- MOA Street Segment

**Proposed
Redevelopment Parcel
with
Surrounding Zoning**
DRAFT

Coordinate System: NAD 1983
StatePlane Alaska 4
FIPS 5004 Feet
Projection: Transverse Mercator
Datum: North American 1983
Units: Foot US



Date: 5/24/2017 **Zoning Map**

Document Path: F:\Alled GIS\GIS_Data\MOA\MXD\30 parcels and surrounding zoning.mxd



Wellhead leaking 1.3 gallons per minute Developer knew it was leaking. Over 250,000 gallons of water released.



Unprotected Drainage - you can see tire tracks directly over the drainage



Deeply Rutted Road



Deeply Rutted Road



Deeply Rutted Road



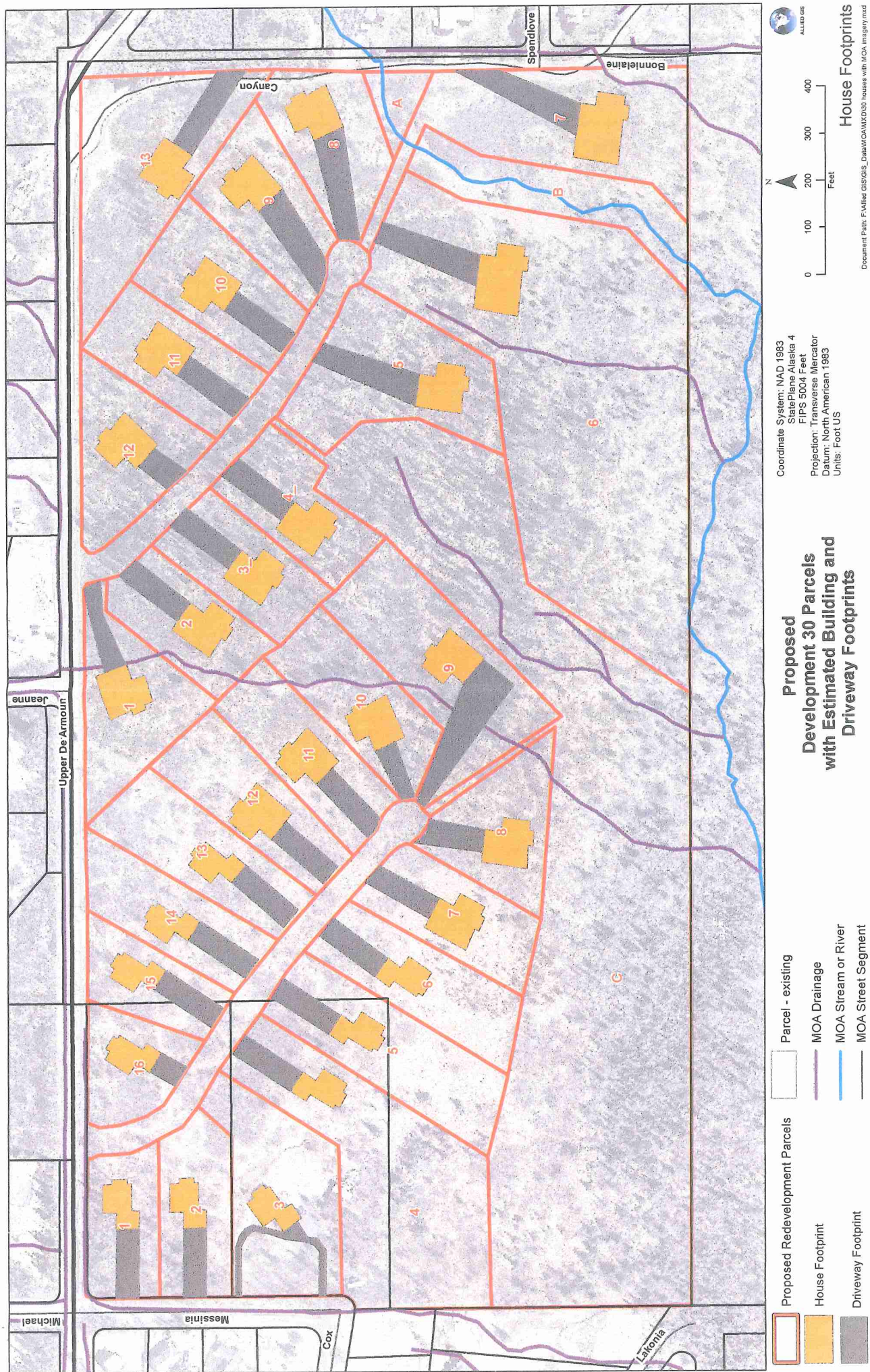
L-8 - Multiple Testholes Dug

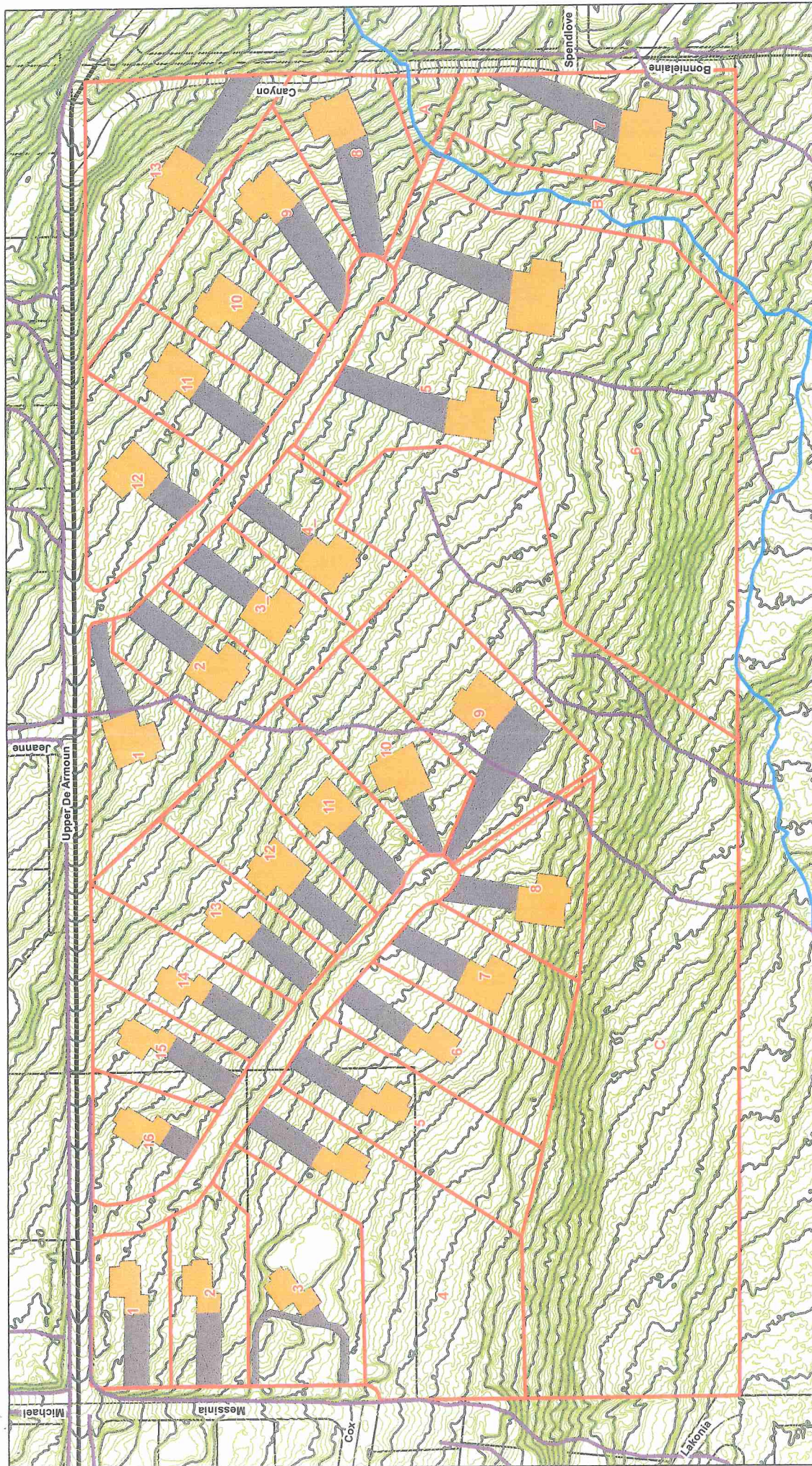


TH 11 - Multiple testholes dug



Proposed Redevelopment Parcels with Environmental Pictures taken May 15, 2017





McLaughlin, Francis D.

From: joan priestley <onecreativedoc@yahoo.com>
Sent: Wednesday, May 24, 2017 1:40 AM
To: McLaughlin, Francis D.
Cc: Hart, Hal H
Subject: thoughts on a recent development proposal

Dear Mr. McLaughlin and Mr. Hart,

Recently Big Sky enterprises has submitted a proposed plan to rezone a large (80 acre) R-8 parcel down to R-6, for the Lewis & Clark Subdivision off of Upper DeArmoun Road and Messina, in south Anchorage.

In addition to the problems with soils that are marginal to poor on their acreage, the developers are asking the Planning Department to ignore the Hillside District Plan, and approve the excessive development pattern that was allowed to despoil our Hillside area, before the advent of the Hillside District Plan.

As you know, the Hillside District Plan (HDP) was created at a cost of \$2,000,000. It also involved uncountable hours of manpower that went into the drafts, discussions, hearings, workshops, professional consultants, public comments, meetings of the Community Councils, citizen volunteer committees and legislators. The HDP was formally adopted by Anchorage Assembly ordinance 2010-22. The HDP states clear and firm policy goals and objectives, that are to be followed, unless there are very compelling reasons to deviate from these mandates. The Big Country plan simply does not provide any such overriding reasons.

In addition, Title 21.03.160E states the principles that every rezone application must meet. This statute allows a rezone only if the proposal meets ALL of sections 1-9. The Lewis & Clark project fails to meet many of those provisions; therefore, the proposed rezone should not be approved.

To highlight a few of the failings of this proposal:

E1- (Best interest of the citizens) This subdivision will be over developed, with an excess density of 30 high end houses. This plan really does nothing to promote the "public health, safety and welfare," or serve "the best interests of the citizens," because it fails to provide the type of affordable housing that Anchorage really needs, with city sewer lines, and transportation, employment and shops nearby. Our Hillside area provides none of these needs.

E2, E3 and E4- I have studied the HDP extensively. Policy 1B and 1C of the HDP both clearly intend for the protective R-8 designation to remain in place, for the future. The development certainly is not in conformance with the comprehensive plan, that was created specifically to lead Anchorage to more sustainable and sensible development. The 2040 Land Use Plan (and map) has not been adopted, and it does not supersede the Hillside Plan.

Also, the developers misstated HDP Policy 5 ("compatible in scale with adjacent uses"). The surrounding lots that are zoned R-6 were developed long before the HDP was put in place. They would have zero chance of being approved as R-6 parcels, now. However, Big Country expects the Planning Department to allow it to revert back to the short-sighted and excessive type of development that has already caused irreversible damage and physical problems, adversely impacting the quality of our neighborhood.

E6 and E7- (no significant adverse impacts on the environment or on nearby land uses) This over dense development will not comply with these two mandates. Developers have provided numbers that appear to be inaccurate and/or misleading. Moving northeast to southwest, the parcel's elevation drops by over 300 feet. This is more than the mild "5% to 15% slope" stated in the Narrative (page 5) of the application.

In addition, the developers refer many times to their “average lot size” of over two acres. In reality, they have stated to us that they intend to reserve several very large lots (up to 9.4 acres) for their own use, so most of the other houses will be crammed into lots that are barely over an acre in size. However, many calculations are based on this unrealistic “average lot size.” So their numbers may not apply at all, given the actual lot footages.

Also, the Drainage Impact report states that the new drainage will be just a “minor increase.” There will be “a minimal change in the impervious areas,” with an increase from 3.3% to 6.1% (page 5). From this description, it sounds like the “minor increase” is only slightly more than present values. In reality, the present amount of 3% will increase to almost twice the current extent of impervious footage. We already have significant runoff problems every year. The effect of this magnitude of increase is not known, but it could have a very adverse impact on the surrounding neighborhood.

E8- The proposed rezone definitely “extends or exacerbates a land use pattern that is inconsistent with the HDP.” The Plan’s clear language (especially Policy 14) calls for maintaining present density, and discourages over development in the Hillside area. The present R-6 lots predate the HDP, and are inconsistent with the mandates stated in the HDP. This new plan just perpetuates that inconsistent usage.

Moreover, if this rezone is allowed, Big Country could easily acquire yet another partner, and annex the adjacent 80 acre spread. The developers now would have a reasonable expectation that the Hillside District Plan has been made irrelevant, and no longer applies to the Hillside, so one more rezone to R-6 should be allowed.

In summary, I recognize that there are few tracts left in Anchorage to develop. I and the other Hillside residents certainly support responsible development, that complies with the Hillside District Plan and does not change the character of the neighborhood. We acknowledge that the developers absolutely have the right to finish out 4 acre lots as an R-8 zone project. None of us would be opposed to such a development plan.

But this project, as envisioned, does not comply with the Hillside District Plan, and will irreversibly and negatively alter the neighborhood. Therefore, I urge the Planning Department staff to demonstrate that they support the Hillside District Plan, by not approving this request to ignore the clear directives contained in the HDP.

Thank you for your consideration of these thoughts.

Sincerely,

Joan Priestley, M.D.

McLaughlin, Francis D.

From: joan priestley <onecreativedoc@yahoo.com>
Sent: Wednesday, May 24, 2017 3:47 AM
To: McLaughlin, Francis D.
Subject: Lewis and Clark research

To Mr. McLaughlin

From: Bern Davis, Jeanne Road

Dear Sirs,

I live very close to the Lewis & Clark proposed subdivision. I have personally walked all over the neighborhood several times, soliciting feedback about this plan, starting back with the earlier proposal in 2014. The position of the residents is striking- there has been, and now still is, unanimous opposition to this plan. I have not found one home owner (besides the developers) who supports this proposal, or thinks that it will benefit the area. We all recognize that even the new proposed plan goes against the carefully crafted guidance in the Hillside District Plan, and it will change the neighborhood in a way that can never be reversed.

We are also very concerned about the quality of soils in the subdivision land, and the impact that such over development will have on several environmental issues that are hard to contend with, even now. The numbers that the developers use, to try to minimize several potential environmental impacts, keep changing and are not necessarily reliable. Thier figures are theoretical, speculative projections about the future, whereas many houses now have moderate to severe runoff, glaciation and septic problems every year, even without this dense housing development.

For the last project, the extensive soils analysis read "the majority of the proposed subdivision has marginal to impermeable soils, with a perc rate of > 120 minutes per inch at four feet" See the Garness Engineering Soils report, p,131 of the Muni Staff Report, that recommended denial of the project.

Back then, only 6 lots (all right near DeArmoun Road) qualified for a conventional septic system. 5 lots failed the tests entirely, and were deemed to be unsuitable for development (they are now lots 4,5,6,7,8 and 9 in the new application plat). These test results do not support the developers' proud claim that all the lots test just fine for a conventional system, and they are just being generous and conservative, by adding a Special Limitation of Category III septic systems. In reality, they have no other choice, if they want to put any houses on this parcel, at all.

Now, however, the sparse, one page soils report from Northrim Engineering in the new application simply reads vaguely that the soils in the subdivision are "consistent with the soils in the surrounding subdivisions." It has no discussion at all about the perc rates, failed tests or undevelopable lots- even though the original Garness data sheets are included with this report. It also makes no mention of the impermeability problems that the Garness firm uncovered. Surely the soils of the entire project did not change that much, in the one year between the old and new testing.

For the above reasons, among others, I and the entire rest of the neighborhood remain opposed to this project. Please do NOT vote for approval of this proposal. R-8 was put in place to protect and preserve the present character of the neighborhood.

This plan to undo the hillside District Plan and change to R-6 excess density on small lots will only be detrimental to our peaceful and rural area.

2017-0072

Buster Bryant

8820 Spendlove Drive
Anchorage, AK 99516

oneofthebryants@alaska.net 348-8900

5/22/2017 8:09:10 PM

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MAY 22 2017

PLANNING DEPARTMENT

My name is Buster Bryant. I am a retired geologist. I have lived in several areas of Anchorage, including Bear Valley for 4 years, and Spendlove Drive (the one parallel to, and north of, Upper Dearmoun) for the last 26 years. From my 30 years on the Hillside, I am very aware of potential, and real, problems with small lots there. As a result of a pre-sale home inspection, I found out that my house in Bear Valley had a marginal well, and the septic system had failed. Because of the size of the lot and the soil type/conditions (lenses of sand and clay; i.e., discontinuous water sources and/or seals), the septic had to be replaced with a holding tank. More recently, we had to replace the 20 year old septic system for our current house and at least two other neighbors have had septic problems. Fortunately for us, according to the civil engineer who designed our new system, our 1+ acre lot is probably large enough to support one more system. The point of this personal anecdote is to show the very real problems with small Hillside lots in general. Considering the proposal for the subject property, depending on a lot's size and shape, there may only be space for one system, especially when one must consider setbacks/standoffs from neighbors' facilities and/or property lines. The subdivision could be faced with several failed septs and the attendant probability of groundwater and surface water contamination. In my opinion, the rezoning is not worth the risk of degradation to the local environment. Other concerns that I am not qualified to address are potential liability and financial issues related to failed septic systems and/or contaminated wells.

My other main concern is the likely deterioration of lifestyle for all residents brought about by adding an additional 30 +/- houses on Upper Dearmoun. Everyone obviously moved to this area for different reasons, but many wanted space, quiet, and to avoid the congestion of a more urban setting. Upper Dearmoun is a substandard, rural suburban road, with no sidewalks, many frost heaves, and sections subject to glaciering. The increased traffic volume will accelerate wear on the road, increase the ambient noise level, and significantly increase the danger for pedestrians and bicyclists.

Finally, growth is inevitable, and I realize that there is a shortage of developable land in the Anchorage Bowl. I am not totally against growth - just short-sighted, poorly-planned growth. The owners of the subject property purchased it with their eyes open - they knew the existing zoning classification. If the original R8 classification did not meet their economic metrics, they should not have made the investment. It originally received that classification for a reason. In my opinion, nothing has changed: there are still ephemeral streams and boggy areas; the soil types still vary areally and with depth; and there is still very limited access to the entire Rabbit Creek Valley. The Zoning Commission has reviewed the proposed change in classification, and previously recommended denying the request. I, too, am requesting that this proposed zoning reclassification request be denied. Thank you for the opportunity to express my opinion.

2017-0072

Molly Hayes

5/22/2017 11:28:21 PM

I moved to Alaska about 13 year ago and my husband and I chose to stay here to raise our family because we love the opportunity and community that Anchorage provides. We have grown out of our little house in midtown and considered building on the hillside, but it's difficult to find property. We have looked at the development plans for this property. They proposed lots will be preserving more land than the surrounding subdivisions. The families seeking the rezone are long time Alaskans who are thoughtful and community minded. I support this project and hope you will consider increasing the opportunity for middle income families to be able to build a home on the hillside.

RECEIVED

MAY 22 2017

PLANNING DEPARTMENT

Matthew Peterkin

tinmansmail@gmail.com

907-440-0022

5/22/2017 12:07:02 PM

9900 Slalom Circle
Anchorage, AK 99516

Born and raised in Anchorage since 1961. I have lived in an original log home downtown and recently in the last 5 years moved unto the hillside. There are not many lots left on the hillside, but I was fortunate to find this house. It is almost identical to the Lewis & Clark proposal with the same density, soils, slope etc. I love my neighborhood and actually am at the top viewing down on the rooftops and it has never bothered me since I can still have a gorgeous view. I have worked extensively in Anchorage with the construction trades and see no reason with this proposal for the rezone. Please feel free to contact me.

2017-0072

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MAY 22 2017

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MAY 22 2017

PLANNING DEPARTMENT

May 22, 2017

MOA, Planning Department
c/o Frances McLaughlin, Planner
PO Box 196650
Anchorage, AK 99519

RE: #2017-0072, Lewis & Clark Rezone

My comments on the above rezone are based on the applicant's documents submitted to the MOA in 2014-15 and 2017, the Hillside District Plan (HDP), other relevant MOA adopted plans/codes, and rezone criteria. This rezone does not meet the requirements for approval.

These bulleted points summarize some of the detailed, numbered points further below:

- Tracting out wetlands is a wise decision and should be done no matter what the zoning is.
- The rezone does not comply with the Hillside District Plan (HDP). It is not compatible with adjacent development because many were developed before the HDP and would not be allowed today. Consult 21.03.160E.2
- About 90% of the surrounding subdivisions are zoned R8 to R10. An R6 rezone would extend an inconsistent pattern that is not compliance with the comp plan (see 21.03.160E.2; 21.03.160.8)
- HDP Policy 14 does not promote increasing densities, rather it discourages reducing densities currently in place.
- The HDP, Policy 1-C and Map 1.2 give clear guidance to maintain current zoning for the Central Hillside Residential Sub-Area.
- HDP Policy 1-B and Map 1.2 for the SE Hillside Residential Sub-Area also promote maintaining the current zoning as in Policy 1-C. See HDP p.2-10, 3rd paragraph, "This plan maintains existing residential land use designations and zoning in southeast Hillside."
- The new 2040 LUPM has not been adopted and can't be used to justify R6. It will not override existing zoning and it refers readers to the HDP text (not maps) for clarification.
- Maps should not be used to justify higher densities because map scales and limited colors force zoning districts to be grouped together--both for the LUPM and the HDP maps.
- Applicant's use of a map (p.53/434) from the Public Hearing draft of the HDP was NOT adopted in the final version and should not be used to adjudicate this case.
- Only one voluntary rezone (12 ac.) has occurred in the HDP's SE sub-area since adoption in 2010 (but without full knowledge of available options). Applicant is in error regarding 80 ac rezone in Potter Valley; the HDP moved the sewer line required down-zoning to a lower density.
- Statement is not supported that the rezone won't result in adverse impacts because there are no conditions for keeping 80% of the parcel vegetated (p. 34/434). There are no SLs, reserve tracts,

or plat requirements that would limit disturbance on each lot. Neither does Title 21 require vegetation retention.

- Adverse impacts ARE likely to occur due to soil issues. Statement (p. 48/434) says soil tests support conventional septic systems, yet the SL will require advanced systems. This makes no sense and raises red flags, especially since nitrate levels are reported to be low.
- Potential adverse impacts are clearly noted in the 2015 soils report summary (p.132-3/199) with a strong cautionary note about impermeable soils and ensuring no cutbanks/slopes/roads/driveways impede the required 'mounded' drainfields' separation.
- The maps do not reflect pedestrian paths per 2020 Policy 55, HDP and relevant sections of Title 21. Ensure any plat/re-plat includes these required facilities.
- Recent Title 21 change allowing minimum size of 4 acres instead of 5 in R-8 has benefited the applicant with several more lots.
- An option for a little more density (5 to 20% without a rezone) is available in the HDP's Policy 14-L, which should be codified soon after adoption of the 2040 LUP.

Expanded Comments on Maps and Densities:

1. P.11/434: map showing surrounding number of lots is meant to mislead the reviewer/public. It isn't relevant.
2. P.14/343: Answer to Community Meeting question (10/25/16) was incorrect. The 2040 LUPM has not been adopted. It does NOT call for 1 DUA in this area. Recognize that maps are limited in the number of colors they can use; the map in question rolled several zones together with a legend that reflects the lower and highest zonings per that color.

Thus, maps should never be taken alone as the deciding factor on zoning, rather, consult the text of the HDP and the HDP's zoning map (1.2).

3. P.31-34/434: #4 compatibility with surrounding zoning/development & #8 exacerbates a land use pattern inconsistent with the comp plan —applicant's answer is misleading because much of the adjacent, older, subdivisions with small lots would not be permitted under today's codes & HDP—especially with the resultant drainage and septic problems that have occurred. Consider HDP Map 1.2 and p. 2-10, 3rd paragraph: "This plan maintains existing residential land use designations and zoning in southeast Hillside."

The HDP Policy 1-B stresses that only about 1,700 out of the remaining 6,000 privately-owned acres are deemed developable. There is no contradiction between policies 1-B and 1-C. Policy 1-B included moving the sewer boundary closer to the west, in Potter Valley (which left one developer having to 'down' zone)

4. P.55/434, E-mail of 1-18-17, Schoenthal to Lipson, indicates that the HDP Policy 1-C may be overly restrictive regarding rezoning. But this is a single opinion, not a MOA Legal opinion.

Expanded Comments on Soil Tests, Nitrates and Septic Systems:

5. P.33/434: Statement requiring Advantex septic systems seems odd if the soils tests truly indicate traditional systems will suffice. No developer would require buyers to install expensive septic systems that require annual maintenance fees when it isn't necessary.
6. P.118/434: The reports for nitrates in subdivisions adjacent to this parcel recorded low levels and were not a concern. Therefore, the requirement for advanced wastewater systems does not compute. Even if the rates were of concern, it is well-known that properly sealed well casings keep nitrates from entering wells.
7. P. 61/434 Summary report of Feb., '17 says soil logs are consistent for on-site systems. However, many of the test holes were very shallow and not dug to the depth of traditional septic systems. Several holes did not perc at an acceptable rate. In some cases, repeat tests in the same location—done at even shallower depths—were rated better. How can those results be judged adequate?
8. P. 132/199, Soils Summary, dated 4/29/15 (from the first rezone application)—this report was not included in the current application, however it contains information that should be considered. It stated: “The majority of the proposed subdivision has marginal to impermeable soils (soils that have a percolation rate of >120 minutes/inch) at a depth of four feet . . . Given the impermeable soils (at four feet and/or shallow groundwater) . . . these proposed lots will most likely require the use of platted drainfield sites served by advanced wastewater treatment systems.”

P. 133/199 of the above report continues with a strong advisory: “It is extremely important that the proposed roadways, driveways and house locations are planned for these properties to ensure no cutbanks are created 50 feet below the platted drainfields.” Additionally, the report states that platted drainfield sites are ‘mounded’ and require 3 to 1 slopes that are vegetated. Five lots were listed as appearing to qualify for conventional septic systems.

9. P. 138/199 the spreadsheet of soil test results from 2014-15 is extremely useful for evaluating the soils of this parcel (below).

Dianne Holmes

[illegible]

138

Hal Hart
Director
Planning Department
Municipality of Anchorage
4700 Elmore Road
P.O. Box 196650
Anchorage, AK 99519-6650

Francis McLaughlin
Senior Planner/Planning Division
Community Development Department
Municipality of Anchorage
4700 Elmore Road
P.O. Box 196650
Anchorage, AK 99519-6650

By email: HartHH@ci.anchorage.ak.us, McLaughlinFD@muni.org

Dear Mr. Hart and Mr. McLaughlin:

I write on behalf of myself and my spouse, Karen J. Worbey, in reference to the proposed rezoning of the Lewis and Clark Subdivision. We live at 8520 Spendlove Drive. Our home is across Upper DeArmoun Road from the mid-point of the northern boundary of the tract, and overlooks the lower half of the proposed subdivision. We are deeply opposed to the rezoning of this property from R-8 to R-6 SL.

To be blunt, we are amazed that this proposal is again under consideration, only months after being buried by the Anchorage Assembly. As you know, before the assembly declined to consider, much less approve, this rezoning, the Planning & Zoning Commission unanimously opposed it. And that rejection was preceded by a strong recommendation against it by the municipal planning department. Recently, in response to a question, the developers confirmed that the current application is essentially the same proposal as before, just with more and more recent -- though not substantively different -- technical attachments.

All of which leaves a mere citizen to wonder: When does this process ever end?

Allow me to state our objections one more time.

While the undeveloped property contributes to the wild character of our neighborhood, we always assumed that someday it would be developed for homes. We did, however, expect it would be developed as zoned, with a

maximum of 15 houses, and with consideration for its particular topographic, hydrologic and environmental qualities.

Approval of this rezoning application to double the number of homes would fundamentally change the character of our neighborhood, for the worse.

Before I go into a few of the specific problems with this rezoning, I'd like to note the history of this application.

Before the developers bought their 72.66 acres, they knew the property was zoned R-8. I assume the price they paid was commensurate with the limitations of R-8 zoning. They knew that rezoning from R-8 to R-6 was contrary to the Anchorage Comprehensive Plan and Hillside District Plan. Nevertheless, they proceeded.

At a recent community council meeting, developer Paul Gionet acknowledged that he and his partners had decided to seek this rezoning *before* they bought the property.

The sale was consummated in July 2014. They submitted their initial rezoning application that December. Their decision to rezone was obviously not informed by the topographic, hydrologic and environmental studies of the property, as they were committed to rezoning *before* their soil and water studies were completed, and probably before they were initiated.

This rezoning has, from the beginning, had only one purpose: to increase the profitability of this development. That decision was made without regard for any consideration except economics. And the economics are simple: Buy an R-8 property, convert it to R-6 and create a financial windfall out of thin air.

What we have here are four individuals attempting to enrich themselves by over-developing the land, undermining a rational planning process, and diminishing the quality of life in our neighborhood. To my wife and me, this is simply greed.

That said, there are good reasons for you to reject this request. I'll speak to a few of them.

First, the entire neighborhood opposes this rezoning. There is no mix of pro and con among nearby homeowners (except the one who is part of the project). But don't take this as reflexive opposition to any development. We do not oppose competent development under the R-8 zoning.

For another, Upper DeArmoun is a substandard road, according to municipal criteria and those of us who drive it daily. The portion of the road that would be used by residents of the Lewis and Clark subdivision is a long series of severe heaves, bumps and cracks. If the Lewis & Clark subdivision were to be fully built

out under the current R-8 zoning, daily traffic on Upper DeArmoun would increase by roughly 15 percent. If rezoned to R-6, the estimate would jump to 260 or more car trips a day, an increase of about 33 percent.

The developers like to point out that this road is classified as a “neighborhood collector” and theoretically could handle traffic increases up to or exceeding 500 percent. If you’ve driven the road, you know that’s preposterous.

Every additional car on Upper DeArmoun increases wear and tear. It makes no sense to double the amount of added wear that’s built into current zoning. And that does not consider any additional damage resulting from use of the road by heavy commercial vehicles -- dump trucks, bulldozers, etc. -- that will be required for the construction of twice as many homes.

Still, relatively speaking, damage to Upper DeArmoun Road is the *good-news* aspect of this request. Why? Well, road damage can be fixed. All it takes is money. (Requiring additional public expenditures on repairs does, of course, have the effect of transferring money from taxpayers to the developers.)

Money can less readily fix other, more important issues, like disrupted re-charging of water wells, surface water drainage problems, malfunctioning septic systems, well pollution or altering the flow of water into Rabbit Creek, which runs all the way down to Potter Marsh. Mistakes with these issues could irreversibly damage or diminish the value of neighboring and downhill properties and degrade the environment. (In which case, once again, rezoning in effect would transfer wealth from current residents, or the public at large, to the developers.)

The authors of the Hillside District Plan and Anchorage Comprehensive Plan worked hard to recognize the peculiar features of this area: steep slopes, wetlands, small stream courses and soggy soils. That’s how this property came to be zoned R-8 -- the culmination of an imperfect but ultimately rational process. The threat from this rezoning goes right to the heart of the Hillside District Plan.

If approved, the rezone will directly subvert the effort, embodied in the HDP, to prevent the consequences of earlier shoddy subdividing across the Hillside. The developers in this case argue that the bad subdivision practices of 40 years ago - - which are amply in evidence in surrounding tracts -- should be *revived* for their benefit today. If you permit that, you should plan on every future developer across the Hillside asking for the same special treatment, and reasonably expecting to get it.

In their application, the developers assert that “this rezone will help reduce environmental impacts.” In fact, the property, which the planning department describes as environmentally fragile, is not suited to the proposed intensity of development. It’s obvious that this rezone would *increase* every environmental impact associated with development.

The developers' average Dwelling Units per Acre figures are misleading, to put it kindly. This is a project with a handful of larger lots and a preponderance of small, one-and-a-quarter-acre lots shoved up against Upper DeArmoun Road. Current R-8 zoning requires minimum lot size of four acres, which I understand is actually a reduction from five acres under the old Title 21.

The soil and water studies of the developers' technical professionals, which document soggy ground and a great deal of surface runoff, were produced in atypically dry years and do not reflect historical norms, a fact they either did not know or chose not to include in their application.

According to their request, after development is complete, 80 percent of the project area will be heavily vegetated with mature trees and brush. That is simply not credible. The ground cover and soil-stabilizing vegetation is certain to be reduced by more than 20 percent during development. Then, once the lots are sold, there will be no covenants or limitations preventing buyers from removing as much more of the cover as they choose. Even minimal clearing will increase runoff in volumes and directions that are not entirely foreseeable.

The developers started with the conclusion that the land was suitable for rezoning. Everyone they've hired since has lined up behind that position (although even their most favorable studies suggest the case for rezoning is marginal). The conclusions of the technical professionals seem massaged to advance the interests of their clients.

In the first application, the technical professionals' concluded the property was suitable for 32 houses using conventional septic systems. After that was rejected, they performed additional studies and further analysis and, unsurprisingly, came to exactly the same conclusion for slightly fewer lots reshuffled and presented in a new application. The developers still maintain that their studies show that conventional septic systems would be appropriate, but now they're committing to use the more expensive (though apparently unnecessary?) "advanced" septic systems.

We neighbors do not have the resources to do our own technical studies, so I can only urge you to view the developers' technical submissions with appropriate skepticism.

It's important to keep in mind that the issues we raise do not affect only those of us on neighboring properties. The people who will someday occupy these homes are entitled to a subdivision that doesn't erode or flood, has reliable, pollution-free wells, septic systems not at risk for failure and a road that doesn't loosen their teeth.

Honestly, I can't imagine how this rezoning request could be approved. It would defy reasonable planning and common sense, and deny the interests of everyone involved -- everyone except four individuals who, despite their professed good intentions, seem determined to ignore the concerns of every other affected party in a single-minded pursuit of their economic self-interest.

The Rabbit Creek Community Council has formally voted to oppose this rezoning.

In a straw poll at a special meeting of the Hillside Community Council last week, attendees voted overwhelmingly to oppose this application.

Mr. McLaughlin, Mr. Hart and other members of the Planning Department, please do the right thing and uphold your department's previous work and the considered judgment of the Planning and Zoning Commission by strongly recommending against this rezoning.

Thank you.

Patrick Dougherty & KJ Worbey
pdougherty@gci.net

8520 Spendlove Drive
Foreland View, Block 2, Lot 1
(Parcel ID: 017-401-48-000)

William Cotter
220 Langnes Court
Anchorage, AK 99515

mmd@gci.net

907-223-8328

5/22/2017 10:56:46 AM

I have lived in Anchorage over the last 37 years and I was stationed before that at Fort Richardson. I have seen a lot of changes to the hillside area over many years. I know that we are running out of room to let the next generation like my children, be able to enjoy such a beautiful place like all of us previously have had. I have seen the property and design and I can easily see that this was well thought out and the amount of houses would be well below the current standards of how the other neighborhoods look. I cannot see why this Lewis & Clark development wouldn't be perfect for Anchorage and probably MY kids and grandkids. Thanks

RECEIVED

MAY 22 2017

PLANNING DEPARTMENT

May 15, 2017

To: Francis McLaughlin, Planning Department, Municipality of Anchorage
Re: Lewis & Clark (Upper DeArmoun) subdivision re-zone, Case # 2017-0072

Via Email: McLaughlinfd@muni.org

I am writing to express my opposition to a request by Big Country Enterprises to re-zone approximately 77 acres on the south side of Upper DeArmoun Road from R-8 to R-6. I have been a resident on Upper DeArmoun for 39 years, residing on Lot 2 of Gombart Subdivision, which is directly north of the proposed Lewis & Clark subdivision.

There are numerous springs throughout the adjoining neighborhoods and Rabbit Valley, which drain down into the land under consideration for re-zoning. In years with above average precipitation, these springs run throughout the entire summer, fall and winter. In many winters, glaciation is common throughout the valley.

While some areas of the proposed subdivision appear dry on the surface, other areas, especially east of Jeanne Road, often have standing surface water – even in years of average precipitation. Much of this land is wet and in my opinion is not suitable for R-6 zoning. The potential for winter glaciation and septic system failure is greater with the higher density housing under R-6 zoning.

I would like to point out that recent soil and hydrology studies on the Lewis & Clark parcel have occurred during years of below average precipitation and snowfall, which may give the impression of drier surface and sub-surface conditions than what typically exist in the area.

As a volunteer weather observer and record-keeper for the National Weather Service, I have kept extensive weather records at my location since 1978, including daily, monthly, and annual snowfall. I have also measured rainfall each day from May through October 1985 to present. Beginning in 2006 to present, I measured the water content in the snow at the request of the National Weather Service. As a result, I have annual precipitation for the entire years of 2006 through present.

My records show the average annual precipitation 2006 to 2016 is 23.10 inches and average winter snowfall 1978 to 2017 is approximately 121 inches. During the past three winters, snowfall has been well below normal. In fact, only 33.5 inches fell during the winter of 2014-15, which was my lowest on record. The following winter of 2015-16 was my second lowest on record with 57.5 inches. Due to frequent thaws, little snow had accumulated during both of those winters for extended periods. In both winters, there were periods between January and March when only a trace of snow was present on the ground.

This past winter 99 inches of snow fell at my location, which was approximately 20% below the nearly 40-year average. However, 70 of those inches fell in a six-week period between mid-January and late February, giving the impression this past winter was a big snow season. I have attached monthly and annual snow and precipitation tables to this letter.

Another concern I have with the proposed re-zone is the impact of R-6 zoning in the proposed subdivision on existing and future water wells in the area. There are a number of homes in the neighborhood that have limited water for household use. While surface water from nearby springs is often plentiful, water drawn from local wells is not.

Finally, I would like to express my opposition to the proposed clustering of homes along the northern portion of the parcel. Such a plan would have a serious impact on the existing neighborhood and the rural character of Rabbit Valley. This land was zoned R-8 for good reason, given its rural character, soil, and drainage issues.

Thank you for considering my comments.



Carl Portman
8831 Upper DeArmoun Road

UPPER DEARMOUN PRECIPITATION

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SPET	OCT	NOV	DEC	TOTAL
1978													
1979													
1980													
1981													
1982													
1983													
1984													
1985					1.2	0.8	1.8	2.08	4.25	1.15			
1986					0.4	0.29	2.37	3.41	4.08	3.7			
1987					0.99	2.11	1.64	1.91	4.48	3.35			
1988					1.21	1.36	1.43	2.96	2.45	3.32			
1989					3.36	0.95	2.76	8.33	3.4	5.55			
1990					1.27	1.48	0.6	2.08	6.1	1.87			
1991					0.13	0.47	5.32	2.34	3.5	2.74			
1992					1.06	1.68	1.94	2.99	3.44	3.3			
1993					1.07	0.32	0.74	3.76	5.1	2.7			
1994					1.4	1.41	1.31	1.12	2.48	2.12			
1995					1.33	0.74	3.85	2.04	4.66	1.41			
1996					0.07	0.71	1.39	1.68	2.68	4.05			
1997					1.22	0.97	1.39	8.46	2.27	2.28			
1998					0.88	2.8	1.66	4.6	1.33	0.89			
1999					0.96	1.58	2.18	5.64	4.54	3.86			
2000					0.81	0.82	2.33	3.41	3.67	0.61			
2001					1.27	1	3.71	1.65	2.71	3.24			
2002					0.45	0.89	2.35	4.27	4.19	5.32			
2003					1.73	1.1	1.57	2.32	1.69	3.28			
2004					0.32	0.39	0.62	4.17	6.67	1.9			
2005					0.76	1.35	2.79	4.45	4.94	1.07	2.29	1.98	
2006	0.65	2.65	0.94	1.34	0.82	0.92	2.1	7.06	4.07	2.4	0.1	3.19	26.24
2007	3.06	0.33	0.58	0.58	0.44	0.47	4.04	2.63	6.47	2.02	3.27	0.97	24.86
2008	1.86	1.75	1.31	3.32	0.49	0.65	2.54	1.38	3.97	2.73	2.05	1.36	23.41
2009	2.07	0.93	1.96	0.25	0.91	1.21	1.05	1.85	1.83	2.05	2.13	1.71	17.95
2010	0.39	2.05	1.83	1.33	0.14	1.29	2.6	3.04	1.1	0.98	3.55	1.32	19.62
2011	0.78	0.76	0.25	0.95	0.22	1.34	3.1	3.9	1.17	4.2	3.34	6.74	26.75
2012	2.03	3.45	1.23	0.62	0.35	1.48	1.28	2.41	8.8	2.05	0.18	1.38	25.26
2013	4.43	1.94	2.38	1.47	1.94	0.55	0.75	5.3	6.83	5.18	1.79	2	33.54
2014	2.08	1.23	1.62	0.44	0.97	3.3	2.27	2.89	2.81	1.65	0.37	0.59	20.22
2015	0.86	1.04	0.24	1.46	0.28	0.68	2.07	1.71	5.31	1.54	2.03	2.39	19.61
2016	0.82	1.25	1.3	0.03	0.75	1	2.77	2.92	3.85	0.69	0.29	1.04	16.71
2017	2.25	2.02	0.87	0.48									
AVG	1.77	1.61	1.2	1.02	0.91	1.12	2.13	3.39	3.9	2.6	1.78	2.05	23.10**

*January 2017 precipitation is an estimate, based on Anchorage International Airport water content in snow and snow accumulation at Upper DeArmoun.

**Average annual precipitation 2006-2016

***2017 precip Jan to May 12 is 5.62 inches, average is 5.60. However, season snowfall Sep-May is 20% below average.

UPPER DEARMOUN SNOWFALL

	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	TOTAL
1978-79	0	15.5	9.25	45.5	7	6	38.75	9.5	0	131
1979-80	0	8	25.5	35.25	18.5	31.25	14	9.75	0	141
1980-81	0	24.5	7.75	2.75	5.5	6	12.5	2.5	2.5	61
1981-82	5.5	10	44.5	16.75	0.5	1	8	9.75	3.5	100
1982-83	0	30.5	17.75	5.5	8.25	8.75	0	20.5	0	91
1983-84	0	24.75	0.75	17.5	30.5	34	3.25	37.5	0	148
1984-85	0	2.5	0.5	5	13.5	18.5	15	18	4	76
1985-86	0	3.25	0.5	9	8	9.75	25.75	11.75	1.5	69
1986-87	0.25	0	12	14	32.5	13.5	6.5	5	0	84
1987-88	0	0.5	48	34	5.25	15.5	20	13.75	0	139
1988-89	0	14	44.5	44	21.75	2	6	2	6.5	127
1989-90	0	22.5	16	18	41	25.75	24	2	2	151
1990-91	0	4	10	20.5	2.5	20.5	27.5	0	0	85
1991-92	0	18.5	27.75	55.5	28.5	32	18.5	9.25	4.5	195
1992-93	5.25	29	35.75	32.25	29.75	35	17.5	0	6	180
1993-94	2.5	13	39.75	36.5	7.5	2	55	7.75	0.5	149
1994-95	0	17.5	70	48	16	22	33	0	1.5	208
1995-96	0	8.5	3.5	0.25	3.25	51	9	2.5	0	78
1996-97	0	29	24.25	9.2	6	8.75	9.75	4.5	0	91.5
1997-98	0.5	14.75	17	61	5.75	5	2	8.5	3.5	119
1998-99	0	5	16.25	39	25	13	39	17	2	156
1999-00	0	19.5	11	25	50	15.5	30	4	0	155
2000-01	0	5.5	3.25	13.25	30	22.5	16	4.5	14.2	109.25
2001-02	0	35.75	11	35.5	12	18.25	19	2	1	134.5
2002-03	0.5	0	0.5	41	5	0	8.25	1.5	2	58.75
2003-04	2	0	23.75	40	14	15	39	8	0	141.75
2004-05	6	14.5	28	40	1	23	17	2.5	0	132
2005-06	0	1.5	25.5	16	14.25	25.5	11.25	14.5	3.75	112.25
2006-07	0	7	2	54	53.5	4.5	8.5	0	0	129.5
2007-08	0	9	27	13	33	25.5	11	45	0	163.5
2008-09	0	19	24	22	9	14.5	28	1.5	0	118
2009-10	0.5	4	25	21	4.5	30.5	33.5	14.5	0	133.5
2010-11	0	1	37	18.5	8	9	4	9	0.5	87
2011-12	0	3	45	66	35	45.5	19	7.5	0	221
2012-13	7	8	3	11.5	13.5	27.5	32.5	29.5	10.5	143
2013-14	4	0	14	29.5	9.5	16.5	28	4	0.5	106
2014-15	0	10	3	3	8	1	0.5	8	0	33.5
2015-16	9	4	13	9.5	4.5	5.5	12	0	0	57.5
2016-17	0	5	0	13.5	39.5	29	12	0	0	99
AVERAGE	1.1	11.333	19.67	26.197	16.94	17.69	18.321	8.91	1.8	120.88

8611 Upper Dearmoun Rd
Anchorage, AK 99516

RECEIVED

MAY 15 2017

PLANNING DEPARTMENT

2017-0072

My name is John Oliver, and I live on Upper DeArmoun Rd with my family. I have lived in Alaska since 1983 and on the Hillside since 2008. I live directly across from the proposed development.

I am writing this letter because I am unable to attend the Hillside Community Council meeting. However, the last time I attended the same group presented their "new" plan. What I heard from the meeting is that after purchasing the land, they concluded that the R8 zoning would not be in their financial benefit. The developers had their experts to say everything is fine. However, the Corps of Engineers and other experts have provided information in the past that is in direct opposition to the developers team that it is documented. Moreover, the developers agenda goes against the Hillside development plan.

At the same Council meeting the developers said they wanted to share the wonders of the Hillside with new young families. I have one possibly one of the smallest houses and acreage on Upper DeArmoun. The developers new proposal to R6 has lots twice the size as mine. When I asked them if they would put small 2 bedroom houses on the lots they laughed and said, "of course not." I laughed too, because I knew of course they wouldn't. They are proposing to have lots and homes that will push the half a million mark. And new young families are going to be able to afford that?

After the Council meeting I stood at the front to view what was being proposed and the wife of the main speaker asked me what I thought. I told her that I understood the profit difference for the developers, however, I could see no benefit to me, the environment, or our community. I asked her to provide me just one possible benefit for my family or our community, and she could not give me one.

The Dept. of Transportation has labeled the road as substandard. I run for miles up and down my street, as well as, Hillside drive in both directions. I have just started teaching my boys to do the same. There are lots of community members that walk, run or bike yet there always exists a danger due to the substandard road conditions. The trails and back country access already increases the traffic up and down our road. The Developers have no plan to improve this and will only make this significantly worse. The impact to all community members who attempt to enjoy our neighborhood by being outside will be severely impacted.

At any time, you can find in my yard: moose, bear, porcupine, rabbits, lynx, and a massive assortment of birds. While the R8 will already have a negative impact on the ecosystem, the R6 is certain to destroy it. I have purposefully not put up a fence to allow freedom for all to move through our space. I cannot tell you the magic my kids have experienced because of the wildlife across our street and in our yard. As a younger person, it is extremely disheartening to see it possibly destroyed by financial self interests. As a community, I hope that we continue to support responsible development.

Here we are again as a community, voicing opposition against this development. After attending Planning and Zoning meetings for hours, and then Live Streaming Anchorage Assembly meetings, and then attending the Hillside Community Council meeting, I have a respect all individuals and what they do. It was a learning experience about processes. For that I am thankful. The bottom line is that a small group of developers/investors are looking to benefit financially at the expense of the environment, the community, and individual families. I cannot express or write the significant impact this development will have on my family personally. However, I am part of a larger community that will also be impacted. I urge you to support the community and environment that we all live in and deny the developers proposal.

I appreciate your time and support for the Hillside Community and those of us that live on Upper Dearmoun, Sincerely, John...

RECEIVED

LAW OFFICES OF MARC JUNE
807 G Street, Suite 150
Anchorage, Alaska 99501

MAY 10 2017

PLANNING DEPARTMENT

Telephone (907) 277-5234

Facsimile (907) 277-9120

May 10, 2017

Municipality of Anchorage, Planning Department
Attention Francis McLaughlin,
4700 Elmore Road
Anchorage, AK 99507

Re: Lewis and Clark Subdivision, File 2017-0072

Dear Mr. McLaughlin:

I am a homeowner at 8801 Upper Dearmoun, a land parcel adjacent to the proposed Lewis and Clark Subdivision. I strongly object to this Rezone Request.

This is the same Rezone Request that was rejected 2 years ago (Case 2014-0219). The Planning Department recommended denial of that application. It did not receive a single supporting vote from the Planning and Zoning Commission. Because there was no support for that Rezone Request, its appeal to the Assembly was tabled indefinitely. Revisiting that Rezone Request again, in the present petition, will require a finding by the Planning and Zoning Commission that the Planning Department and the Planning and Zoning Commission were not only wrong the last time around, but were wrong by a lot.

Repackaging the Rezone Request as a R-6 SL ("Special Limitation") request does not change the earlier Request in any meaningful way. The Request still reduces lot size from the existing 4 acres to 1 acre. The number of proposed lots still increases from 15 homesites to 30. The Applicant's promise to build 30 homes instead of 32 homes simply recognizes the presence of wetlands, which preclude more dense development in any case. The proposed "new technology" septic system limitation also adds nothing to help the Request, because septic system adequacy is addressed through the subsequent Permitting/Planning process, regardless of representations made to the Planning and Zoning Commission..

There are many details in the new Rezone Request application which are misleading. One example is its claim of a DUA of more than 2 acres, a figure that is achieved only by including one large lot and some undevelopable land. The reality is that the 30 homes would be stacked up in 1-acre lots against Upper Dearmoun Road and the

Dearmoun/Canyon Road corner. When one imagines 30 Goldenview-style homes stacked like drydocked ships in this manner, there is no question that the proposed development would change the existing character of the neighborhood, and would create additional congestion and traffic problems in the entire Upper Dearmoun/Canyon Road neighborhood.

Focusing on the bigger picture, granting this Rezone Request will simply mean the death of the present Hillside District Plan (HDP). Adjacent owners of other large R-8 parcels further up the Rabbit Creek valley will naturally make identical rezone requests, based on your approval of this Rezone Request. The small, 1-acre neighborhood lots that were created as long ago as the 1970's (before any comprehensive zoning on the Hillside) cannot be used to justify the rezoning of R8 parcels to R6. The overall objective of the Hillside District Plan was to harmonize future home construction with the physical limitations of geography and water/sewer protection. With no meaningful difference between the decades-old, pre-zoning chopping-up of the Hillside and the rejection of the present Hillside District Plan's maintenance of "existing zoning," all of these future large-lot rezone requests could not be denied. With a domino effect of this magnitude, all such rezone requests should be preceded by a comprehensive request to amend the Hillside District Plan, to eliminate its clear large-lot objectives and requirements.

Everyone agrees that Upper Dearmoun Road, while theoretically a collector road, is in a substandard physical condition, and is already overused because of non-local traffic accessing Chugach State Park. Seeking to build 30 homes, when the maximum under existing zoning and the HDP should be 15 homes, will only make this traffic problem worse. Of course, the Rezone Request will deny any responsibility for making the traffic problem worse.

The only "new" information contained in this renewed Rezone Request pertains to water/soils testing, proclaiming that 30 homes – instead of 15 homes in the same space -- will magically not lead to any significant water/drainage/septic issues. There is common knowledge that water/drainage/septic issues exist on nearby properties. Any contrary conclusion is suspect.

In the end, the Planning and Zoning Commission's prior findings, when the earlier Rezone Request for this same tract came before it, remain sound. Increased housing density on this site is unnecessary (Finding of Fact 1). Most of the property has marginal to impermeable soils (Finding of Fact 2). The request for rezoning is inconsistent with the Hillside District Plan, which calls for the current R-8 zoning to be maintained (Finding of Fact 5). The proposed increase in home density is not a good urban plan for Anchorage, which needs more compact housing near employment centers. (Finding of Fact 6). Development as proposed would increase run-off drainage into Rabbit Creek and would add traffic onto substandard Upper Dearmoun Road (Finding of Fact 7).

I have attended a number of presentations by the Developer/Applicant where statements were made about "love for the land," and some nearby lots being 1 acre in size. My response is that, not only were those small lots created prior to current zoning, those lots experience the same water/drainage/septic issues that have prompted the existing R-8 zoning in this entire area. Larger R-8 lots make it much less likely that problems will arise in this fragile environment that will not support high-density development. R-8 zoning is the most appropriate zoning for the area. The Rezone Request, if granted, would only make the problem of -acre, small-lot development worse, and it will lead the owners of other undeveloped R-8 parcels to file rezone applications to ignore the HDP and increase their density.

Most importantly, the Developer/Applicant knew all about these issues and the existing R-8 zoning before he spent a single dollar to purchase the Lewis & Clark property and to twice request a rezoning. The Developer is simply asking to be given a financial windfall at the expense of his neighbors, and sound land-use planning. With the Developer's eyes being wide open during this entire process, there will be nothing unfair to the applicant if this Rezone Request is denied. What was a bad idea in 2014 is still a bad idea in 2017. The Developer should be encouraged to present a project consistent with the existing R-8 zoning on this tract.

Very truly yours,

LAW OFFICES OF MARC JUNE



Marc W. June

MWJ/wws

cc: Hal H. Hart, Planning Director

RECEIVED

MAY 10 2017

Public Comments: 2017-0072

PLANNING DEPARTMENT

Commenter	Email	Phone Number	Submitted
Wayne E. Westberg 12200 Avion Street Anchorage, Ak 99516	w44west.wayne@aol.com	907-440-2536	5/10/2017 8:13:49 AM
<ol style="list-style-type: none"> 1. Anc is rapidly running out of good building sites or this nature and there is a real public need. 2. A well done R6 zoned subdivision in this area would be a continuation of the development conditions and precedents of the south Anchorage hillside. 3. There is adequate water for individual wells and the soils are good for septs in this specific area. 4. R6 lots would not detract from the urban ambiance of the hillside and would actually provide more budget for a well developed subdivision and adherence to the hillside development plan. 5. R8 lots would restrict development budget and thereby reduce the quality of the subdivision. 6. R8 lots would reduce the total value of the tax base for the subdivision. 			

Affidavit of Posting and Historical Information



AFFIDAVIT OF POSTING

CASE NUMBER: 2017-0072

I, Craig Brando hereby certify that I have posted a **Notice** as prescribed by Anchorage Municipal Code 21.03.020H.5. on the property that I have petitioned for Vergason - Jones. The notice was posted on 5-9-17 which is at least 21 days prior to the public hearing on this petition. I acknowledge this Notice(s) must be posted in plain sight and displayed until all public hearings have been completed.

Affirmed and signed this 9 day of May, 2017.

Craig Brando
Signature

LEGAL DESCRIPTION

Tract or Lot 1 & 2

Block: _____

Subdivision: Vergason - Jones

N¹/₂ of SE ¹/₄, Sec 25, T12N, R3W S.M.,
excepting NW ¹/₄ of the NW ¹/₄ of the SE ¹/₄ of
Sec 25, T12N, R3W, S.M.

Submitted by: ASSEMBLY MEMBER JOHNSTON
Prepared by: Dept. of Law
For reading: February 23, 2016
POSTPONED INDEFINITELY 4-26-2016
NOTICE OF RECONSIDERATION WAS
GIVEN BY MR. STARR 4-27-2016
RECONSIDERATION FAILED
ANCHORAGE, ALASKA
AO No. 2016-28
5-10-2016

1 AN ORDINANCE OF THE ANCHORAGE ASSEMBLY AMENDING THE ZONING
2 MAP AND APPROVING THE REZONING OF 72.66 ACRES OF LAND FROM R-8
3 (RURAL RESIDENTIAL - LARGE LOT) DISTRICT TO R-6 (SUBURBAN
4 RESIDENTIAL - LARGE LOT) DISTRICT FOR PROPERTY DESCRIBED AS THE N
5 ½ OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA EXCEPTING THE
6 NW ¼ OF THE NW ¼ OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA,
7 AND LOT 2, VERGASON-JONES SUBDIVISION (PLAT 98-178); GENERALLY
8 LOCATED SOUTH OF UPPER DEARMOUN ROAD, WEST OF CANYON ROAD
9 AND EAST OF MESSINIA STREET, IN ANCHORAGE.

10
11 (Hillside East Community Council) (Planning and Zoning Commission Case 2014-
12 0219)

13
14 **WHEREAS**, the Planning and Zoning Commission passed Resolution 2015-026
15 denying an application to amend the zoning map to rezone 72.66 acres located on the
16 upper hillside from R-8 zoning district to R-6;

17
18 **WHEREAS**, pursuant to Anchorage Municipal Code (old code) section 21.20.100D,
19 the applicant requested an ordinance approving the rezone be submitted to the
20 Assembly for approval;

21
22 **WHEREAS**, Anchorage Municipal Code (old code) section 21.20.120A.3 authorizes
23 the Assembly to approve the proposed ordinance with or without the addition of
24 special limitations or other modifications;

25
26 Now, therefore,

27
28 **THE ANCHORAGE ASSEMBLY ORDAINS:**

29
30 **Section 1.** The Assembly finds the recommended zoning map amendment described
31 herein satisfies the criteria of Anchorage Municipal Code (old code) section 21.20.090
32 and is hereby approved. The zoning map shall be amended by designating the
33 following described property as R-6 (suburban residential - large lot) district:

34
35 The N ½ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska excepting the
36 NW ¼ of the NW ¼ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska, and
37 Lot 2, Vergason-Jones Subdivision (Plat 98-178)

38
39 **Section 2.** This zoning map amendment is subject to the following special limitations,
40 which must be addressed by the Platting Board:

- 41
42 a) The issue of marginal to impermeable soils. (See AIM 137-2015, page
43 2, lines 1 through 9).
44

- i) The Applicant shall submit to the Platting Board in its application that no lots will be platted for residential development that do not meet current codes in regards to well installations; and
- b) The issue of on-site septic systems. (See AIM, page 2, line 7).
 - i) The Applicant shall submit to the Platting Board in its application that no lots will be platted for residential development that do not meet current codes in regards to on-site septic systems; and
 - ii) As a warranty against septic system failure, the Applicant shall establish a Trust Account funded at Ten Thousand Dollars (\$10,000.00) per lot. In the event of a failure of any septic system within five (5) years of the septic systems construction, the Applicant will pay to the home owner from the Trust Account Fund up to Ten Thousand Dollars (\$10,000.00) for the installation of an advanced waste management system; and
- c) The issue of the number of permitted lots. (See AIM, page 2, lines 11 through 25).
 - i) The Applicant shall apply for a maximum of thirty (30) lots in this subdivision all of which shall meet current platting requirements.
- d) The issue of surface water run-off. (See AIM, page 3, lines 17 & 18).
 - i) The Platting Board will require a drainage plan that will address down grade drainage appropriately.
 - ii) The Applicant will construct no residences closer than One Hundred feet (100') to any surface run-off area.
- e) The issue related to the Hillside District Plan (See AIM, page 2, lines 27 through 32 and page 3, lines 10 through 15). The Hillside District Plan provides that "For the most part, retain the status quo in land use designations" (See page 2-1 of the Plan). Staff notes this same policy on page 3 of the AIM. The term "designation" is not used in Municipal Code. Instead the term "classification" is used to describe land uses. The classifications in code are residential commercial, industrial, commercial-industrial, environmentally sensitive land, mixed use and commercial recreation (See AMC 21.05.050-Land use classifications).
 - i) This project shall not provide for any change in the existing land use "classification" which is residential.
- f) The issue of traffic and vehicle trips on adjacent roads as the result of approval of this application. (See AIM, page 3, Lines 18 & 19). Upper DeArmoun is classified as a neighborhood collector (See the Official Streets and Highways Plan, Appendix "A"). A neighborhood collector

“collects traffic from local streets and then conducts it to arterials or to local traffic generators...” (See OSHP page 6). A neighborhood collector is designed to handle 2,000 to 10,000 vehicles per day (See OSHP, page 10). The traffic volume on Upper DeArmoun is far less than the maximum for a neighborhood collector.

- i) The Platting Board may require a traffic impact analysis if the Board determines that such an analysis is necessary and appropriate.

Section 3. This ordinance shall become effective 10 days after the Director of the Planning Department has received the written consent of at least 51 percent of the owners of the property within the area described in Section 1 above to any special limitations contained herein. The rezone approval contained herein shall automatically expire, and be null and void, if the written consent is not received within 120 days after the date on which this ordinance is passed and approved. In the event no special limitations are contained herein, this ordinance is effective immediately upon passage and approval. The Director of the Planning Department shall change the zoning map accordingly.

PASSED AND APPROVED by the Anchorage Assembly this _____ day of _____, 2016.

Chair of the Assembly

ATTEST:

Municipal Clerk

MUNICIPALITY OF ANCHORAGE
ASSEMBLY MEMORANDUM

No. AM 219-2016

Meeting Date: March 22, 2016

From: ASSEMBLY MEMBER JOHNSTON

Subject: AN ORDINANCE OF THE ANCHORAGE ASSEMBLY AMENDING THE ZONING MAP AND APPROVING THE REZONING OF 72.66 ACRES OF LAND FROM R-8 (RURAL RESIDENTIAL - LARGE LOT) DISTRICT TO R-6 (SUBURBAN RESIDENTIAL - LARGE LOT) DISTRICT FOR PROPERTY DESCRIBED AS THE N ½ OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA EXCEPTING THE NW ¼ OF THE NW ¼ OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA, AND LOT 2, VERGASON-JONES SUBDIVISION (PLAT 98-178); GENERALLY LOCATED SOUTH OF UPPER DEARMOUN ROAD, WEST OF CANYON ROAD AND EAST OF MESSINIA STREET, IN ANCHORAGE.

The Planning and Zoning Commission passed Resolution 2015-026 denying an application to amend the zoning map to rezone 72.66 acres located on the upper Hillside from R-8 zoning district to R-6. Pursuant to Anchorage Municipal Code (old code) section 21.20.100D, the applicant requested an ordinance approving the rezone be submitted to the Assembly for approval. AO 2015-102 was introduced along with AIM 137-2015, however both were “postponed indefinitely” on September 29, 2015. With the rezoning request being submitted to the Assembly now, AIM 137-2015 is appended here as a historical document because it is necessary to the overall understanding and also because it is referenced in the AO. The Planning Department’s and the Planning and Zoning Commission’s positions laid out in AIM 137-2015 are unchanged and attached hereto, including the PZC’s resolution and packet related to the application.

I RECOMMEND ASSEMBLY CONSIDERATION OF THIS REZONE REQUEST.

Prepared by: Department of Law
Respectfully submitted: Jennifer Johnston, Assembly Member
District 6, South Anchorage

MUNICIPALITY OF ANCHORAGE ASSEMBLY INFORMATION MEMORANDUM

No. AIM 137-2015

Meeting Date: September 29, 2015

From: Mayor

Subject: PLANNING AND ZONING COMMISSION DENIAL OF A REZONING APPLICATION AND THE APPLICANT'S REQUEST FOR ASSEMBLY CONSIDERATION OF THE ATTACHED DRAFT ORDINANCE AMENDING THE ZONING MAP AND APPROVING THE REZONING OF 72.66 ACRES OF LAND FROM R-8 (RURAL RESIDENTIAL – LARGE LOT) DISTRICT TO R-6 (SUBURBAN RESIDENTIAL – LARGE LOT) DISTRICT FOR PROPERTY DESCRIBED AS THE N ½ OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA EXCEPTING THE NW ¼ OF THE NW ¼ OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA, AND LOT 2, VERGASON-JONES SUBDIVISION (PLAT 98-178); GENERALLY LOCATED SOUTH OF UPPER DE ARMOUN ROAD, WEST OF CANYON ROAD AND EAST OF MESSINIA STREET, IN ANCHORAGE.

1 The Planning Department recommended disapproval of an application to amend the zoning
2 map, and the Planning and Zoning Commission denied the application by unanimous vote.
3 Pursuant to Anchorage Municipal Code (old code) section 21.20.100D. the applicant
4 requested the application be submitted to the Assembly. Accordingly, attached is a draft
5 ordinance for consideration by the Assembly, the Planning and Zoning Commission's
6 resolution denying the application and the packet presented to the Commission. To take
7 action on the attached ordinance will require an Assembly sponsor.

8
9 The property owners of two parcels totaling 72.66 acres have submitted a request to rezone
10 this property from R-8 (rural residential – large lot) district to R-6 (suburban residential –
11 large lot) district (PZC Case 2014-0219). The property is located south of Upper De
12 Armoun Road between Messinia Street to the west and Canyon Road to the east. The
13 application included a proposed plat of a 32 lot subdivision that could be created under the
14 R-6 zoning district. Under the R-8 district, a 14 lot subdivision could be developed.

15
16 On April 6, 2015, the Planning and Zoning Commission opened and closed the public
17 hearing. Twenty people testified in opposition to the rezone petition. Due to time
18 constraints and missing information, action on the case was postponed to the June 1, 2015,
19 Planning and Zoning Commission meeting.
20

1 In the interim, missing maps from the wetlands report and a Soils Investigation Report
2 prepared by Garness Engineering Group Ltd. were submitted. The soils report found that
3 “the average slopes (of the property) range from 5 to 20 percent running generally from
4 northwest to south east.” Thirty-eight test holes were performed on the proposed
5 subdivision. “The majority of the proposed subdivision has marginal to impermeable soils
6 (soils that have a percolation rate of >120 minutes/inch) at a depth of four (4) feet.”
7 Several lots were determined to be unsuitable for onsite septic systems. The soils report
8 summary is included in this packet; soil logs are available on request to the Planning
9 Department.

10
11 A revised proposed plat under the R-6 district regulations was submitted that would allow
12 for 32 lots with a minimum lot size of one acre; two wetland tracts were also proposed.
13 Development under the R-8 district regulations would allow approximately 14 residential
14 lots with a minimum lot size of four acres. An estimated 127% percent increase in density
15 would result from rezoning the property to R-6.

16
17 The applicant asserts that one reason this rezone is appropriate is that subdivisions in the
18 surrounding area have been developed with one acre lots. Review of adjacent subdivisions
19 revealed that the development patterns were established prior to the implementation of the
20 Areawide Rezoning Program for Area G-1. During the areawide rezoning in the 1980s, it
21 was determined that the R-6 district was most appropriate for those areas which were
22 already developed at a greater density even though the individual lot sizes did not meet the
23 minimum 1.25-acre lot size required in the R-6 district. Property that was subdivided
24 subsequent to the implementation of zoning has met the minimum lot size of the applicable
25 zoning district.

26
27 As noted in the Planning and Zoning Commission’s findings, excerpted below, the *Hillside*
28 *District Plan* land use plan map does not differentiate between densities of less than one
29 dwelling unit per acre, which includes both the R-6 and R-8 zoning districts. The plan
30 does include Policy 1-C that states, “Maintain the same land use designations and zoning
31 in this area [Central Hillside Residential] as were established prior to the beginning of this
32 plan.”

33
34 The Commission considered the information presented, both written and oral, and
35 recommended denial of the petition to rezone the property from R-8 to R-6 finding that:

- 36
37 1. Soils tests have been performed and the soils report indicates that most of the property
38 has marginal to impermeable soils.
39
40 2. Comments from On-Site Water and Wastewater Services stated further research on the
41 dry drainageways is needed to determine if there is surface water as septic tanks and
42 drainfields are required to be at least 100 feet from surface water.
43

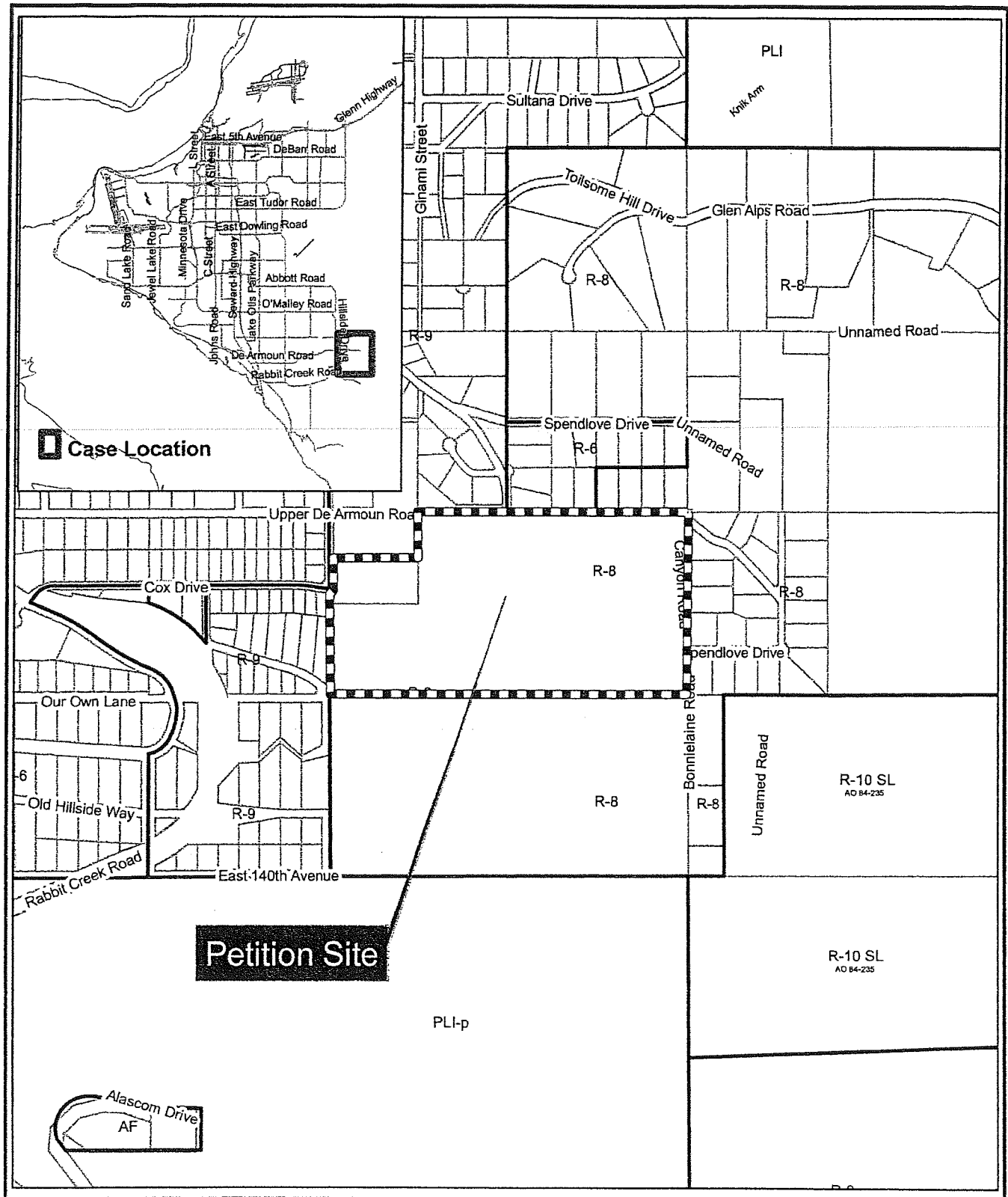
3. There are elevated nitrates in neighboring wells and a nitrate study will be required prior to development of a subdivision.
4. The 2012 housing study found that there is a need for more housing in Anchorage; however the results of the study determined that there was an oversupply of large lot zoned land for single-family residential development. What the Anchorage community does not have enough of is small lot development served by public utilities and services.
5. The *Hillside District Plan*, which is the guiding comprehensive plan element for this property, doesn't indicate that the rezone is inconsistent with the Land Use Plan Map in terms of density. However, one of the policies in the *Hillside District Plan* indicates that the same land use designations should be maintained in this area as were established prior to the beginning of this plan. In that respect, the rezone is not consistent with the *Hillside District Plan*.
6. Adding more housing to the Hillside is clearly a risk with respect to the groundwater and the flow into Rabbit Creek. It would add more vehicle trips onto a substandard street which is strip paved without shoulders or sidewalks. This is not the right proposal at this particular site.
7. With the R-8 zoning it is less likely that problems will be created with larger lot development in a fragile environment, and the R-8 zoning is the most appropriate zoning for this particular area.

The applicant has requested that the zoning change application be submitted for consideration by the Assembly in accordance with AMC (old code) 21.20.100D. Accordingly, attached to this AIM is a draft ordinance for the rezoning request and the Planning and Zoning Commission's resolution and packet related to this application.

THE ADMINISTRATION RECOMMENDS DENIAL OF THE REZONING REQUEST.

Prepared by:	Erika McConnell, Manager, Current Planning Section
Approved by:	Hal H. Hart, AICP, Director, Planning Department
Concur:	Lance Wilber, Director, Office of Management and Budget
Concur:	Christopher Schutte, Director of Economic and Community Development
Concur:	William D. Falsey, Municipal Attorney
Concur:	Michael K. Abbott, Municipal Manager
Respectfully submitted:	Ethan Berkowitz, Mayor

2014-0219



Municipality of Anchorage
Planning Department

Date: January 06, 2015



MUNICIPALITY OF ANCHORAGE
PLANNING AND ZONING COMMISSION RESOLUTION NO. 2015-026

A RESOLUTION RECOMMENDING DENIAL OF THE REZONE OF APPROXIMATELY 72.66 ACRES FROM R-8 (RURAL RESIDENTIAL – LARGE LOT) DISTRICT TO R-6 (SUBURBAN RESIDENTIAL – LARGE LOT) DISTRICT FOR PROPERTY DESCRIBED AS THE N ½ OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA EXCEPTING THE NW ¼ OF THE NW ¼ OF THE SE ¼ OF SECTION 25, T12N, R3W, S.M., ALASKA, AND LOT 2, VERGASON-JONES SUBDIVISION (PLAT 98-178); GENERALLY LOCATED SOUTH OF UPPER DE ARMOUN ROAD, WEST OF CANYON ROAD AND EAST OF MESSINIA STREET, IN ANCHORAGE.

(Case 2014-0219; Parcel ID Nos. 017-073-06 and 017-074-06)

WHEREAS, a request was received from Big Country Enterprises, LLC, to rezone approximately 72.66 acres from R-8 (rural residential – large lot) district to R-6 (suburban residential – large lot) district for property described as the N ½ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska excepting the NW ¼ of the NW ¼ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska, and Lot 2, Vergason-Jones Subdivision (Plat 98-178), generally located south of Upper De Armoun Road, west of Canyon Road and east of Messinia Street, in Anchorage; and

WHEREAS, public hearing notices were published, posted, and mailed, and a public hearing was opened on April 6, 2015; and

WHEREAS, all present wishing to testify had the opportunity to address the Commission on April 6, 2015; and

WHEREAS, the Chair, having called for anyone else wishing to testify and hearing no response, closed the public hearing on April 6, 2015; and

WHEREAS, the case was continued to the June 1, 2015 meeting at which time the Commissioners deliberated and decided the matter before the Commission.

NOW, THEREFORE, BE IT RESOLVED by the Anchorage Planning and Zoning Commission that:

A. The Commission makes the following findings of fact:

1. The request before the Commission is to rezone a 72.66-acre parcel and Lot 2, Vergason-Jones Subdivision from R-8 (rural residential – large lot) district that requires a minimum five acre lot size, to R-6 (suburban residential – large lot) district that requires a minimum 1.25 acre minimum lot size.
2. The Commission addressed the need for more housing in Anchorage, but found that an increase in density does not need to happen on this particular site with the proposed R-6 zoning. The 2012 Housing Study found that there is a need for more housing in Anchorage; however the

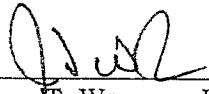
results of the study determined that there was an oversupply of large lot zoned land for single-family residential development. What the Anchorage community does not have enough of is small lot development served by public utilities and services.

3. The Commission could not support the rezone request based on the soils tests that were submitted and the comments from On-Site Services that some of the lots will not be able to support on-site septic systems. Soils tests have been performed, and the soils report indicates that most of the property has marginal to impermeable soils.
4. The Commission referenced comments from On-Site Water and Wastewater Services that stated further research on the dry drainageways is needed to determine if there is surface water, as septic tanks and drainfields are required to be at least 100 feet from surface water. There are elevated nitrates in neighboring wells and a nitrate study will be required prior to development of a subdivision.
5. The *Hillside District Plan*, which is the guiding comprehensive plan for this property, doesn't indicate that the rezone is inconsistent with the Land Use Plan Map in terms of density. However, one of the policies in the *Hillside District Plan* indicates that the same land use designations should be maintained in this area as were established prior to the beginning of this plan. In that respect, the rezone is not consistent with the *Hillside District Plan*.
6. From a general point of view, this proposal is not necessarily a good urban plan. It is not necessarily good to expand the low-density sprawl in the community throughout the Hillside. What is needed is more compact development concentrated near employment centers as the comprehensive plan recommends.
7. Adding more housing to the Hillside is clearly a risk with respect to the groundwater and the flow into Rabbit Creek. It would add more vehicle trips onto a substandard street which is strip paved without shoulders or sidewalks. This is not the right proposal at this particular site.
8. The issue is that this property is in an area where there are lots that are the same size as what is proposed to be developed with this rezone petition. However, those lots were platted and developed prior to the implementation of the current zoning. If the adjoining property were to be zoned today, the zoning would be reconsidered as public testimony has proved that there are some problems with some of those smaller lots.

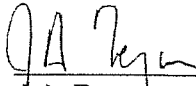
9. With the R-8 zoning it is less likely that problems will be created with larger lot development in a fragile environment, and the R-8 zoning is the most appropriate zoning for this particular area.
- B. The Commission recommends DENIAL to the Anchorage Assembly that approximately 77.62-acres be rezoned from R-8 (rural residential - large lot) district to R-6 (suburban residential - large lot) district by a vote of 8 nays and 1 abstention.

DENIED by the Anchorage Planning and Zoning Commission on June 1, 2015.

ADOPTED by the Anchorage Planning and Zoning Commission this 6th day of July, 2015.



Jerry T. Weaver, Jr.
Secretary



J.A. Fergusson
Chair

(Case 2014-0219)
(Parcel ID Nos. 017-073-06 and 017-074-06)

mro

PLANNING AND ZONING COMMISSION

**Assembly Chambers
Z.J. Loussac Library
3600 Denali Street
Anchorage, Alaska**

**MINUTES OF
June 1, 2015
6:30 PM**

A. ROLL CALL

Present Stacey Dean
 James Fergusson
 Tyler Robinson
 Jon Spring
 Gregory Strike
 Mitzi Barker
 Brandon Walker
 Brandon Spoerhase
 Anthony Cange

Excused None

Staff Erika McConnell
 Margaret O'Brien
 Tom Davis

B. MINUTES - None

C. SPECIAL ORDER OF BUSINESS / EXECUTIVE SESSIONS

1. Disclosures

COMMISSIONER DEAN disclosed that she was absent from the initial consideration of Case 2014-0219 and has not listened to the audio of the proceedings. She will recuse herself from participating.

CHAIR FERGUSSON disclosed in Case 2014-0063 that as a member of the Downtown Rotary he rings the bell every Christmas for the Salvation Army. He does not believe that will have an impact on his ability to act fairly.

COMMISSIONER SPRING expressed that the Salvation Army is doing its best to fill the needs in the community in terms of services for persons with alcohol and drug dependencies, and there is a clear need for more services such as this. Even though this has been expedited, he shares the concerns regarding the fact that the Commission and staff are being asked to review this without having additional time, but he feels the impacts, heard in the petitioner's testimony, appear to be minimal. In particular, the assessment on the impact of traffic is correct that very few people are going to drive to this facility, and he pointed out that there would be a maximum of twenty-five people at one night meeting if everyone did drive, and traffic during the day would be limited to the individuals who will be meeting with individual counselors. 20th Avenue is a good facility with a collector road and a traffic light at Bragaw, and it is capable of handling the traffic without impacting the neighborhood. These people are not being disruptive, but are just seeking counseling for their addictions.

COMMISSIONER CANGE believes this project is in the best interest of the community and is supported with statements made by the petitioner and staff. He will be supporting the motion.

COMMISSIONER SPOERHASE concurred with his fellow Commissioners. He added that it was beneficial to have the owner present to testify.

COMMISSIONER BARKER added that the subject property is in the middle of a larger human services campus in that area, which has had a variety of changes over the years. It is not unreasonable that this use should also be flexible to give these valuable facilities the ability to continue to serve the community.

CHAIR FERGUSON added that Major McWhorter and staff's efforts were accurate and he appreciated them bringing this forward. The concerns raised by the Commission regarding the quality of the application were not directed at staff. He thinks the applicant needs to make sure that their professionals get the information and follow the procedures making everyone's job much easier.

AYE: Cange, Spoerhase, Walker, Barker, Strike, Spring, Robinson, Fergusson, Dean
NAY: None

PASSED

E. UNFINISHED BUSINESS AND ACTIONS OF PUBLIC HEARINGS

1. **CASE: 2014-0219 (MRO)**
PETITIONER: Big Country Enterprises, LLC
REQUEST: Rezone from R-8 (rural residential-large lot) district to R-6 (suburban residential-large lot) district.

Commissioner Dean recused herself and left the room.

COMMISSIONER WALKER asked staff to provide an updated report.

MARGARET O'BRIEN presented the staff report and recommendations on behalf of the Municipality's Planning Division. Planning recommended denial of the rezone.

The Commission discussed elevated nitrates in the wells surrounding the area and septic systems.

CHAIR FERGUSSON asked the petitioner to approach the Commission.

JIM GARNESS with Garness Engineering Group responded to questions from the Commission. Tom Dreyer with S4 Group was also present.

The Commission discussed the test hole percolation readings. They also discussed if it were appropriate to develop this density in these soils.

COMMISSIONER CANGE moved in Case 2014-0219 to approve the request to rezone approximately 72.66 acres from R-8 district to R-6 district. COMMISSIONER ROBINSON seconded.

COMMISSIONER CANGE noted that he is conflicted with this case because he has been in development for the majority of his life. He agreed with Commissioner Walker's statement that this can be done even though the soils are questionable. He feels there is a need for more housing in Anchorage, but does not intend to support the motion because he does not believe that development needs to happen on this particular site with this particular zoning given the facts of the soils and the tests received, and the On-Site Services comments recommend that some of these lots will not be able to have septic systems on them.

COMMISSIONER ROBINSON will also not be supporting the motion.

COMMISSIONER SPRING will not be supporting the motion. He referred to the housing study completed approximately 1-1/2 years ago, and he agreed that there is a need for housing in this community, but the study results showed an over-supply of large lot zoning for single-family. Anchorage does not have enough small lots with sewer and water, and if he was convinced that there was a dire need for more large lots for single-family housing on the Hillside, then he would be in favor of this, but in this case he does not see it. With respect to the *Hillside District Plan*, which is the guiding document in this case, it does not really state that, based on the map, this is inconsistent, but it does state that property shall not be rezoned in the Hillside. He is not sure that he agrees with that, but it is stated in the plan and that is justification for staff to indicate that it is not consistent with the *Hillside District Plan*. From a general point of view, he does not think this is a good urban plan and it is not necessarily good to expand the low-density sprawl in the community through the Hillside. He thinks more compact development is needed and should be concentrated near an employment center as it is documented in the *Comprehensive Plan* not to add more housing in the Hillside when there is, clearly, a risk involved particularly with respect to the groundwater and the flow into Rabbit Creek. Also, this is something he considers to be a sub-standard street which is just strip-paved with no shoulders or sidewalks, and he does not think this is the right proposal in this particular area.

COMMISSIONER ROBINSON added that it is important that the decision in this case does not reflect his belief that a property owner ought to have the right to bring forward a plan that they think has a market ability behind it, and he thinks that just because more urban housing is needed, it does not mean they ought not have more rural housing. His issue was that an area exists that has lots that are the same size as what is being petitioned for, but those lots preclude current zoning, and if that were to be reconsidered at this time, and as testimony proved, there are problems with some of those smaller lots. He thinks with the R-8 zoning that it is less likely to create problems in fragile environments, and he also thinks it is the most appropriate zoning for that particular area.

AYE: None

NAY: Cange, Spoerhase, Walker, Barker, Strike, Spring, Robinson, Fergusson

RECUSED: Dean

FAILED

In response to Ms. McConnell's request to explain to the public what the decision of the Commission actually meant, COMMISSIONER ROBINSON stated that the Assembly is the ultimate approver of rezoning petitions, and the petitioner can choose to accept the decision of the Planning and Zoning Commission or take their petition, as is or with changes, to the Assembly requesting approval. The record will reflect the decision and the findings of the Commission made this evening.

2. **CASE: 2015-0049 (EBM)**
PETITIONER: Municipality of Anchorage Community Development Department
REQUEST: An ordinance amending Title 21 sections 21.04.020, 21.06.020, 21.06.030, 21.07.030, 21.07.040F., 21.07.060F., 21.07.110 and 21.14.040 to address needed corrections to multifamily and townhouse design standards, open space and related regulations.

Commissioner Dean returned to the meeting.

MS. MCCONNELL presented the staff report on behalf of the Municipality's Planning Division. TOM DAVIS with the Municipality's Long-Range Planning Department was also present and assisted in responding to questions.

The Commission discussed examples of other projects and how they fit into the design standards, townhouse articulation, problems with the multifamily standards, and the benefits of postponing this and resolving any concerns in a work session.

COMMISSIONER CANGE moved to table Case 2015-0049 until after the June 4th work session. COMMISSIONER BARKER seconded.

PLANNING AND ZONING COMMISSION

**Assembly Chambers
Z.J. Loussac Library
3600 Denali Street
Anchorage, Alaska**

**MINUTES OF
April 6, 2015
6:30 PM**

A. ROLL CALL

Present James Fergusson
Tyler Robinson
Jon Spring
Gregory Strike
Mitzi Barker
Brandon Walker
Brandon Spoerhase
Anthony Cange

Excused Stacey Dean

Staff Erika McConnell
Francis McLaughlin
Margaret O'Brien
Sharon Ferguson
Craig Lyon
Tom Davis
Dave Whitfield

B. MINUTES

C. SPECIAL ORDER OF BUSINESS / EXECUTIVE SESSIONS

1. Disclosures

COMMISSIONER WALKER disclosed in Case 2015-0013 that he is currently working on transactions with parties that are closely involved with the petitioner, Muldoon Community Improvement, LLC. He is not directly involved in any transactions pertaining to this site, but he is involved in some transactions involving the site across the creek from it and some of the members.

consists of five members with two members from the Department of Transportation, two Assembly Members and the Mayor. He pointed out that based on information from previous creations of Citizens Advisory Committees that it would be virtually impossible to take over the Citizens Advisory Committee in a way that Chair Fergusson is implying with that kind of balance on the Policy Committee. The Department of Transportation does not always agree with the Assembly Members and the Mayor does not always agree with the other members. He could almost guarantee that it would be fairly well-balanced as far as the politics of transportation are concerned. There is no way this Committee could be skewed one way or another, and he also thinks it will be as balanced as practicable in this community, and might even be balanced more toward road development. With respect to the utility of the Citizens Advisory Committee, if approved, this will give certain enhanced expertise and abilities to be developed through this committee and they will be able to make sound decisions. There is an opportunity with a dedicated committee to develop more expertise than the Planning and Zoning Commission will ever achieve in this because this Commission is unable to devote the time, and AMATS can utilize this Citizens Advisory Committee in the development of a transportation plan, and that would serve as one of its functions.

COMMISSIONER WALKER stated that Commissioner Spring had a very convincing argument, but he will not be supporting the motion.

AYE: Barker, Spring, Robinson

NAY: Cange, Spoerhase, Walker, Strike, Fergusson

FAILED

G. PUBLIC HEARINGS

1. CASE: 2014-0219 (MRO)
PETITIONER: Big Country Enterprises, LLC
REQUEST: Rezone from R-8 (rural residential-large lot) district to R-6 (suburban residential-large lot) district.

MARGARET O'BRIEN presented the staff report and recommendations on behalf of the Municipality's Planning Division. Planning recommended denial.

The Commission discussed the condition and maintenance of Upper De Armoun Road, the wetland delineation, and the reason why this conforms to the *Hillside District Plan* but not the *Comprehensive Plan*. They also discussed rural residential standards for roadways, and concerns that rezoning to R-6 would exceed the carrying capacity of the land.

TOM DREYER with S4 Group represented the petitioner. Also present were Jeff Garness with Garness Engineering and Pat Athey with Hemlock Scientific, LLC.

CHAIR FERGUSSON asked the public, by a show of hands, who was intending to testify for each case. He commented that the testimony for Case 2014-0219 appears that it would last until 11:00 p.m. and that would not allow enough time to hear Case 2015-0007.

COMMISSIONER CANGE moved to postpone Case 2015-0007 in order to allow the opportunity to hear all of the public testimony for both cases. COMMISSIONER WALKER seconded.

COMMISSIONER ROBINSON suggested evaluating the status of the hearing in one hour. CHAIR FERGUSSON suggested to consider suspending Case 2014-0219 and allow staff's and the petitioner's presentation for Case 2015-0007, and then postpone it which would resolve the petitioner's travel issues having to appear from out of state for a future date. COMMISSIONER ROBINSON assured the Commission that the petitioner would prefer to be present for rebuttal testimony.

COMMISSIONER BARKER asked staff if there would be a public hearing on Case 2014-0219 if the petitioner wanted to develop this site with the existing zoning. MS. O'BRIEN replied there would not be a public hearing because they would be developing under the existing R-8 zoning district. COMMISSIONER BARKER wanted that clarification because some of the written comments received appear to be leaning toward no development at all. MS. O'BRIEN pointed out that the petitioner would be required to have a public hearing before the Platting Board.

COMMISSIONER CANGE withdrew his motion to postpone Case 2015-0007.

CHAIR FERGUSSON opened the hearing to public testimony. The following individuals testified:

JOAN PRIESTLEY	RALPH LOREN
VERN DAVIS	JASON ROHWER
GAIL MORRISON	ROB BROWN
MARK MORRISON	BART HAWKINS
CARL PORTMAN	CAROL ASHLOCK
PETE WOODSON	CLIFF HYATT
MARK JUNE	SERGEI NEFEDOV
ERICA SCHMIDT and ALEX DELGADO	CHRIS ALEXANDER
BRUCE VERGASON	RON BAILEY
JEANETTE DELANEY	TIMOTHY THOMAS
STEPHEN DAY	

PAUL GIONET, co-owner, provided rebuttal testimony.

CHAIR FERGUSSON closed the public hearing.

COMMISSIONER SPRING asked staff if they would be able to review the late submittal of the wetland delineation report if he were to request to postpone this case, and if that would be

beneficial to the Commission for staff to evaluate the report and possibly make changes to the staff report and recommendations regarding the carrying capacity. MS. O'BRIEN indicated that staff would need the maps that were not included in that report and it would be helpful to have the information that was produced by Mr. Garness. She expressed that she would hesitate to make an assumption as to whether or not it would change the recommendation of some of the reviewing agencies. COMMISSIONER SPRING asked staff if they were to have received the report in ample time to review it, would they have consulted with the wetlands staff and included their comments as part of the staff report. MS. MCCONNELL noted it is her understanding that neither the Municipal wetlands staff nor the Corps of Engineers can verify the wetlands report until spring or summer. She added that it would help to have that information, but she is not sure they can accept the report and work toward a jurisdictional determination until they are able to access the property. COMMISSIONER SPRING explained that he was not looking for a wetlands determination, but just wanted to have the accuracy of the report validated. He also wanted to know the feasibility of acquiring information regarding septic systems in the area, particularly the rate of failure, and if this information could be provided if this case was to be postponed. MS. O'BRIEN expressed that failure of septic systems would be more difficult because it depends on how many years are being requested noting that not all of that information is computerized and readily accessible. She added that she had spoken with personnel from Watershed Management and they are not able to verify what drainage-ways actually exist in that area until spring.

MS. O'BRIEN suggested postponing for one month allowing the petitioner the opportunity to submit the information that was not submitted with the application, and ask the wetlands coordinator and on-site services to review the additional materials.

COMMISSIONER WALKER expressed that he approached this case a bit incredulous regarding staff's recommendation that this site cannot, in fact, carry the additional lots but after listening to the public testimony he feels there are definitely some significant groundwater issues that need to be considered, including Rabbit Creek.

COMMISSIONER WALKER moved in Case 2014-0219 to postpone to June 1, 2015 to allow the applicant additional time to provide all requested information to staff. This would also allow the applicant time to meet with the community council. COMMISSIONER ROBINSON seconded.

AYE: Cange, Spoerhase, Walker, Barker, Spring, Robinson, Fergusson
NAY: Strike

PASSED

Commissioner Strike left the meeting at 9:55 p.m.

**MUNICIPALITY OF ANCHORAGE
COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION**

MEMORANDUM

DATE: June 1, 2015

TO: Planning and Zoning Commission

THRU: *fw* Jerry T. Weaver, Jr., Director, Community
Development Department

FROM: *MOB* Margaret O'Brien, Senior Planner

SUBJECT: **2014-0219:** Request to rezone approximately
72.66 acres from R-8 (rural residential- large lot)
district to R-6 (suburban residential- large lot)
district

**APPLICABLE ZONING
CODE:** 'Old' Title 21

APPLICANT: Big Country Enterprises, LLC

REPRESENTATIVE: S4 Group, Tom Dreyer

RECOMMENDATION DENIAL

SUMMARY:

April 6
On ~~March 2~~, 2015, the Commission opened and closed the public hearing for a request to rezone 72.66 acres from R-8 (rural residential – large lot) district to R-6 (suburban residential – large lot) district). The property is located south of Upper De Armoun Road between Messinia Street to the west and Canyon Road to the west.

Property to the north is zoned R-6 (suburban residential-large lot) district requiring a minimum 1.25 acre lot size, R-8 (rural residential-large lot) district requiring a minimum 5.0 acre lot size, and R-9 (rural residential) district requiring a minimum 2.50 acre lot size.

Property adjoining the west petition site boundary is zoned R-6 and R-9; to the northwest property is zoned R-6. Property to the east is zoned R-8 and R-10 SL. Section 36 to the south is zoned PLI-p.

Twenty people testified in opposition to the rezone during the public hearing held on April 6, 2015. During the public hearing, a report on the delineation of wetlands was submitted; however, the maps of the wetland areas were not

included with the report. A Soils Investigation Report prepared by Garness Engineering Group Ltd. was submitted as well. The reports had not been submitted in time for reviewing agencies to provide comments to the Commission. The case was postponed for one month.

The soils report found that “the average slopes across the majority of this parcel range from 5 to 20 percent running generally from northwest to southeast.” Thirty-eight test holes were performed on the proposed subdivision. “The majority of the proposed subdivision has marginal to impermeable soils (soils that have a percolation rate of >120 minutes/inch) at a depth of four (4) feet.”¹

Test holes were performed “on the southeast quarter of the property for proposed Lots 1 through 4 (TH#1, TH#2, TH#3, and TH#4). Based upon our findings, these proposed lots appear to be unsuitable for onsite septic systems due to impermeable soil and/or high groundwater. Additionally, two (2) test holes (TH #11 and TH#11A (old TH#6)) were performed on proposed (on) Lot 11 and found that the lot will not meet the requirement for septic reserve area or platted drainfields. In short, this lot appears unsuitable for an onsite septic system.”²

“Given the impermeable soils (at four feet and/or shallow groundwater) and based (on) our experience with the MOA Onsite Department on other subdivisions with similar conditions, these proposed lots will most likely require the use of platted drainfield sites served by advanced wastewater treatment systems.”³

The petitioner is proposing a special limitation to allow 32 lots to be platted with a future plat. Based on the soils report, five (5) lots were found to be unsuitable for conventional on-site septic systems and may require advanced wastewater treatment systems.

AGENCY COMMENTS

The wetlands study was routed to the Wetlands Coordinator, On-Site Water and Wastewater Services and Watershed Management. To the Department’s knowledge, the applicant has not submitted the wetlands report to the U.S. Army Corps of Engineers for a wetland determination. No additional comments were received from the Wetlands Coordinator or Watershed Management.

On-Site Water and Wastewater Services (OSWWS) comments are as follows:

Onsite Septic Systems

A quick review of the summary, soils logs and preliminary subdivision drawing originally dated January 2015 provided by Garness Engineering Group appears to be showing most but not all of the proposed 32 lots should be able to be served by

¹ Lewis and Clark Soils Investigation and Well/Septic Reserve Area Report, January 2014, revised April 29, 2015, page 2 of 4.

² Ibid.

³ Ibid

individual onsite septic systems. Further research regarding the “dry drainageways” needs to be completed to determine if there is “surface water” as defined by AMC 15.65.010 Wastewater Code. Since AMC 15.65 requires septic tanks and drainfields to be at least 100 feet from surface water, the determination may render some of the proposed lots to be developable at great expense or possibly undevelopable at all.

Source Aquifer(s) for Domestic Water Supply – Nitrates

Based on nitrate levels in neighboring wells, the source aquifer for new wells serving the proposed subdivision will be required to have a nitrate study in addition to the standard subdivision aquifer study. The study results may indicate nitrate reducing septic systems should be required for the subdivision.

Proposed Rezone

The Wastewater Code, AMC 15.65, does not recognize or use zoning requirement for subdivision development review.

DISCUSSION

Both the density of the R-6 and R-8 zoning districts comply with the *Hillside District Plan* (HDP) Land Use Plan Map 2.1 recommended Limited Density 0-1 DUA. However, the proposed rezone of the petition site does not conform to Policy 1-C that states: “Maintain the same land use designations and zoning in this area as were established prior to the beginning of this plan.” (HDP p. 2-11) This area was developed earlier than southeast Hillside; it has been developed with on-site utilities; public services are unlikely to be extended in the foreseeable future due to the distance from existing services.

Many of the subdivisions to the west and north of the petition site were platted prior to the implementation of the Areawide rezoning on June 6, 1974 (AO 74-84B). The lots do not meet the minimum lot size required by the R-6, R-8 and R-9 zoning districts that were implemented during the areawide rezoning. Many of the smaller lots to the west are served by holding tanks and there is evidence of elevated nitrates, albeit within the limits established by AMC 15.65.010 Wastewater Code. Development of Lots 1-4 and 11 that were found to be unsuitable for on-site septic systems may have to be developed with advanced wastewater treatment systems.⁴

The intent of the R-8 (rural residential – large lot) district “is designed primarily to satisfy the needs of low-density residential development in areas where topographic or other natural conditions are such that higher-density development and the provision of public sewers and water would be unfeasible at any time. In

⁴ Advanced wastewater treatment systems (AWWTS) means all wastewater disposal systems, designs or types that use advanced technology to provide a higher quality effluent than a conventional septic system.

addition to topography, some of the natural conditions which could exist to render land desirable for the densities proposed in this zone are wind hazards, marginal soils, landslide susceptibility, groundwater pollution and groundwater availability. A secondary use of the R-8 district is to allow for low-density residential development in areas where public sewers and water are unlikely to be provided in the foreseeable future and where higher density development would exceed geological and hydrological capacities for safe and healthful human habitation unless these facilities were provided. An example of such a condition would be where higher density development in certain water recharge areas, utilizing on-site sewage disposal systems, could pollute the groundwater supply in the immediate areas as well as in areas of lower elevation.”

With the proposed R-6 zoning district, 32 lots that are 1.25 acres in size would be allowed versus 14 lots containing 5.0 acres each that are permitted under the existing R-8 zoning district. There will be more grading and removal of natural vegetation under the R-6 zoning district increasing the potential for surface water run-off due to the impermeable soils and shallow groundwater. The greater the number of on-site septic systems, the greater the potential is for nitrate pollution of drinking water. On-Site Water and Wastewater Services (OSWWS) is requesting a nitrate study to determine if nitrate reducing systems will be required for development of the lots. OSWWS stated that “[F]urther research regarding the ‘dry drainageways’ needs to be completed to determine if there is ‘surface water’ as defined by AMC 15.65.010 Wastewater Code. Since AMC 15.65 requires septic tanks and drainfields to be at least 100 feet from surface water, the determination may render some of the proposed lots to be developable at great expense or possibly undevelopable at all.”

The Department recognizes the intent stated by the owners of developing an environmentally sound subdivision during the public hearing. However, the development of the individual lots will be the responsibility of the future property owners who will be responsible for grading the lots, locating the home sites and constructing the homes and installing the on-site septic systems and wells.

DEPARTMENT RECOMMENDATION

The Department does not support the request and recommends DENIAL of the petition to rezone approximately 72.66 acres from R-8 (rural residential- large lot) district to R-6 (suburban residential- large lot) district.

Attachments: On-Site Services Comments

Public Comments

Preliminary Determination of Wetlands and Waters

Upper De Armoun and Canyon Road Preliminary Drainage Impact Analysis

Soils Investigation and Well/Septic Reserve Area Report

Revised preliminary plat (under separate cover)

**MUNICIPALITY OF ANCHORAGE
MEMORANDUM**

DATE:	April 6, 2015
TO:	Planning and Zoning Commission
THRU:	<i>JTW</i> Jerry T. Weaver, Community Development Director
FROM:	Margaret O'Brien, Senior Planner
SUBJECT:	2014-0219 Rezone of ± 73.67 acres from R-8 (rural residential- large lot) district to R-6 (suburban residential- large lot) district for

This is to advise the Commission that there is a mathematical error on Page 7 in the second paragraph under the heading of Transportation/Drainage that reads as follows:

Using the trip generation factor of 8.2, 545 ADT will be generated if the property in the R-6 district. The estimated maximum 14 lots that could be developed in the R-8 district would add 115 average daily trips. A 373% increase in traffic would result from a zoning change to the R-6 district.

Using the trip generation factor of 8.2, 262 ADT will be generated if the property is rezoned to the R-6 district. The maximum 14 lots that could be developed in the R-8 district would add 115 average daily trips. A 78% increase in traffic would result from a zoning change to the R-6 district.

At the last PZC lunch with the Director, a commissioner inquired why traffic issues were raised by Planning as a concern with the rezoning proposal, when the Traffic Engineering Section provided no comment. In discussions with the Traffic Engineering Section, it was noted that in rezone reviews, Traffic Engineering looks for numerical changes in traffic counts that trigger specific thresholds set by code or policy. If such thresholds are not triggered, Traffic does not comment. Current Planning, on the other hand, is reviewing against the approval criteria set in AMC 21.20.090B. Planning is analyzing whether or not the development allowed under the proposed rezoning has an effect on neighborhood transportation. This is a broader analysis than Traffic Engineering's threshold review.

In a memo from S4Group, the petitioners' representative responded to the Department recommendation. A special limitation was suggested to respond to the concerns outlined in the staff report prepared for the original public hearing date of March 2, 2015. A special limitation is proposed to limit the development of the property to 32 lots that would result in an average lot size of the 2.5 acres. However, the proposed special limitation reflects the preliminary plat that based on a rezone of the property to the R-6 zoning district. The special

limitation does not address the concerns raised in the staff report. Therefore, the Department recommendation remains unchanged.

Attached is a Preliminary Determination of Wetlands & Waters, dated December 22, 2014, prepared by Hemlock Scientific, LLC which is being forwarded to the Commission. This report has not yet been reviewed by the Corps of Engineers or the Municipal wetlands staff.

**COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION**

REZONING

DATE: March 2, 2015

CASE NO: 2014-0219

APPLICANT: Big Country Enterprises, LLC

REPRESENTATIVE: S4 Group, Tom Dreyer

REQUEST: Request to rezone approximately 73.67 acres from R-8 (rural residential- large lot) district to R-6 (suburban residential- large lot) district

APPLICABLE ZONING CODE: "Old" Code'

LOCATION: N ½ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska excepting the NW ¼ of the NW ¼ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska, and Lot 2, Vergason-Jones Subdivision, generally located south of Upper De Armoun Road, west of Canyon Road and east of Messina Street

SITE ADDRESS: 13301 Messina Drive (Lot 2, Vergason-Jones Subdivision)

COMMUNITY COUNCIL: Hillside East

TAX NUMBER: 017-073-06; 017-074-06

GRID: SW2941

ATTACHMENTS:

1. Zoning & Location Maps
2. Agency Comments
3. Posting Affidavit
4. Application

RECOMMENDATIONS SUMMARY:

Denial of the request to rezone the petition site from R-8 to R-6.

SITE:

Acres: 72.67 acres (3,165,205 SF)
Vegetation: Birch, spruce and undergrowth
Zoning: R-8 (rural residential- large lot) district
Topography: Steep and variable topography
Existing Use: Undeveloped
Soils/utilities: On-site well and septic

COMPREHENSIVE PLAN:

Classification: Residential per the *Hillside District Plan*
Density: Limited Intensity, 0-1 DUA per the *Hillside District Plan*
Land Use Plan Map 2.1

APPLICABLE LAND USE REGULATIONS:

	AMC 21.40.100 R-8 (rural residential- large lot) district	AMC 21.40.080 R-6 (suburban residential- large lot) district
Minimum Lot Area:	5.0 acres ¹	54,450 SF ²
Minimum Lot Width:	300 feet	150 feet
Yard Setbacks:		
Front:	25 feet	50 feet
Side:	15 feet	25 feet
Rear:	25 feet	50 feet
Maximum Lot Coverage:	5% by all buildings	30% by all buildings
Maximum Height:		
Principal structure	35 feet	Unrestricted subject to FAA regulations
Accessory structure	30 feet	

¹Includes one-half of the area of abutting dedicated right-of-way.

²Includes one-half of the area of abutting dedicated right-of-way. Individual lot square footage may vary up to one percent.

SURROUNDING AREA:

	<u>NORTH</u>	<u>EAST</u>	<u>SOUTH</u>	<u>WEST</u>
Zoning:	R-9/R-6/R-8	R-8/R-10 SL AO 84-235	R-8/PLI-p	R-9/R-6
Land Use:	Residential	Residential	Vacant/Section 36 - park	Residential

PROPERTY HISTORY:

06-06-74	AO 74-84B	Petition site zoned R-8 (rural residential-large lot) district during the Areawide Rezoning of Area G-4.
12-31-98	Plat 98-178	Final plat recorded for Lots 1 & 2, Vergason-Jones Subdivision, a 10 acre subdivision of the NW ¼ of the NW ¼ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska with dedication of 30 feet for Upper De Armoun Road along the north boundary and dedication of 30 feet for Messina Street along the west boundary. (Case S-10259)
2000		Single-family dwelling constructed on Lot 2, Vergason-Jones Subdivision which is a 5 acre lot.

RELATED CASE HISTORY

Please see Appendix A and B for history of development in the surrounding area.

SITE DESCRIPTION AND PROPOSAL:

The request before the Commission is a petition to rezone approximately 72.57 acres from R-8 (rural residential- large lot) district to R-6 (suburban residential-large lot) district. The petition site includes a 67.83-acre undeveloped parcel and Lot 2, Vergason-Jones Subdivision (Plat 98-178) containing 4.83 acres. Lot 2 is developed with a single-family residential dwelling that was constructed in 2000.

The property is located south of Upper De Armoun Road, west of Messina Street and east of Canyon Road. Upper De Armoun Road has a discontinuous right-of-way dedication. There is a 70 foot dedicated right-of-way for the western 280 feet of De Armoun Road; a 30 foot dedicated right-of-way for the south half of De Armoun Road that extends for 331 feet, and a 1,322.59 foot dedication for the north half of De Armoun Road. Depending on the traffic volume, a minimum 50 foot to a maximum 60 foot dedicated right-of-way is required for strip-paved and gravel streets in the rural improvement areas as defined at AMC 21.85.020C., which includes the R-6, R-8 and R-9 zoning districts.

De Armoun Road along the north petition site boundary, Messina Street along the west petition site boundary and Canyon Road along the east petition site boundary appear to be constructed with a gravel and/or dirt surface.

Property to the north is zoned R-6 (suburban residential-large lot) district requiring a minimum 1.25 acre lot size; R-8 (rural residential-large lot) district requiring a minimum 5.0 acre lot size, and R-9 (rural residential) district requiring a minimum 2.50 acre lot size.

Property adjoining the west petition site boundary is zoned R-6 and R-9; to the northwest property is zoned R-6. Property to the east is zoned R-8 and R-10 SL. Section 36 to the south is zoned PLI-p.

Most of the land to the north and west has been subdivided and developed with single-family residential uses. The R-8 zoned property adjoining the east property boundary has been subdivided and developed with single family residential uses. Of the recorded plats that were reviewed, approximately 190 acres were subdivided prior to the effective June 6, 1974 date of the Areawide Rezoning at gross densities ranging from 0.53 to 1.25 dwelling units per acre (DUA). Many of these lots do not meet the minimum lot size required by the applicable zoning district.

The density of subdivisions developed after the effective date of the Areawide Rezoning ranges between 0.19 DUA and 0.88 DUA. The lot sizes meet the minimum lot size of the applicable zoning district. *(Please see Appendix A and B at the end of this report.)*

21.20.090 Standards for Zoning Map Amendments.

A. Conformance to the Comprehensive Plan.

This standard has not been met.

Anchorage 2020

Policy 5: *Rezones and variances shall be compatible in scale with adjacent uses and consistent with the goals and policies of Anchorage 2020.*

Policy 13: *New rural residential subdivision shall be designed to:*

- a) Maintain the rural character of the area;
- b) Link to existing adjacent road and trail systems;
- c) Protect, maintain, or avoid sensitive environmental areas (wetlands, steep slopes, drainageways, unsuitable soils, geohazard areas); and,
- d) Incorporate wildland fire safety design standards.

Hillside District Plan – Central Hillside Residential

Goal 1: Guide the amount and location of future development while maintaining the quality and diversity of the Hillside District as a place to live, ranging from low-density rural areas, to single-family suburban neighborhoods, to areas with duplexes and multi-family housing.

Policy 1-C: *Maintain the same land use designations and zoning in this area as were established prior to the beginning of this plan.*

Much of the land surrounding the petition site was subdivided and developed prior to implementation of the Areawide Rezoning. Although the estimated gross densities are relatively low, the lots in much of the development do not meet the minimum lot size of the zoning district within which the property is located. Those subdivisions developed after the Areawide Rezoning contain larger lots that meet the applicable district regulations.

“Watersheds in this area include the systems that feed into Campbell Creek, headwaters of Furrow Creek, and the lower portions of the Rabbit Creek watershed.” (*Hillside District Plan*, page 2-11)

Goal 8: Drainage Management

Develop a functional, watershed-based drainage management system for the Hillside District to achieve the following:

- *Create a practical, effective approach to manage the drainage needs of new and redevelopment.*
- *Ensure existing residents and landowners are protected when new development occurs.*
- *Resolve existing drainage problems and mitigate hazards and adverse impacts associated with inadequate drainage controls in existing developed areas.*
- *Protect existing stream and wetland functions by maintaining the natural quantity, quality, and periodicity of recharge to natural waterbodies and wetlands.*

The petition site declines in elevation from 1,260 feet in the northeast corner down to 920 feet in the southwest corner of the property. The northeast corner of the parcel is impacted by slopes of up to 26%. Slopes range from 17% to 29% along a ridgeline that runs west to east in the southern portion of the parcel. The central area of the property experiences estimated slopes of 12 percent. This is an area of the parcel that has hydric soils. A copy of the preliminary plat indicates that wetlands impact the central and southwestern portions of the property.

A stream enters the petition site at the midpoint of the east property boundary and flows southwesterly to Rabbit Creek which crosses Section 36 park property adjoining the south petition site boundary. Open channels have been identified crossing the property from north to south and originating in the area that has been identified as wetlands. These

drainageways have not been verified and mapped by Watershed Management Services. Late spring/summer is the earliest that the mapping can be done.

Map 1.7, Development Suitability, of the *Hillside District Plan* shows that portions of the petition site are marginally suitable for development. Wetlands, streams and natural drainageways provide storm water management functions. Development affects runoff by replacing permeable land with less permeable surfaces for buildings, roads and driveways. "As natural land is developed and replaced by impermeable surfaces, the potential for runoff-related problems increases." (*HDP, page 3-2*)

By definition, Limited Intensity Residential 0 – 1 dwelling units per acre includes the R-6, R-8, R-9, and R-10 zones. The preliminary plat proposed under the R-6 district regulations would allow for 32 lots and the creation of two wetland tracts. The proposed wetland tracts do not incorporate all the wetland area, portions of which would impact five of the residential lots.

Development under the R-8 district regulations would allow approximately 14 residential lots. An estimated 127% percent increase in density would result from rezoning the property to R-6 from that which could be achieved under the current R-8 zoning.

The petition site is located in an area with a rural development pattern that is outside the water and wastewater service boundaries. It is an area that is furthest from employment and services. It is an area that is served by underdeveloped local roads and inadequate drainage systems and contains environmental constraints which preclude more intense development.

The R-6 district allows a higher density development than the R-8 district which is intended to retain a rural development pattern. The fact that some of the adjacent subdivisions were developed prior to implementation of zoning should not be used as an argument to allow rezoning to a higher density which is not in keeping with the intent of the comprehensive plan.

- B. A zoning map amendment may be approved only if it is in the best interest of the public, considering the following factors:
1. The effect of development under the amendment, and the cumulative effect of similar development, on the surrounding neighborhood, the general area and the community; including but not limited to the environment, transportation, public services and facilities, and land use patterns, and the degree to which special limitations will mitigate any adverse effects.

Environment and Land Use Patterns

The petition site is impacted by steep and variable slopes, wetlands, hydric soils, streams and drainageways. Public water and sanitary sewer are not available to the parcel. Several open channels or drainageways bisect some of the proposed lots. Hydric soils are indicative of wetlands that are not conducive to supporting on-site septic systems.

Thirty-two residential lots are more than double the 14 lots which could be developed under the existing R-8 zoning district. Given the environmental constraints related to this property in terms of steep slopes, wetlands, streams and drainageways, the density that could be achieved with the R-6 district would exceed the carrying capacity of the land.

Review of adjacent subdivisions revealed that the development patterns were established prior to the implementation of the Areawide Rezoning Program for Area G-1. It was determined that the R-6 district was most appropriate for those areas which were developed at a greater density even though the individual lot sizes did not meet the minimum 1.25-acre lot size required in the R-6 district.

As mentioned above, property that was subdivided subsequent to the implementation of zoning has met the minimum lot size of the applicable zoning district. The fact that the areawide rezoning created legal non-conforming lots of record established during the 1950's, 1960's and early 1970's cannot and should not be used as a reason to rezone the current petition site.

Transportation/Drainage

Access to the site is from Upper De Armoun Road, Messinia Street and Canyon Drive. Messinia Street and Canyon Drive are not constructed to municipal standards. At the location of the petition site, De Armoun Road appears to be a dirt road.

Based on AMC 21.85.050A.2. *Determination of average daily trips*, a single-family detached dwelling would generate 8.2 average daily trips (ADT). The proposed preliminary plat submitted with the application indicates that 32 single-family residential lots will be created. Using the trip generation factor of 8.2, 545 ADT will be generated if the property in the R-6 district. The estimated maximum 14 lots that could be developed in the R-8 district would add 115 average daily trips. A 373% increase in traffic would result from a zoning change to the R-6 district.

Public Services and Facilities

The petition site is located in the Building Safety Service Area, the Fire Service Area, and the Parks and Recreation Service Area. Road maintenance and snow plowing is provided by the Glen Alps Service Area.

Public water and sanitary sewer services are not available to the petition site. The proposed lots will be served with on-site wells and septic systems.

Telephone, electric, gas and cable services are available to the petition site.

The adjoining rights-of-way appear to be gravel and/or dirt roads. Messinia Street and Canyon Road do not appear to be constructed to municipal standards.

The petition site is not served by public transportation services.

2. The supply of land in the economically relevant area that is in the use district to be applied by the zoning request or in similar use districts, in relationship to the demand for that land.

The land to the east is zoned R-8 and R-10 SL. There is no R-6 zoned property in the surrounding area available for development. As mentioned above, the property that was zoned R-6 during the Areawide Rezoning Program was applied to subdivisions that had already been developed at a higher density.

3. The time when development probably would occur under the amendment, given the availability of public services and facilities, and the relationship of supply to demand found under paragraph 2 above.

Development is proposed to occur over a period of five years starting in 2015 to 2020.

4. The effect of the amendment on the distribution of land uses and residential densities specified in the Comprehensive Plan, and whether the proposed amendment furthers the allocation of uses and residential densities in accordance with the goals and policies of the Plan.

Both the R-6 and R-8 are residential zoning districts. There would be no change in land use if the rezoning were to be approved. However, there would be an increase in density, impermeable surface and

removal of natural vegetation if the request to rezone the property were to be approved.

AGENCY AND PUBLIC COMMENTS:

On February 4, 2015, 75 public hearing notices were mailed. One comment was received and two notices were returned unclaimed.

Hillside East Community Council: No comments received.

Watershed Management Services: There is a stream in the eastern portion of the area to be rezoned. When this property is subdivided a flood study, individual tract for the stream or additional stream setbacks will be required.

Long Range Planning: Without a wetland delineation, it is unclear whether or not there is sufficient upland to justify a rezone from R-8 to R-6 notwithstanding Policy 1-C of the HDP. Additionally, the presence of streams and drainageways make it more difficult to create greater density while preserving environmental features. Several proposed lots are encumbered with streams and drainageways that would make development of these lots very challenging. We have not had the opportunity to review any data that resulted in the wetland polygons on the proposed subdivision map, and it would be very helpful if that information was made available to staff. *(Please see full comments included in the report.)*

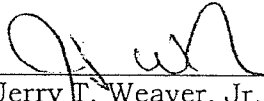
Other agencies that responded had no comment on the proposed rezone to R-6.

DEPARTMENT RECOMMENDATION:

Denial of the request to rezone the petition site from R-8 to R-6 due to:


- Does not conform to the comprehensive plan;
- Environmental impacts that includes steep slopes; wetlands and hydric soils; stream and drainageways; and,
- Significant increase in density and average daily trips travelling on a substandard road system.

Reviewed by:



Jerry T. Weaver, Jr.
Director

Prepared by:



Margaret O'Brien
Senior Planner

(Case No. 2014-0126)
(Tax ID Nos. 017-073-06; 017-074-06)

APPENDIX A
Related Property History¹
Subdivisions Established Prior to the Areawide Rezoning

Recording Date	Plat No.	Zoning District ²	Subdivision
06-22-59	P-476	R-6	Amended final plat recorded for Kimberly Manor Subdivision, Block 1, Lots 1-16 with a net density of 1.2 DUA. <i>Adjoining the west petition site boundary.</i>
03-28-62	P476-A	R-6	Final plat recorded for Kimberly Manor Subdivision, Addition No. 1, Block 2, Lots 1-2 with a net density of 1.25 DUA. <i>Adjoining the west petition site boundary.</i>
11-15-61	P-636	R-6	Final plat recorded for South Hills Subdivision containing 103.43 acres and 78 lots with a gross density of 0.75 DUA. <i>Adjoining the west petition site boundary.</i>
07-27-66	66-82	R-6	Final plat recorded for Terrace Heights, Block 1, Lots 1-20 with a gross density of 0.53 DUA. <i>Adjoins the west petition site boundary.</i>
05-14-68	68-57	R-8	Final plat recorded for Spendlove View heights Subdivision, Block 1, Lots 1-4, Block 2, Lots 1-8, Block 3, Lots 1-11; a 31.76-acre subdivision with a gross density of 0.72. <i>Adjoining the east petition site boundary.</i>
10-30-68	68-141	R-9	Final plat recorded for Random Heights Subdivision, Lots 1-4; a 5.0-acre subdivision with a gross density of 0.80 DUA. <i>Located north of the petition site.</i>
05-22-70	70-113	R-9	Final plat recorded for Woolever Subdivision, Block 1, Lots 1-3 and Block 2, Lots 1-3; a 5.01-acre subdivision with a gross density of 0.83 DUA. <i>Located north of the petition site.</i>
08-04-71	71-168	R-9	Final plat recorded for Mountain Shadows Subdivision, Block 1, Lots 1-11 and Block 2, Lots 1-4; a 15.04-acre subdivision with a gross density of 1.0 DUA. <i>Located northwest of the petition site.</i>
08-26-70 04-05-72	70-234 refiled as 72-64	R-6	Final plat recorded for Grecian Hills Subdivision, Block 1, Lots 1-10, Block 2, Lots 1-18, Block 3, Lots 1-14, and Block 4, Lot 1; a 25.59-acre subdivision with a gross density of 0.76 DUA. <i>Adjoins the west petition site boundary.</i>
07-24-74 ³	74-143	R-8	Final plat recorded for Gombart Subdivision, Lots 1-4; a 5.02-acre subdivision with a gross density of 0.80 DUA. <i>Adjoins the north petition site boundary.</i>

¹ Plats Submitted and/or recorded prior to the effective date of the Areawide Rezoning

² Minimum lot sizes: R-6 - 1.25 acres; R-8 - 5.0 acres; R-9 - 2.50 acres

³ The preliminary plat for this subdivision was submitted prior to the 6/6/74 effective date of the R-8 zoning.

APPENDIX B
Related Property History⁴
Subdivisions Established After the Areawide Rezoning

Recording Date	Plat No.	Zoning District	Subdivision
02-27-76	76-43	R-6	Final plat recorded for Spendlove View Heights, Addition No. 2, Lots 1-7 and Tract A, a 15.03-acre subdivision with a gross density of 0.67 DUA. (Tract A acreage not included in the density calculation.) <i>Adjoins the north petition site boundary.</i>
06-28-83	83-224	R-6	Final plat recorded for Spendlove View Heights Addn. 3, Block 5, Lots 1-4 a subdivision of Tract A, Spendlove View Heights, Addn. 3, a 4.55-acre subdivision with a gross density of 0.88 DUA <i>Located north of the petition site.</i>
12-13-79	79-238	R-8	Final plat recorded for Sun Shine Acres, Lots 1-4; a 20.02-acre subdivision with a gross density of 0.19 DUA. <i>Located north of the petition site.</i>
06-13-83	83-203	R-9	Final plat recorded for Foreland View Subdivision, Block 1, Lots 1-6, Block 2, Lot 1, Block 3, Lot 1 and Tracts A-D; a 15.14-acre subdivision with a gross density of 0.53 DUA. <i>Located northwest of the petition site.</i>
09-20-84	84-323	R-8	Final plat recorded for Tower Estates Subdivision, Block 1, Lots 1-6, Block 2, Lots 1-2; a 40.07-acre subdivision with a gross density of 0.20 DUA <i>Located further north of the petition site.</i>
07-19-85	85-179	R-9	Final plat recorded for Winter Estates, Lots 1-2; a 5.01-acre subdivision with a gross density of 0.40 DUA. <i>Located northwest of the petition site.</i>

⁴ Final plats recorded after the June 6, 1974 effective date of the Areawide Rezoning for Area G.

Application

Lewis & Clark

Index of Professional Reports & Studies

Attached to this application are reports from professionals in their field, they are tabbed from A to H and include:

- A. A report from the law firm of **Ashburn & Mason**, authored by attorneys Mr. Don McClintock & Ms. Rebecca Lipson, concerning HDP language on rezoning;
- B. A report from Mr. Will Webb, PE, PTOE, of **Kinney Engineering, LLC** concerning traffic issues;
- C. A report by Mr. Steve Eng, PE, PH, of **NorthRim Engineering** concerning suitability of soils for septic systems. It should be noted that Mr. Steve Eng was the District Engineer for the Alaska Department of Environmental Conservation, Steve was in charge of subdivision review & approval in Anchorage/Western Alaska; reviewing & approving all soils/wastewater designs to meet State Regulations. During this time, he approved the first advanced wastewater treatment systems. As owner of NorthRim Engineering since 2001, Steve has designed numerous wastewater systems to meet subdivision requirements in the Anchorage area. NorthRim Engineering was hired to monitor & sample effluent from Advantex systems in Anchorage; this advanced wastewater system is used worldwide to provide superior effluent treatment. This is the system that is planned for Lewis & Clark Subdivision.
- D. A report by Mr. Dan Young, CPG of **Terrasat, Inc** evaluating the groundwater resources for Lewis & Clark.
- E. A report by Mr. Dan Young, CPG of **Terrasat, Inc** on the evaluation of nitrates in local wells surrounding the Lewis & Clark development.
- F. A report by Mr. David Grenier, PE, and Mr. Brandon Marcott, PE, of **Triad Engineering** on the Drainage Impact Analysis.
- G. A report by Mr. David Grenier, PE, and Mr. Brandon Marcott, PE, of **Triad Engineering** on the Upper DeArmoun Road condition assessment.
- H. A report by Mr. Pat Athey of **Hemlock Scientific, LLC**. On the preliminary determination of wetlands and waters for Lewis & Clark.

April 17, 2017

Lewis & Clark

Proposed A.O.

The Assembly finds the recommended zoning map amendment described herein satisfies the criteria of the Anchorage Municipal Code and is hereby approved with special limitations as listed below. The zoning map shall be amended by designating the following described property as R-6SL district. (This property is commonly known as Lewis & Clark.)

Legal Description:

The N $\frac{1}{2}$ of the SE $\frac{1}{4}$ of Section 25, T12N, R3W, S.M., Alaska excepting the NW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 25, T12N, R3W, S.M. Alaska, and Lot 1 and 2 of Vergason-Jones Subdivision (Plat 98-178)

This zoning map amendment is subject to the following special limitations:

1. The maximum number of lots on the parcel is 30 single family home lots.
2. The use of a Category III Nitrogen Reducing Wastewater System is required for the development of each lot in the subdivision, except for the currently approved septic system utilized by the existing home on Lot 2, Vergason-Jones Subdivision.

This ordinance shall become effective 10 days after the Director of the Planning Department has received the written consent of at least 51 percent of the owners of the property within the area described above to any special limitations contained herein. The rezone approval herein shall automatically expire, and be null and void, if the written consent is not received within 120 days after the date on which this ordinance is passed and approved. The Director of the Planning Department shall change the zoning map accordingly.

PASSED AND APPROVED by the Anchorage Assembly this _____ day of _____, 2017.

Application for Zoning Map Amendment

Municipality of Anchorage
Planning Department
PO Box 196650
Anchorage, AK 99519-6650



PETITIONER*		PETITIONER REPRESENTATIVE (if any)	
Name (last name first): Big Country Enterprises, LLC (Todd Brownson)		Name (last name first): S4 Group (Tom Dreyer)	
Mailing Address: 4700 E 147TH AVE		Mailing Address: 124 E 7th Avenue	
ANCHORAGE AK 99516		Anchorage, AK 99501	
Contact Phone – Day: 907-406-0792 406-698-6969	Evening:	Contact Phone – Day: 907-227-1847	Evening:
Fax: N/A		Fax: N/A	
E-mail: toddbrownson@hotmail.com		E-mail: Tom@S4AK.com	

*Report additional petitioners or disclose other co-owners on supplemental form. Failure to divulge other beneficial interest owners may delay processing of this application.

PROPERTY INFORMATION

Property Tax # (000-000-00-000): 017-073-06-000 017-074-06-000 017-074-05-000			
Site Street Address: 8600 UPPER DEARMOUN RD			
Current legal description: (use additional sheet if necessary) THE NORTH ONE-HALF OF THE SOUTHEAST ONE-QUARTER (N1/2 SE1/4) OF SECTION 25, TOWNSHIP 12 NORTH, RANGE 3 WEST, SEWARD MERIDIAN, LOCATED IN THE ANCHORAGE RECORDING DISTRICT, THIRD JUDICIAL DISTRICT, STATE OF ALASKA. EXCEPTING THEREFROM THE NORTHWEST ONE-QUARTER OF THE NORTHWEST ONE-QUARTER OF THE SOUTHEAST ONE-QUARTER (NW1/4 NW1/4 SE1/4) OF SECTION 25, TOWNSHIP 12 NORTH, RANGE 3 WEST, SEWARD MERIDIAN, LOCATED IN THE ANCHORAGE RECORDING DISTRICT, THIRD JUDICIAL DISTRICT, STATE OF ALASKA. LOTS 1 & 2, VERGASON-JONES SUBDIVISION (PLAT 98-178)			
Existing Zoning: R-8	Acreage: 80 Acres	Grid #:	SW2941
Proposed Zoning: R-6SL			
Existing use: Vacant		Proposed use (if any): Residential	

I hereby certify that (I am)/(I have been authorized to act for) owner of the property described above and that I petition to rezone it in conformance with Title 21 of the Anchorage Municipal Code of Ordinances. I understand that payment of the application fee is nonrefundable and is to cover the costs associated with processing this application, and that it does not assure approval of the rezoning. I also understand that assigned hearing dates are tentative and may have to be postponed by Planning Department staff, the Planning and Zoning Commission, or the Assembly for administrative reasons.

Signature ☒ Owner ☒ Representative 4/3/2017
Date
(Representatives must provide written proof of authorization)

Print Name
Thomas H. Dreyer

Accepted by:	Poster & Affidavit:	Fee:	Case Number:	Requested Meeting Date:
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COMPREHENSIVE PLAN INFORMATION

Anchorage 2020 Urban/Rural Services: ☐ Urban ☒ Rural

Anchorage 2020 Major Elements - site is within or abuts:

- ☐ Major employment center ☐ Redevelopment/mixed use area ☐ Town center
☐ Neighborhood commercial center ☐ Industrial reserve
☐ Transit-supportive development corridor ☐ District/area plan area: _____

Chugiak-Eagle River Land Use Classification:

- ☐ Commercial ☐ Industrial ☐ Parks/open space ☐ Public lands/institutions ☐ Town center
☐ Transportation/community facility ☐ Alpine/slope affected ☐ Special study area ☐ Development reserve
☐ Residential at _____ dwelling units per acre ☐ Environmentally sensitive area

Girdwood- Turnagain Arm Land Use Classification

- ☐ Commercial ☐ Industrial ☐ Parks/open space ☐ Public lands/institutions ☐ Resort
☐ Transportation/community facility ☐ Alpine/slope affected ☐ Special study area ☐ Reserve
☐ Residential at _____ dwelling units per acre ☐ Mixed use ☐ Rural homestead

ENVIRONMENTAL INFORMATION (All or portion of site affected)

- Wetland Classification: ☐ None ☒ "C" ☐ "B" ☐ "A"
Avalanche Zone: ☒ None ☐ Blue Zone ☐ Red Zone
Floodplain: ☒ None ☐ 100 year ☐ 500 year
Seismic Zone (Harding/Lawson): ☐ "1" ☒ "2" ☐ "3" ☐ "4" ☐ "5"

RECENT REGULATORY INFORMATION (Events that have occurred in last 5 years for all or portion of site)

- ☒ Rezoning - Case Number: 2014-0219
☐ Preliminary Plat ☐ Final Plat - Case Number(s): _____
☐ Conditional Use - Case Number(s): _____
☐ Zoning variance - Case Number(s): _____
☐ Land Use Enforcement Action for _____
☐ Building or Land Use Permit for _____
☐ Wetland permit: ☐ Army Corp of Engineers ☐ Municipality of Anchorage

SUBMITTAL REQUIREMENTS

- 1 copy required: ☒ Signed application (original)
☒ Ownership and beneficial interest form
- 35 copies required: ☒ Signed application (copies)
☒ Signatures of other petitioners (if any)
☒ Map of area to be rezoned
☒ Map of area surrounding proposed rezoning, including zoning and existing uses
☒ Narrative statement explaining:
☒ need and justification for the rezoning
☒ the proposed land use and development
☒ the probable timeframe for development
☒ an analysis of how the proposal meets the rezoning criteria on page 3 of this application
☒ Summary of community meeting(s)
☒ Proposed special limitations, if any

(Additional information may be required.)

APPLICATION CHECKLIST

1. Zoning map amendments require a minimum of 1.75 acres of land excluding right-of-way or a boundary common to the requested zoning district. (For exceptions, see AMC 21.03.160B.)
2. In the case of multiple owners, the petitioning property owners must provide documentation showing ownership of at least 51% of property to be rezoned.

ZONING MAP AMENDMENT STANDARDS (AMC 21.03.160)

A rezoning request may only be approved if it meets the approval criteria stated in AMC 21.03.160E. Please explain how the proposal meets the required criteria:

1. The rezoning shall be in the best interest of the citizens of Anchorage and shall promote the public health, safety, and general welfare.
2. The rezone complies with and conforms to the comprehensive plan, including the comprehensive plan map(s). (If the proposed rezone does not conform to the comprehensive plan, it may be considered along with a comprehensive plan amendment.)
3. The rezoning is generally consistent with the zoning district purpose in the requested zone, and the purpose of this title.
4. The rezoning is compatible with surrounding zoning and development, and protects areas designated for specific uses on the zoning map from incompatible land uses or development intensities.
5. Facilities and services (including roads and transportation, water, gas, electricity, police and fire protection, and sewage and waste disposal, as applicable) are capable of supporting the uses allowed by the zone or will be capable by the time development is complete, while maintaining adequate levels of service to existing development.
6. The rezoning is not likely to result in significant adverse impacts upon the natural environment, including air, water, noise, storm water management, wildlife, and vegetation, or such impacts shall be substantially mitigated.
7. The proposed rezoning is not likely to result in significant adverse impacts upon adjacent land uses, or such impacts shall be mitigated through stipulations.
8. The rezone does not extent or exacerbate a land use pattern that is inconsistent with the comprehensive plan.
9. The rezoning does not result in a split-zoned lot.

Supplemental Form: OWNERSHIP AND BENEFICIAL INTEREST DISCLOSURE

PETITIONER: CORPORATE OFFICERS OR PARTNERS

Applicants for an entitlement that will be in possession and the responsibility of more than one individual, such as a co-owner, joint venture, partnerships, corporations, company, or other similar form of ownership, are required to disclose a full and complete list of the name and address of each principal. (use additional paper if necessary)

Name	Title or Office(if any)	Address
Todd Brownson	Manager, Member	3640 E. 65 th Ave, Anchorage, AK 99507
Elisha Brownson	Member	3640 E. 65 th Ave, Anchorage, AK 99507
Paul Gionet	Member	4700 E. 147 th Ave, Anchorage, AK 99506
Susanne Gionet	Member	4700 E. 147 th Ave, Anchorage, AK 99516

PROPERTY OWNER: CORPORATE OFFICERS OR PARTNERS

The petitioner of a property owned by more than one individual that will benefit from an entitlement is required to disclose a full and complete list of the name and address of each partner, officer, or co-owner. The other owner interest to be reported is co-owner, joint venture, partnership, corporation, company, or other similar form of ownership. (use additional paper if necessary)

Name	Title or Office(if any)	Address

Attach this sheet to your application form

Accepted by:	Date	Application for	Case Number
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Disclosure (Rev 01/02)

Supplemental Form: ADDITIONAL PETITIONERS

ADDITIONAL PETITIONERS:

Applicants for an entitlement involving more than one property description and owned by more than one individual are required to provide the name, legal description of property owned, and signature of each petitioner. Persons signatory to this application supplement are deemed to be petitioners (use additional paper if necessary)

We, the undersigned, hereby apply for: A zoning map amendment to T2-B

Signature	Name (printed or typed)	Legal description of property owned within petition area
	Evelyn Lavi Vergason	Lot-1 Vergason-Jones Subd.
	Bruce Vergason	" " "
	Lor: Jones	Lot-2 Vergason-Jones Subd
	Jeff Jones	" " "
5.		
6.		
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11.		
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13.		
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17.		
18.		
19.		
20.		

Attach this sheet to your application form

Accepted by: _____	Date: _____	Application for: _____	Case Number: _____
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Petitioners (Rev 01/02)



Land Surveying
Land Development Consultants
Subdivision Specialists
Construction Surveying

124 E 7th Avenue, Anchorage, Alaska 99501 www.S4AK.com 907-306-8104

September 1st, 2016

Mr. Hal Hart
MOA Planning Director
4700 Elmore Road
Anchorage, Ak 99507

Letter of Authorization


Lewis & Clark Rezone

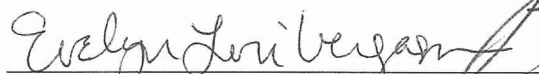
Dear Mr. Hart,


The authorized signers for the below listed parcels, do hereby authorize the S4 Group to represent them before the MOA for the re-zoning of these parcels commonly known as Lewis & Clark.

The current legal description of the property includes three separate parcels of land, they are;


1. The N ½ of the SE 1/4, Section 25, T12N, R3W, S.M., Alaska, excepting the NW ¼ of the NW ¼ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska, approx. 70 acres.
2. Lot 1, Vergason-Jones Subdivision, approx. 5 acres,
3. Lot 2, Vergason-Jones Subdivision, approx. 5 acres,

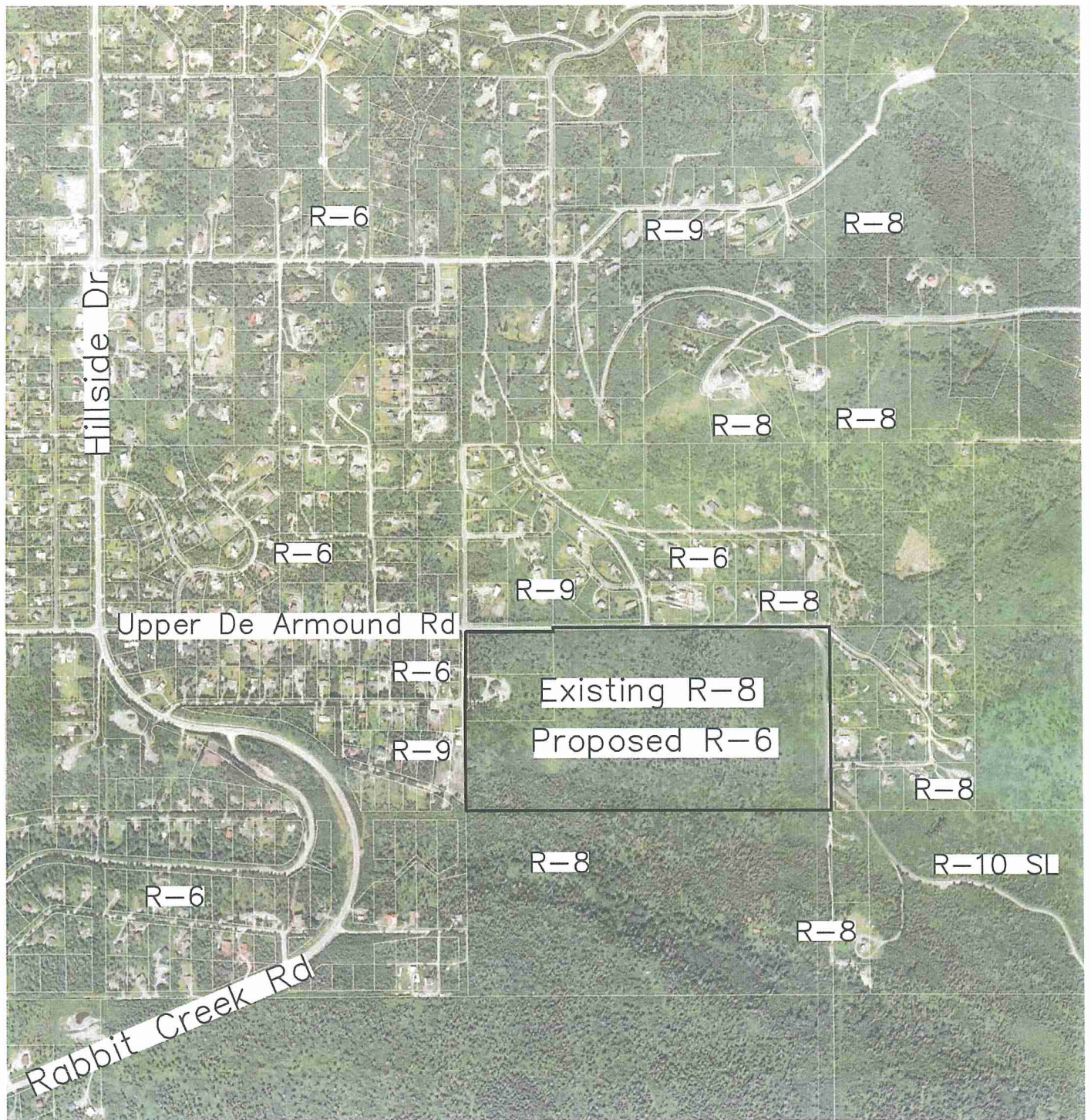

Parcel 1 authorized signature for: Elisha & Todd Brownson, Paul & Susanne Gionet


Parcel 2 authorized signature for: Evelyn Lori & Bruce Vergason


Parcel 3 authorized signature for: Lori & Jeff Jones

Thank you,


Tom Dreyer, PLS
S4 Group
Petitioner's representative

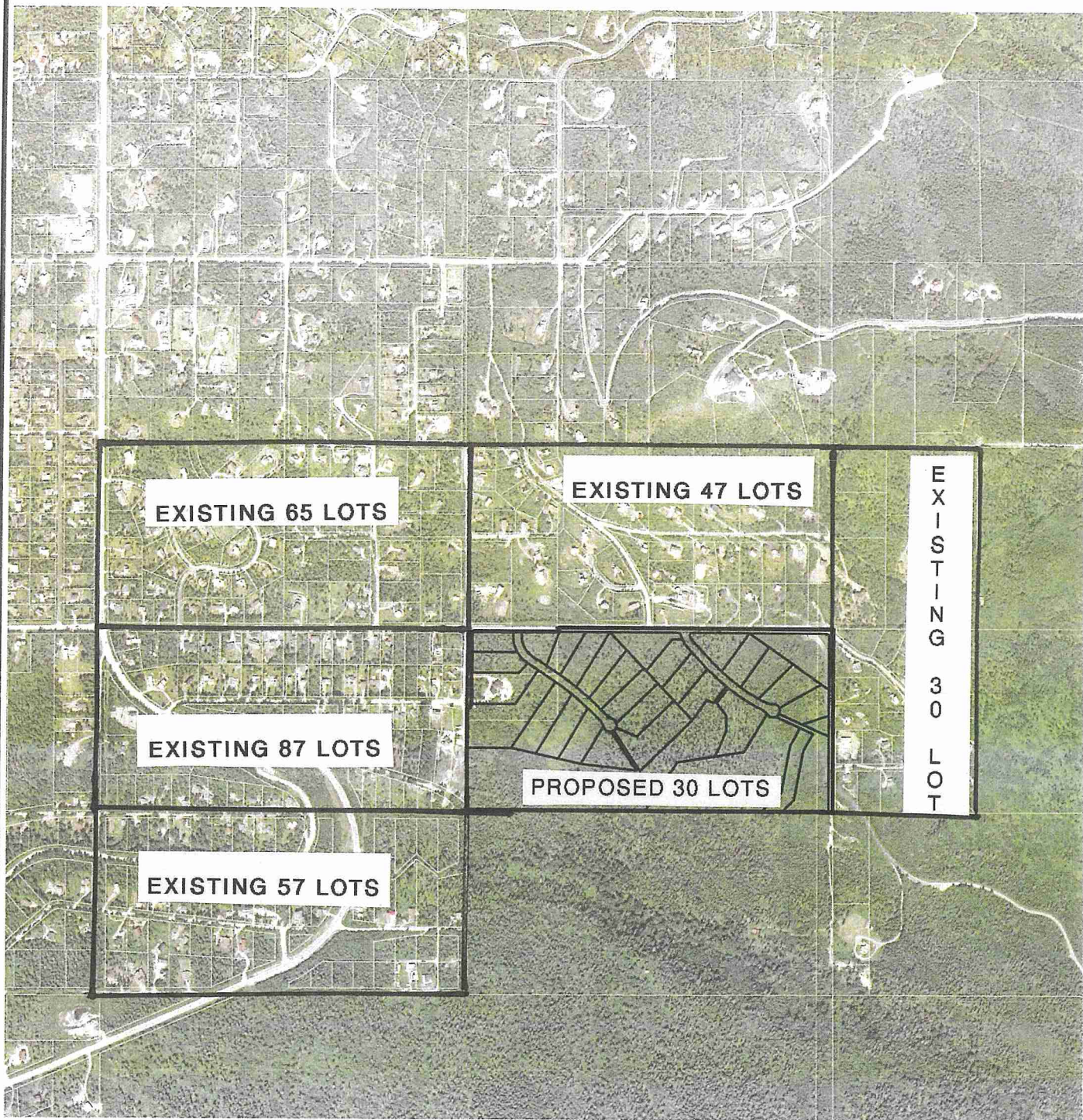


S4
Group

Land Surveying
Land Development Consultants
Subdivision Specialists
Construction Surveying

Proposed Lewis & Clark ReZone

Scale 1" = 1000'



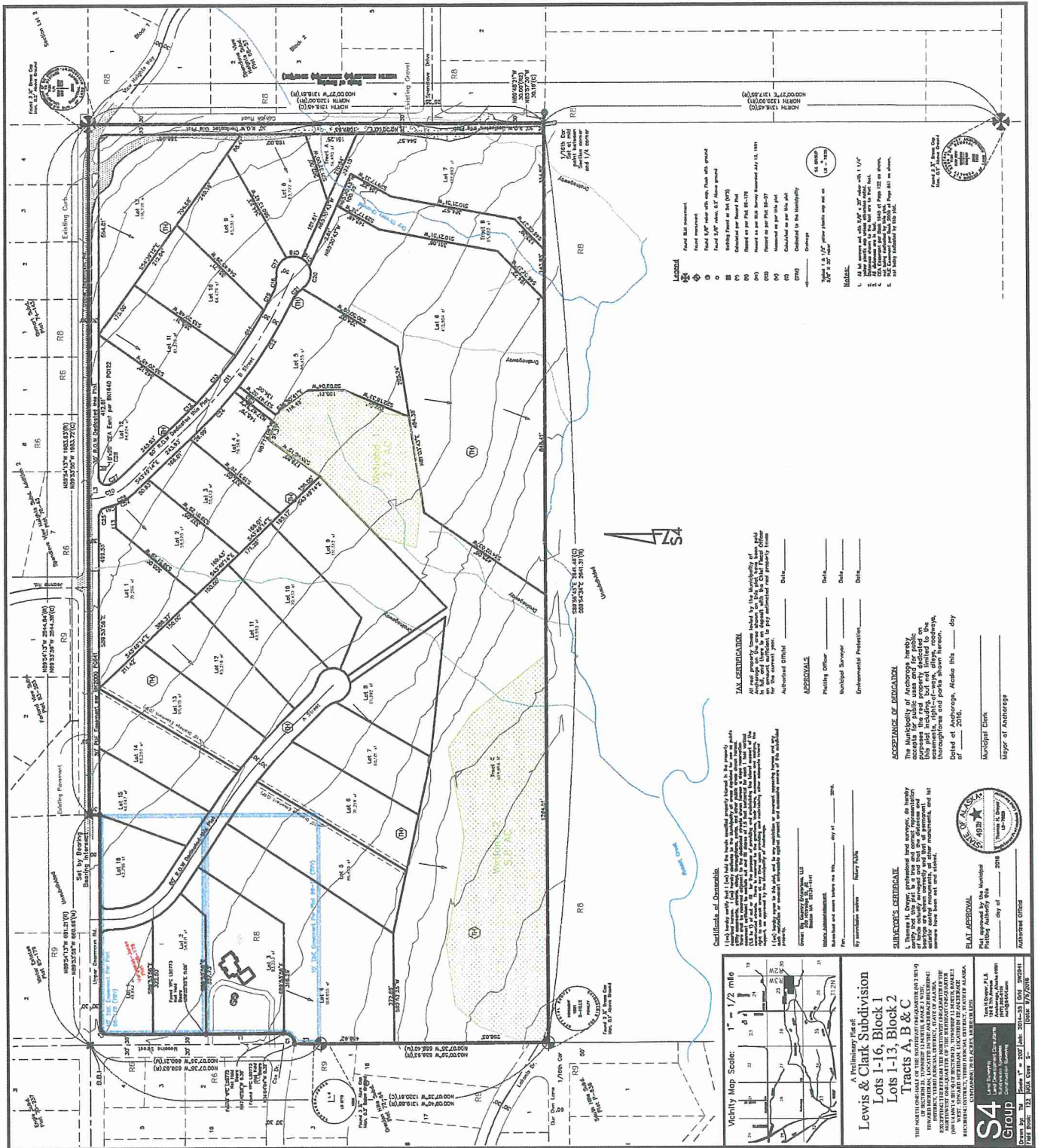
S4
Group

Land Surveying
Land Development Consultants
Subdivision Specialists
Construction Surveying

Lewis & Clark Rezone
Showing Surrounding Neighborhood Lot Counts
& The Proposed Lewis & Clark Subdivision

Scale 1" = 1000'





Community Meeting!

You're Invited.....

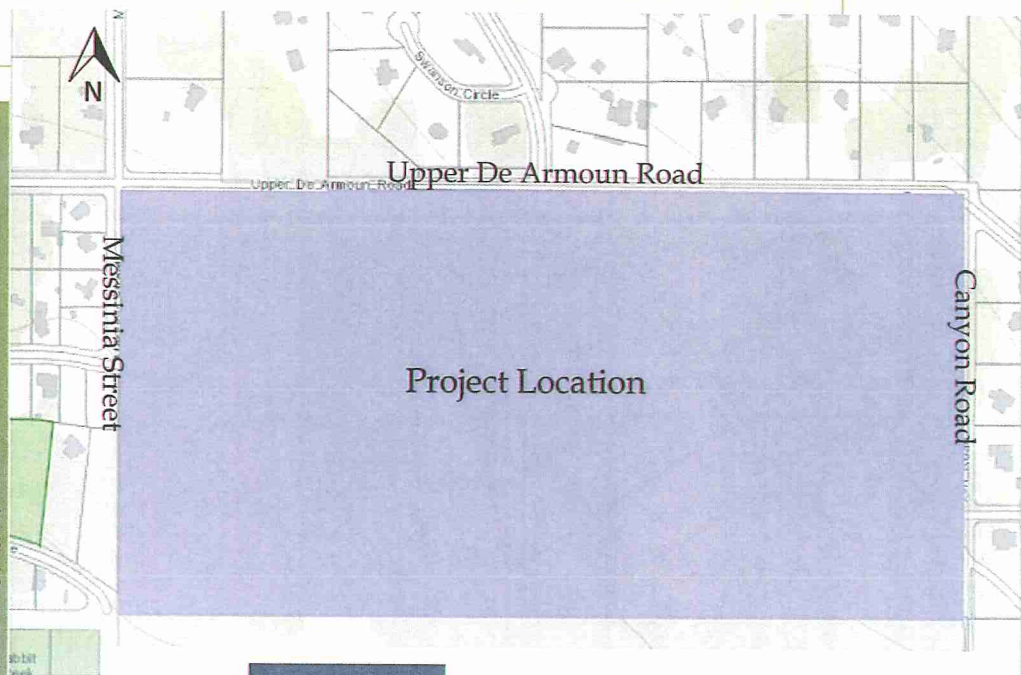
Petitioner: Big Country Enterprises, LLC

Rezoning

Community Meeting Agenda Notification

Big Country Enterprises, LLC represented by S4 Group LLC, will be at the Hillside Community Council on October 26, 2016 to present on a proposed rezoning case. The project site is located where Upper De Armoun Road turns into Canyon Road (Vergason-Jones Lots 1 & 2, T12N R3W Sec 25 S 1/2W 1/2 NW 1/4 SE 1/4 & E 1/2 NW 1/4 SE 1/4 & NE 1/4 SE 1/4) aka Lewis & Clark.

This project site is zoned low density residential (R8). The zoning map amendment is requesting a rezone to R6. Representatives will provide an overview of the rezone request, project schedule and will be available to answer questions.



Tuesday, October 25th
2016

O'Malley Elementary School
Library
1100 Rockridge Drive
Anchorage, AK 99516
7:00 PM

We welcome your feedback! Interested parties may appear at the meeting and speak on the matter. You can also submit your comments or request additional information by contacting:

Tom Dreyer, PLS
S4 Group, LLC
tom@s4ak.com

S4
Group

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124 E 7th Ave Anchorage, AK 99501 www.s4ak.com



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November 1, 2016

Mr. Hal Hart, MOA Planning Division Director
4700 Elmore Road
Anchorage, Ak 99507

Re: Summary of Community Meeting

Project: "Lewis & Clark" Re-zoning

Dear Mr. Hart,

This Letter serves as the 'Summary of Community Meeting' as per Title 21.03.020.C.6. The property is commonly known as the 'Lewis & Clark' property, the legal description consists of three separate parcels;

1. The N ½ of the SE ¼, Section 25, T12N, R3W, S.M., Alaska, excepting the NW ¼ of the NW ¼ of the SE ¼ of Section 25, T12N, R3W, S.M., Alaska, approx. 70 acres.
2. Lot 1, Vergason-Jones Subdivision, approx. 5 acres,
3. Lot 2, Vergason-Jones Subdivision, approx. 5 acres,

We mailed out 177 first class notices of the community meeting on October 4th, which was 21 days before the community meeting.

We held a community meeting at the 10/25/2016 regular meeting of the Hillside Community Council. The meeting was held at the O'Malley Elementary School located at 11100 Rockridge Drive at 7:30 PM. There were approximately 25 people at the meeting.

SUMMARY OF NOTES TAKEN AT 10/25/16 COMMUNITY COUNCIL MEETING:

Question: Original proposal was for 36 Lots?

Response: Original proposal had 32 Lots, now 29 – 30 Lots with a total acreage of 80 acres.

From Gail Morrison – 8600 Spendlove Drive, 017-401-31, R6 Zoning, lives on a 1.03 acre lot.

Question: Why did you go against the Hillside District Plan? 2040 plan calls for "Large Lots".

Response: 2040 Plan calls for 1 DUA, we are at less than half the density, 0.4 du/a.

Question: What is the setback for drainage ways?

Response: 25 ft either side of drainage ways, 50' either side for streams.

Question: Army Corps of Engineers Report for Wetlands was not completed.

Response: Full delineation of existing wetlands and report was completed by Pat Athey of Hemlock Scientific and provided to the MOA, but left out of package by the Planning & Zoning Department. Army Corps of Engineers JD permit submitted. We are tracting out the wetlands.

Question: If completed, why is it so difficult to produce?

Response: It is not, the report is public information, we can get you a copy.

Comment: You said 2.5 acre lots, but are showing some that are more like an acre.

Response: 2.5 acre is average density, 30 lots on 80 acres is an overall average land use of 2.5 acres per dwelling unit.

Question: Soils are clay. How can you have septic systems?

Response: 25 new test holes completed. There was not any clay encountered. Soils are silty sand with gravel and grading to more dense silt. Advanced treatment systems are not required, based on soils, but will be required by owners in development, possibly as a special limitation to the zoning.

Question: I've drilled holes in the neighborhood and always found clay.

Response: From Mr. Steve Eng, and My Dan Young: Not clay, by definition (USCS).

Question: Do you have a plan for a residence in the NE corner of property?

Response: Yes.

Question: Are you looking at cluster housing?

Response: No.

Unknown Neighbor:

- a. Question: How far is southern property border from Rabbit Creek?
- b. Response: It's at least 300 ft, from the southern boundary line, plus there is approximately 300 ft of "greenbelt" along the majority of the southern boundary proposed layout.

Unknown Neighbor:

Question: What are white tape descriptions on presented plan? How large are wetland areas?

Response: White Tape marks show delineated wetland areas. There is a total of approximately nine acres of wetlands. We have tracted out a total of approximately 15 acres of "greenbelt" including wetland areas.

John Oliver – 8611 Upper DeArmoun Rd, 017-401-28, R6 Zoning, lives on a 0.92 acre lot.

Question: How many roads in & out? Input & Output on Upper DeArmoun? We would like to see DeArmoun Road fixed.

Response: Two Cul-De-Sacs, input & output will be onto DeArmoun Road. We would like to see Upper DeArmoun Road fixed too.

Question: How can these lots be affordable. He has teacher/nursing loans and was fortunate to get a lot. Says traffic has gone up over last 8 years because of hikers going to Rabbit Lake.

Response: It is our goal to make the lots as affordable as possible.

From Rob Brown – 13688 Canyon Road, 021-021-07, R8 Zoning, lives on a 3.03 acre lot.

Question: Army Corps JD Permit? What year was it applied for? Under what name?

Response: Hemlock Scientific performed the Wetland Delineation and Report in 2014. The permit is under Big Country Enterprises. We are tracting out the wetlands.

Question: Would conventional systems pass? Where will advanced treatment system requirement be shown?

Response: Conventional systems would pass, but owners have elected to require advanced systems. Requirement will be a plat note, or a special limitation on the zoning.

Comment: Last application we were told all of these septic issues would be dealt with at platting. We want answers now.

Response: Advanced systems could be required in the Special Limitations of the rezone.

Comment: SE corner of property has clay. The Mills family has dealt with clay.

Question: Do you know how much acreage is occupied by Canyon Road on corner?

Response: We haven't measured that.

Question: Are you in negotiation with the city regarding right of way?

Response: Yes.

Carl Portman – 8831 Upper DeArmoun Rd, 017-41-24, R8 Zoning, lives on a 1.14 acre lot.

Question: How many lots on the upper cul-de-sac between Jeanne Road and Canyon Road. Appears that highest density of housing in that area. Concerns are views, noise, and aquifer/wells. Indicated that they bought that property thinking that lots would be 5 acres.

Response: Carl was brought up to the proposed plan. Indicated that his lot is on the north side of Upper DeArmoun Road and that he has a 1.25 acre lot. Showed him that all of the lots in his area of concern are larger than his lot and topography would not allow views to be blocked. Concerns about aquifer/wells discussed by Mr. Dan Young.

Unknown Neighbor:

Question: What about the natural springs out there?

Response: Comprehensive drainage plan is being undertaken currently, and also during the platting process. We have an obligation to manage as per strict MOA regulations.

Unknown Neighbor:

Question: This has been a dry year. Are tests accurate? Hillside rain is different than the Airport measurement.

Response: Wet June/July, 45% more precipitation than average.

Ralph Warren – 7901 Upper DeArmoun Rd, 017-014-03, R6 Zoning, lives on a 2.07 acre lot (owns 4-5 lots)

Comment: He has a property with a pond. Certain years has to pump pond. Has wells with high nitrates. Nitrate levels 10ppm.

Response: From Mr. Dan Young- Where is well? Haven't seen any readings that high. Mr. Young Has all MOA data for the last 30 years.

Mark Minor:

Question: Is there concern about egress if wildfire because of two cul-de-sacs?

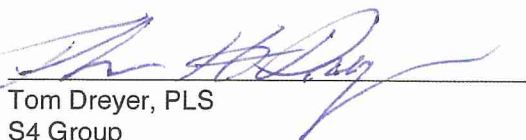
Response: AFD reviewed during pre-application, meets code requirements.

Question: Will advanced septic system be individual or community?

Response: Individual.

If members of the Community Council or the MOA Planning staff need any further information or clarification, please email me at: tom@s4ak.com.

Thank you,



Tom Dreyer, PLS

S4 Group

Petitioner's representative

10/25/2010 HKS

MTNG

NAME

LANCE POWELL

Shirley Cote

STEVE ENG

Jo Kidd

Raph Watren

Tom Dryer (54 Group)

Scott Steele

Nancy Harvey

Rob Brown

Jan Denon

Gail Morrison

James Brady

Todd + Elisha Brownson

David Gussis

Anita Baker

Eric + Joan Wasserman

David L. ...

E-MAIL OR I REE PHONE#

Lw Powell @ Sandra
shirlancote@gmail.com

Steve Eng PE@gmail.com

Tommy Kidd gci.net

7901 Upper DeArmed N 3452010

tom@54AK.COM

AKQONBEE@hotmail.com

brharvey@gcinet

robbrun1998@gmail.com

2LPS4STD@gmail.com

gmorrison@alliedgis.com

lazej907@gmail.com

todd@bigcountryak.com

DAVID@GUSSEFORAKSA.COM

anka@allspiebaraksa.com

Wasser people@gci.net
3452010

NAME

KATELINA AUSTIN

DAN YOUNG

Bart Jenkins

Stark Mills

Greg Kuipper

Mark Miner

E MAIL OR Telephone #

907-250-4756

344/4370

345-8888

Smills@christian
heath.org

522-

7083

gregandkate@homein.alaska.net

	A	B	C	D	E	F
1	2101109000	ALEXANDER CHRISTOPHER & JANET LIVING TRUST	9000 SPENDLOVE DRIVE	ANCHORAGE	AK	99516
2	1740143000	ALLEN TIMOTHY J & CASSIDY ELAINE M	8450 SWANSON CIRCLE	ANCHORAGE	AK	99516-3369
3	1701348000	AMSTADTER KYLE M & JENNIFER R	8101 UPPER DEARMOUN ROAD	ANCHORAGE	AK	99516-3808
4	2102111000	ARMSTRONG BARBARA A & TUCKEY JOHN D	13551 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-6915
5	1707431000	BAILEY RONALD M & JAIME L	13240 MESSINIA ST	ANCHORAGE	AK	99516-3809
6	1707372000	BELTZ THOMAS C & ABBY L	8000 COX DR	ANCHORAGE	AK	99516
7	1707306000	BIG COUNTRY ENTERPRISES LLC	4700 E 147TH AVENUE	ANCHORAGE	AK	99516
8	1740154000	BLAKESLEE-EDWARDS TERESA	PO BOX 221624	ANCHORAGE	AK	99522-1624
9	1701368000	BRADSHAW KORY W & CAROLINE	13045 PATRICK ROAD	ANCHORAGE	AK	99516-3317
10	1740126000	BRADY JAMES A & NANCY J	8731 UPPER DE ARMOUN ROAD	ANCHORAGE	AK	99516-3366
11	2102125000	BROOKS RYAN EUGENE	PO BOX 112042	ANCHORAGE	AK	99511-2042
12	2102107000	BROWN GINA M	13688 CANYON ROAD	ANCHORAGE	AK	99516-3188
13	1740153000	BRYANT WILLIAM C IV & CORINNE A (TOD)	8820 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-3358
14	1707234000	BUCHHOLDT DYLAN C & ELTON CARA J	8143 RABBIT HILL DRIVE	ANCHORAGE	AK	99516-3860
15	1740147000	BURKET JOHN E & CYNTHIA G	8521 SWANSON CIRCLE	ANCHORAGE	AK	99516-3369
16	1707370000	CAMERON W B & LINDA	8040 COX DRIVE	ANCHORAGE	AK	99516-3842
17	1701309000	CASSITY GLEN KEVIN	PO BOX 90354	ANCHORAGE	AK	99509-0354
18	1740107000	CLOUD JAMES L & D LEE	PO BOX 110742	ANCHORAGE	AK	99511-0742
19	2102108000	COOK FRANK E	PO BOX 2255	VALDEZ	AK	99686-2255
20	1707429000	COVINGTON CHARLES ALBERT	7761 MCLURE CIRCLE	ANCHORAGE	AK	99507-6232
21	1707437000	DAVIS RODGER C	8000 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516-3807
22	1707436000	DAVIS RODGER C & CONNIE K	8000 UPPER DE ARMOUN ROAD	ANCHORAGE	AK	99516-3807
23	1707430000	DELANEY JEANETTE N	13250 MESSINIA ST	ANCHORAGE	AK	99516-3809
24	1740135000	DELGADO ALEXIS	8601 SPENDLOVE DR	ANCHORAGE	AK	99516-3394
25	2102123000	DIRKS JEFF & ANGELA LIVING TRUST DIRKS J R & M A CO TTES	3440 SOUTHLUFF CIR	ANCHORAGE	AK	99515
26	1740148000	DOUGHERTY-WORBY REV TRUST	8520 SPENDLOVE DR	ANCHORAGE	AK	99516-3356
27	1707434000	DUFLOUR DANIEL A & CANDANCE	5738 HERITAGE HEIGHTS DR	ANCHORAGE	AK	99516-2362
28	1740142000	FORELAND VIEW SUB ASSOC % AL HOFFIENS	BRIERWOOD DRIVE	MOBILE	AL	36606-2322
29	2102124000	HAARPER-LEWIS LOIS E	13240 VIEW HEIGHTS WAY	ANCHORAGE	AK	99516-6916
30	1701367000	HARVEY ROBERT P & NANCY	13001 PATRICK RD	ANCHORAGE	AK	99516-3317
31	1707204000	HAVARD E DANE & CATHERINE LIVING TRUST	8035 RABBIT HILL DRIVE	ANCHORAGE	AK	99516-3832
32	1707366000	HAWKINS BARTLEY C & CYNTHIA SUE ALLEN	12921 MONTEREY CIR	ANCHORAGE	AK	99516-2753
33	1740155000	HODOR MARK A LIVING TRUST & FITILIS HILARY J LIVING TRUST	8918 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-3398
34	1740133000	HOLMAN AMY	8740 SPENDLOVE DR	ANCHORAGE	AK	99516-3356
35	1740122000	HUGHES KRAIG R	8931 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516-3386
36	1740130000	HYATT JORGENSEN TRUST HYATT CT & JORGENSEN A L / TTES	PO BOX 112176	ANCHORAGE	AK	99511-2176
37	1707432000	JENSEN TEDDY B	13230 MESSINIA ST	ANCHORAGE	AK	99516-3809
38	1707382000	JOHNSON HAAKON K & LINDSAY A	8160 COX DR	ANCHORAGE	AK	99516-3871
39	1707405000	JONES JEFF F & LORI C	11801 MARY AVE	ANCHORAGE	AK	99515
40	1740125000	JUNE MARC W & SUSAN E	8801 UPPER DE ARMOUN ROAD	ANCHORAGE	AK	99516-3368
41	1707459000	KAUFFMAN BRYCE D	7940 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516-3833
42	1740149000	KAUFMAN RAYMOND J	8521 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-3357
43	2102121000	KIDD CHARLES P & JOANN K	PO BOX 111898	ANCHORAGE	AK	99511-1898

	A	B	C	D	E	F
44	1707368000	KIM CHONG MUK & CHONG MI	8130 COX DR	ANCHORAGE	AK	99516-3842
45	1740152000	KRYNYTZKY MARTA I 63% & LITTLE JERRY R 37%	8800 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-3358
46	1701369000	LARSON GERALD W & SHIRLEY A	13145 PATRICK ROAD	ANCHORAGE	AK	99516-3317
47	2102130000	LEE CHONG NO & HYUN KYUNG JA	13391 CANYON ROAD	ANCHORAGE	AK	99516-6905
48	1740136000	LEE HARRY R & MARY ANN	8701 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-3357
49	1740137000	LEHRMANN RAQUEL V	PO BOX 231634	ANCHORAGE	AK	99523-1634
50	2102109000	LOOMIS TODD M FLEEK ADRIENE K	13591 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-6915
51	1740140000	MACDONALD STEVEN & JANET M	13130 JEANNE ROAD	ANCHORAGE	AK	99516-3346
52	2102128000	MATSUOKA STEVE & DOROFF CARLA	13564 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-6915
53	1707463000	MCCASLIN ERICA R & JUSTIN E	8111 LAKONIA DRIVE	ANCHORAGE	AK	99516-3872
54	1707377000	MILLER ERICA M	13441 LARISA STREET	ANCHORAGE	AK	99516-3845
55	1707201000	MILLS WILLIAM J JR & ELAINE	1544 HIDDEN LANE	ANCHORAGE	AK	99501-4916
56	1707378000	MOBLEY PAMELA & THOMAS	8011 LAKONIA DR	ANCHORAGE	AK	99516-3838
57	1701350000	MONDAY PATRICIA C	13000 MICHAEL RD	ANCHORAGE	AK	99516-3344
58	1740131000	MORRISON MARK R & GAIL W	8600 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-6971
59	1740106000	MUELLER ROYCE KENSTON REVOCABLE LIVING TRUST MUELLER D A & R K/ TRUSTEES	8335 E 130TH AVENUE	ANCHORAGE	AK	99516-3336
60	1740141000	NEFEDOV SERGEY Y	8460 SWANSON CIRCLE	ANCHORAGE	AK	99516-3369
61	1740128000	OLIVER JOHN A	8611 UPPER DEARMOUN RD	ANCHORAGE	AK	99516-3316
62	2102110000	OTT BRIAN C & RUNA HALEY L	13551 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-6915
63	1707423000	PEEPLES KENNETH W	7961 COX DRIVE	ANCHORAGE	AK	99516-3843
64	1740144000	PENNINGTON DAVID B JR & NIKI D	8400 SWANSON CIRCLE	ANCHORAGE	AK	99516-3369
65	2102120000	PFISTERER ROBERT B & JOANN M	13210 SPENDLOVE DR	ANCHORAGE	AK	99516-6915
66	1707376000	PHILLIPS SHERI L	13431 LARISA ST	ANCHORAGE	AK	99516-3845
67	1740146000	PIVI PAOLA	13010 JEANNE RD	ANCHORAGE	AK	99516-3392
68	1701349000	PLATT MICHAEL D & ROBIN KELLY	13160 MICHAEL RD	ANCHORAGE	AK	99516-3344
69	1707427000	POPE DAVID J	8041 COX DR	ANCHORAGE	AK	99516-3870
70	1707426000	POPE DAVID J & MICHELLE L	8041 COX DRIVE	ANCHORAGE	AK	99516-3863
71	1740124000	PORTMAN CARL RAY	8831 UPPER DEARMOUN ROAD	ANCHORAGE	AK	99516-3368
72	1740127000	PRIESTLEY JOAN CAROL 50% & DAVIS BERNARD ROBERT 50%	3705 ARCTIC BLVD #1332	ANCHORAGE	AK	99503-5774
73	1701309000	Resident	12940 MICHAEL RD	ANCHORAGE	AK	99516
74	1701348000	Resident	8101 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
75	1701349000	Resident	13160 MICHAEL RD	ANCHORAGE	AK	99516
76	1701350000	Resident	13000 MICHAEL RD	ANCHORAGE	AK	99516
77	1701367000	Resident	13001 PATRICK RD	ANCHORAGE	AK	99516
78	1701368000	Resident	13045 PATRICK RD	ANCHORAGE	AK	99516
79	1701370000	Resident	13145 PATRICK RD	ANCHORAGE	AK	99516
80	1707201000	Resident	13880 BONNIELAINE RD	ANCHORAGE	AK	99516
81	1707204000	Resident	8035 RABBIT HILL DR	ANCHORAGE	AK	99516
82	1707234000	Resident	8143 RABBIT HILL DR	ANCHORAGE	AK	99516
83	1707368000	Resident	8130 COX DR	ANCHORAGE	AK	99516
84	1707370000	Resident	8040 COX DR	ANCHORAGE	AK	99516
85	1707371000	Resident	8020 COX DR	ANCHORAGE	AK	99516
86	1707372000	Resident	8000 COX DR	ANCHORAGE	AK	99516

	A	B	C	D	E	F
87	1707373000 Resident		7960 COX DR	ANCHORAGE	AK	99516
88	1707376000 Resident		13431 LARISA ST	ANCHORAGE	AK	99516
89	1707377000 Resident		13441 LARISA ST	ANCHORAGE	AK	99516
90	1707378000 Resident		8011 LAKONIA DR	ANCHORAGE	AK	99516
91	1707382000 Resident		8160 COX DR	ANCHORAGE	AK	99516
92	1707383000 Resident		8170 COX DR	ANCHORAGE	AK	99516
93	1707384000 Resident		8120 LAKONIA DR	ANCHORAGE	AK	99516
94	1707389000 Resident		7990 LAKONIA DR	ANCHORAGE	AK	99516
95	1707406000 Resident		13301 MESSINIA ST	ANCHORAGE	AK	99516
96	1707423000 Resident		7961 COX DR	ANCHORAGE	AK	99516
97	1707424000 Resident		8001 COX DR	ANCHORAGE	AK	99516
98	1707425000 Resident		8021 COX DR	ANCHORAGE	AK	99516
99	1707426000 Resident		8041 COX DR	ANCHORAGE	AK	99516
100	1707427000 Resident		8101 COX DR	ANCHORAGE	AK	99516
101	1707428000 Resident		8141 COX DR	ANCHORAGE	AK	99516
102	1707429000 Resident		8161 COX DR	ANCHORAGE	AK	99516
103	1707430000 Resident		13250 MESSINIA ST	ANCHORAGE	AK	99516
104	1707431000 Resident		13240 MESSINIA ST	ANCHORAGE	AK	99516
105	1707432000 Resident		8120 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
106	1707433000 Resident		8000 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
107	1707437000 Resident		7940 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
108	1707459000 Resident		8111 LAKONIA DR	ANCHORAGE	AK	99516
109	1707463000 Resident		8324 E 130TH AVE	ANCHORAGE	AK	99516
110	1740104000 Resident		8335 E 130TH AVE	ANCHORAGE	AK	99516
111	1740106000 Resident		8301 E 130TH AVE	ANCHORAGE	AK	99516
112	1740107000 Resident		8931 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
113	1740122000 Resident		8831 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
114	1740124000 Resident		8801 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
115	1740125000 Resident		8731 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
116	1740126000 Resident		8701 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
117	1740127000 Resident		8611 UPPER DE ARMOUN RD	ANCHORAGE	AK	99516
118	1740128000 Resident		13101 JEANNE RD	ANCHORAGE	AK	99516
119	1740129000 Resident		13035 JEANNE RD	ANCHORAGE	AK	99516
120	1740130000 Resident		8600 SPENDLOVE DR	ANCHORAGE	AK	99516
121	1740131000 Resident		8700 SPENDLOVE DR	ANCHORAGE	AK	99516
122	1740132000 Resident		8740 SPENDLOVE DR	ANCHORAGE	AK	99516
123	1740133000 Resident		8601 SPENDLOVE DR	ANCHORAGE	AK	99516
124	1740135000 Resident		8701 SPENDLOVE DR	ANCHORAGE	AK	99516
125	1740136000 Resident		8801 SPENDLOVE DR	ANCHORAGE	AK	99516
126	1740137000 Resident		8901 SPENDLOVE DR	ANCHORAGE	AK	99516
127	1740138000 Resident		13130 JEANNE RD	ANCHORAGE	AK	99516
128	1740140000 Resident		8460 SWANSON CIR	ANCHORAGE	AK	99516
129	1740141000 Resident					

	A	B	C	D	E	F
130	1740143000	Resident	8450 SWANSON CIR	ANCHORAGE	AK	99516
131	1740144000	Resident	8400 SWANSON CIR	ANCHORAGE	AK	99516
132	1740146000	Resident	13010 JEANNE RD	ANCHORAGE	AK	99516
133	1740147000	Resident	8521 SWANSON CIR	ANCHORAGE	AK	99516
134	1740148000	Resident	8520 SPENDLOVE DR	ANCHORAGE	AK	99516
135	1740149000	Resident	8521 SPENDLOVE DR	ANCHORAGE	AK	99516
136	1740152000	Resident	8800 SPENDLOVE DR	ANCHORAGE	AK	99516
137	1740153000	Resident	8820 SPENDLOVE DR	ANCHORAGE	AK	99516
138	1740154000	Resident	8900 SPENDLOVE DR	ANCHORAGE	AK	99516
139	1740155000	Resident	8918 SPENDLOVE DR	ANCHORAGE	AK	99516
140	1740157000	Resident	13111 MICHAEL RD	ANCHORAGE	AK	99516
141	2101109000	Resident	9000 SPENDLOVE DR	ANCHORAGE	AK	99516
142	2102107000	Resident	13688 CANYON RD	ANCHORAGE	AK	99516
143	2102108000	Resident	13641 BONNELAINE RD	ANCHORAGE	AK	99516
144	2102109000	Resident	13591 SPENDLOVE DR	ANCHORAGE	AK	99516
145	2102110000	Resident	13571 SPENDLOVE DR	ANCHORAGE	AK	99516
146	2102111000	Resident	13551 SPENDLOVE DR	ANCHORAGE	AK	99516
147	2102112000	Resident	13531 SPENDLOVE DR	ANCHORAGE	AK	99516
148	2102120000	Resident	13210 SPENDLOVE DR	ANCHORAGE	AK	99516
149	2102121000	Resident	13351 VIEW HEIGHTS WAY	ANCHORAGE	AK	99516
150	2102124000	Resident	13240 VIEW HEIGHTS WAY	ANCHORAGE	AK	99516
151	2102125000	Resident	13350 VIEW HEIGHTS WAY	ANCHORAGE	AK	99516
152	2102126000	Resident	13440 VIEW HEIGHTS WAY	ANCHORAGE	AK	99516
153	2102127000	Resident	13456 SPENDLOVE DR	ANCHORAGE	AK	99516
154	2102128000	Resident	13564 SPENDLOVE DR	ANCHORAGE	AK	99516
155	2102129000	Resident	13431 CANYON RD	ANCHORAGE	AK	99516
156	2102129000	Resident	13580 SPENDLOVE DR	ANCHORAGE	AK	99516
157	2102130000	Resident	13391 CANYON RD	ANCHORAGE	AK	99516
158	2102131000	Resident	13341 CANYON RD	ANCHORAGE	AK	99516
159	2102127000	REYNOLDS DEREK S & RACHELLE G	PO BOX 240053	ANCHORAGE	AK	99524-0053
160	2102104000	ROHALEY DONALD L & WASSILISSIA	7100 HUFFMAN	ANCHORAGE	AK	99516-2451
161	1740132000	ROHWER JASON A & LAUREL C	8700 SPENLOVE DR	ANCHORAGE	AK	99516
162	1707384000	ROLFS BENJAMIN & HEATHER	8051 FAIRWOOD CIR	ANCHORAGE	AK	99518
163	1707428000	SECRETARY OF HOUSING & URBAN DEVELOPMENT THE %INFO SYSTEMS & NETWORKS CORP	2401 NW 23RD ST STE 1D	OKLAHOMA CITY	OK	73107
164	2102129000	SHINE RON	13431 CANYON RD	ANCHORAGE	AK	99516-6905
165	1740104000	SMITH LAURA J & MICHAEL R	8324 E 130TH AVE	ANCHORAGE	AK	99516-3335
166	1740157000	SPENCER CURTIS D & YVONNE A	13111 MICHAEL ROAD	ANCHORAGE	AK	99516-3345
167	2102126000	STEDINGH KURT W JR & CAROL	13440 VIEW HEIGHTS WAY	ANCHORAGE	AK	99516-6916
168	2102113000	THOMAS TIMOTHY K & MICHELLE P	PO BOX 244151	ANCHORAGE	AK	99524-4151
169	1707371000	TUTTLE BETTY ANNE	8020 COX DR	ANCHORAGE	AK	99516-3842
170	1707425000	VANDUREN SHAWN & JOSCELYN	8021 COX DR	ANCHORAGE	AK	99516
171	1707406000	VERGASON BRUCE M & EVELYN LORI	13301 MESSINIA ST	ANCHORAGE	AK	99516-3810
172	2102131000	VOLPER DAVID J & KENNISON MERIDEANE	13341 CANYON ROAD	ANCHORAGE	AK	99516-6905

14-55 Lewis and Oct '16 Mailing List

	A	B	C	D	E	F
173	1740156000	WASIAK LIDIA	1800 MISSION HILLS RD APT 412	NORTHBROOK	IL	60062
174	1707373000	WAYT ROBERT E	7960 COX DRIVE	ANCHORAGE	AK	99516
175	2102112000	WOCKENFUSS JEFF L & DEBORAH M	13531 SPENDLOVE DR	ANCHORAGE	AK	99516-6915
176	2101110000	WOODSON GEORGIA BURY REVOCABLE TRUST	8901 SPENDLOVE DRIVE	ANCHORAGE	AK	99516-3359
177		Hillside Community Council	4621 Golden Spring Circle	ANCHORAGE	AK	99507



Land Surveying
Land Development Consultants
Subdivision Specialists
Construction Surveying

124 E 7th Avenue, Anchorage, Alaska 99501 www.S4AK.com 907-306-8104

September 14, 2016

Mr. Francis McLaughlin
MOA Senior Planner
4700 Elmore Road
Anchorage, Ak 99507

Request for a Pre-Application Conference

Lewis & Clark Rezone

Dear Mr. McLaughlin,

On behalf of the petitioners, Big Country Enterprises, LLC, we are requesting a pre-application conference for the rezoning of the property commonly known as Lewis & Clark. The property is currently zoned R-8, and we are requesting rezoning the property to R-6. The property is approximately 80 acres in size and generally lies in the southeast quadrant of Upper DeArmoun Road and Messinia Street.

The current legal description of the property includes three separate parcels of land, they are;

1. The N $\frac{1}{2}$ of the SE $\frac{1}{4}$, Section 25, T12N, R3W, S.M., Alaska, excepting the NW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 25, T12N, R3W, S.M., Alaska, approx. 70 acres.
2. Lot 1, Vergason-Jones Subdivision, approx. 5 acres,
3. Lot 2, Vergason-Jones Subdivision, approx. 5 acres,

At your convenience, anytime on Tuesday, September 20th in the A.M., or anytime Wednesday, September 21th would work for us. If these dates are not available, please give me a call and we can work out another date & time for the pre-app meeting.

Thank you,

A handwritten signature in blue ink, appearing to read 'Tom Dreyer', is written over a horizontal line.

Tom Dreyer, PLS
S4 Group
Petitioner's representative



Municipality of Anchorage
Planning Division
4700 Elmore Rd.
Anchorage, AK 99507

Project Name:

Lewis & Clark Rezone

Case No. _____

Meeting Type:

☐ Concept

☒ Pre-Application

☐ Post-Application

☐ Other

Meeting Requested by:

Tom Dreyer, S4 Group

Date: 9-21-16

Lead MOA Planner:

Francis McLaughlin

Time: 2pm

	NAME (please print)	COMPANY	PHONE	E-MAIL
1	Francis McLaughlin	Current Planning	343-8003	mdanghlinfd@muni.org
2	Terry Schoenthal	Current Planning	343-7917	schoenthaltn@muni.org
3	Ryan Yelle	Current Planning	343-7935	YelleRJ@muni.org
4	Brandon Marott	Triad Engineering	344-3114	brandonmarott@triadeng.com
5	DAN YOUNG	TERRASAT, INC	344-9370	DAN.YOUNG@TERRASAT
6	Tom Dreyer	S4 Group	227-1847	ENVIRONMENTAL.C
7	DAVE GREYER	Triad Engineering	561-6537	tdgreyer@triadeng.com
	Jason Moncrieff	Private Development	343-8310	moncrieffjrm@muni.org
	Jody Seitz	Longrange planning, Muni	343-7940	Seitzji@muni.org
10	BRANDON TELFORD	MOA - PD	343-8443	telfordls@muni.org
11	BROOKE BLESSING	MOA - PM&E	343-8387	blessingbr@muni.org
12	Randy Ribble	MOA - TRAFFIC	343-8415	RRIBBLE@Muni.org
13	PAUL GIONET	Big Country Ent.	345-8989	PAULANDSUSANAE@GMAIL.CO
14	TODD BROWNSON	Big Country Enterprises	698-6969	todd@grndup.com
15				
16				

Notes:



Municipality of Anchorage

Public Works

Road Service Area Administration

GLEN ALPS ROAD SERVICE AREA

DATE: April 4th, 2017

Attention: Hal Hart – Planning Director @ MOA Planning Division

4700 Elmore Road, Anchorage AK 99507

Dear Mr Hal Hart,

While the Glen Alps Road Service Area Board does not endorse, support, oppose, or otherwise take any position on the Lewis and Clark Development project, developer Todd Brownson has shown a willingness to work with our road service area board to resolve issues that impact our roads and current road improvement projects. He has attended a few of our board meetings and has worked with our project manager to collaborate on strategies that could be mutually beneficial to his development and our road improvement projects. All of our interactions with Mr. Brownson to date have been professional and courteous and we are pleased to have a land owner willing to negotiate with us on road-improvement projects that directly impact their property and our service area.

Sincerely,

Joe Connolly, Glen Alps Road Service Area Board Chair

Date: 4-4-17

4700 Elmore Road, 2nd floor
Anchorage, AK. 99507



Land Surveying
Land Development Consultants
Subdivision Specialists
Construction Surveying

124 E 7th Avenue, Anchorage, Alaska 99501 www.S4AK.com 907-306-8104

April 3, 2017

Re-zoning Application Narrative for
Lewis & Clark

Need & Justification for the rezoning: This proposal is to rezone the property to R-6SL which would allow us to subdivide the property through the platting process into individual lots for single family home construction with reduced development costs. The current zoning of R-8 requires lots with a minimum lot size of four acres and 300' in width, this equates to 20 lots that would be allowed on the 80 acre parcel. This proposal is for 30 lots on 80 acres, with lots ranging in size from 1 1/4 to 9 acres in size, the average density on the entire site is less than 0.4 dwelling units per acre. These lot sizes fit in well with the surrounding average lot sizes of about an acre and a quarter. The lots in Lewis & Clark will be highly desirable by home builders, and most of the lots will have incredible views along with a nearly flat paved interior road access.

Proposed land use and development: The proposed land use is for a development of 30 single-family homes, one per lot.

Probable timeframe for development: The probable timeframe for development of the subdivision is from 2018 to 2023.

Special Limitations: We are proposing two special limitations to the zoning. Special limitation 1 will limit the number of lots to 30, and special limitation 2 will require advanced high tech septic systems, commonly known as the Advantex system, or also known as 'Category III Nitrogen Reducing Wastewater Systems'. It should be noted that these systems are not required as per soil tests, but are over and above what is required by regulations.

Professional Reports & Studies: Attached to this application are reports from professionals in their field, they include:

- A. A report from the law firm of Ashburn & Mason, authored by attorneys Mr. Don McClintock & Ms. Rebecca Lipson, concerning HDP language on rezoning;
- B. A report from Mr. Will Webb, PE, PTOE, of Kinney Engineering, LLC concerning traffic issues;
- C. A report by Mr. Steve Eng, PE, PH, of NorthRim Engineering concerning suitability of

soils for septic systems. It should be noted that Mr. Steve Eng was the District Engineer for the Alaska Department of Environmental Conservation, Steve was in charge of subdivision review & approval in Anchorage/Western Alaska; reviewing & approving all soils/wastewater designs to meet State Regulations. During this time, he approved the first advanced wastewater treatment systems. As owner of NorthRim Engineering since 2001, Steve has designed numerous wastewater systems to meet subdivision requirements in the Anchorage area. NorthRim Engineering was hired to monitor & sample effluent from Advantex systems in Anchorage; this advanced wastewater system is used worldwide to provide superior effluent treatment. This is the system that is planned for Lewis & Clark Subdivision.

D. A report by Mr. Dan Young, CPG of Terrasat, Inc evaluating the groundwater resources for Lewis & Clark.

E. A report by Mr. Dan Young, CPG of Terrasat, Inc on the evaluation of nitrates in local wells surrounding the Lewis & Clark development.

F. A report by Mr. David Grenier, PE, and Mr. Brandon Marcott, PE, of Triad Engineering on the Drainage Impact Analysis.

G. A report by Mr. David Grenier, PE, and Mr. Brandon Marcott, PE, of Triad Engineering on the Upper DeArmoun Road condition assessment.

H. A report by Mr. Pat Athey of Hemlock Scientific, LLC. On the preliminary determination of wetlands and waters for Lewis & Clark.

1. The rezoning shall be in the best interest of the citizens of Anchorage and shall promote the public health, safety, and general welfare.

This rezoning to R-6SL will promote the public health & safety and general welfare of the home buying public by providing well designed lots with a safe, paved access road that is designed to all of the current code restrictions that provide safety features such as adequate turn-around for fire trucks, a safe and flat road grade in the interior streets, improved drainage systems, high tech septic systems, and large lots that are conducive to Anchorage Hillside style of living. New subdivisions on the hillside are becoming increasingly rarer as most of the land is fully developed. Lewis & Clark will provide 30 home owners the chance to be in an all-new subdivision with all-new houses, and all-new paved streets. The existing zoning of R-8 with its requirement for lot widths of 300 feet do not allow the development of lots that would be within reach financially of most home buyers. The R-6 lot minimum lot width of 150 feet reduces the cost of the roadway improvements substantially. Most of the Hillside consists of lots conforming to the R-6 dimensional standards.

2. *The rezone complies with and conforms to the comprehensive plan, including the comprehensive plan maps(s). (If the proposed rezone does not conform to the comprehensive plan, it may be considered along with a comprehensive plan amendment.)*

Lewis & Clark conforms to the comprehensive plan. **Policy 5** states that rezones shall be compatible in scale with adjacent uses, which this proposal strictly complies with. Adjacent to the north of this property lies R-6 zoning with developed 1 & 1/4 acre lot sizes. Adjacent to the west of this property lies R-9 zoned property and has been developed with half-acre and acre sized lots. Adjacent to the east lies R-8 zoning developed with 1 & 1/4 acre lots. Adjacent to the south lies undeveloped R-8 property that encompasses Rabbit Creek. With the addition of the special limitation of 30 homes on this property, this rezoning clearly complies with all intents and purposes of the comp plan. **Policy 13** of the comp plan states that new rural subdivisions shall be designed to maintain the rural character of the area, our proposal is for R-6 lots, which are considered rural lots. **Policy 13** states that we should link to adjacent roadway systems, which we do. **Policy 13** states that we should protect wetlands and other environmental areas. We are protecting the wetlands by creating large tracted parcels that include the wetland areas and the stream setback areas. **Policy 5** states that we should incorporate wildland fire safety design standards, which new homes are built to. **Policy 14** of the comp plan states very clearly: "*Conservation of residential lands for housing is a high community priority. New residential developments at densities less than identified in the Neighborhood or District plans is discouraged.*" This policy gives clear direction that in order for the Anchorage community to grow and prosper, properties must be developed at what they can reasonably and responsibly be constructed.

Hillside District Plan Map 2.1 "Hillside Land Use Plan'. Lewis & Clark conforms with the density levels as shown on this map. Lewis & Clark is in an area labeled as "Residential, with an allowed limited density of 0 to 1 DUA. We are proposing a density level that is in the middle of the density range. The density level in Lewis & Clark will be 0.4 dua.

Policy 1-B of the Hillside district plan states: *"This plan maintains existing residential land use designations and zoning in the southeast Hillside."* The intent here is clear: Maintain residential where it is currently residential zoning, commercial where there is currently commercial zoning, and so on. The intent was not to limit zoning changes that would result in lots still equal or larger than that of the surrounding lots. R-6 zoning fits well within the land use designation as specified on page 2-17 of the Hillside District Plan titled "Limited Intensity Residential", which is defined as large lot, single family residences in a rural environment. Lewis & Clark fits every description and location criteria listed in the HDP. To further clarify the issue, please see the attached letter of opinion from attorneys Mr. Donald McClintock and Ms. Rebecca Lipson of the law firm of Ashburn & Mason, along with correspondence with the now retired Planning Division manager, Mr. Terry Schoenthal.

3. The rezoning is generally consistent with the zoning district purpose in the requested zone, and the purpose of this title.

This rezoning will comply with all of the R-6 zoning district purposes and specifications as in Title 21. We are proposing two special limitations; the first special limitation will limit the development to 30 dwelling units on the 80 acre parcel. The second special limitation will require each lot to be built with a Category 3 Nitrogen Reducing wastewater system, commonly called the Advantex system.

4. The rezoning is compatible with surrounding zoning and development, and protects areas designated for specific uses on the zoning map from incompatible land uses or development intensities.

Lewis & Clark will be compatible with the surrounding zoning and development. With our proposed special limitation of 30 lots on the 80 acre parcel, we will be less dense than the areas to the east, the north, and to the west of us. The area to the south is undeveloped. Please refer to the aerial map enclosed with this application that shows the number of lots in each area surrounding Lewis & Clark. In addition to being compatible as to density levels, Lewis & Clark is also compatible as to land use. The only land use allowed will be one single family house per lot.

5. Facilities and services (including roads and transportation, water, gas, electricity, police and fire protection, and sewage and waste disposal, as applicable) are capable of supporting the uses allowed by the zone or will be complete by the time development is complete, while maintaining adequate levels of service to existing development.

All facilities, utilities and services are capable of supporting the planned residential uses in Lewis & Clark. Road Access is by Upper DeArmoun Road, water services will be by

individual water wells on each lot, sewer systems will be on-site systems that utilize the Advantex-style septic system, which will be required by a special limitation to this zoning. Fire protection issues will be addressed by complying with the latest fire codes, and by providing fire department approved turn-arounds at the end of each cul-de-sac within Lewis & Clark, and providing roads that are safe by width and design, and by being nearly flat in grade. For further information on water availability, please refer to the extensive report by Mr. Dan Young of Terrasat, Inc., attached to this application. For further information on the soils, please refer to the report by Mr. Steve Eng of Northrim Engineering, also attached to this application.

6. The rezoning is not likely to result in significant adverse impacts upon the natural environment, including air, water, noise, storm water management, wildlife, and vegetation, or such impacts shall be substantially mitigated.

The approval of this rezone will help reduce environmental impacts, in relation to:

Steep slopes: All lots will comply with the slope chart standards in Title 21. The Slope Chart in Title 21.80 figure 13, defines the lot area and lot width required for different slopes of land. The general slope of the Lewis & Clark parcel is within the range of 5 to 15 %. According to the slope chart, this would require a lot size of 12,000 square feet, or about a quarter acre, and a required width of 100'. Our proposed lots are from one to three acres, with a minimum width of 150'. Areas that are steeper than this have larger lots and wider widths, all within Title 21 strict standards. For example, a lot with a 20% slope would be required to have an area of 15,000 sf, and a lot width of 105', Lewis & Clark lots that are in this steeper area are 2 to 3 acres in size and 300' wide.

Wetlands/Streams/Drainageways: Pat Athey, with Hemlock Scientific, LLC has performed extensive wetland studies that have defined the wetland boundaries streams, drainage-ways, and water features of the property. Lots will be designed to these standards with the wetland areas being protected and they will be tracted out and designed utilizing Title 21 regulations. The platting process will further define and refine the details and lot lines according to the professional reports, Title 21 subdivision standards, and other reporting agencies comments. For further detail, please refer to the report prepared by Mr. Pat Athey titled, "Preliminary Determination of Wetlands & Water" attached to this application.

Hydric soils: Extensive soil and ground water studies have been conducted by the local engineering firm of Northrim Engineering, Terrasat, Inc. and the Garness Engineering Group. We have drilled extensive test holes over the entire parcel to help us define the future lot layout to insure that each lot will have adequate areas and reserve sites for septic

systems. Through the platting process, all lots will meet Title 21 regulations concerning septic site standards and availability of water. Final lot line locations will take into consideration the boundaries of the areas suitable for septic sites and well-site locations. The soils are further protected by our proposed zoning special limitation of requiring each lot to have a septic system that is commonly referred to as an Advantex system. Please refer to the attached soils report by Mr. Steve Eng of NorthRim Engineering.

Traffic: DeArmoun Road, is classified as a type 1C collector according to the Anchorage Official Streets & Highways Plan. A class 1C road is required to have two lanes, a sixty foot ROW width, and a rating of 2,000 to 10,000 ADT's. DeArmoun Road is built to 1C standards, and is designed to accommodate 10,000 ADT's. This rezoning would allow 10 more lots than the existing zoning currently allows. A single family house is rated at 9.52 ADT's, which equates to an additional 95 ADT's, which equals less than 1.0% of the allowed ADT's onto DeArmoun Road as per the design standards. DeArmoun Road is a two lane paved roadway. Data Sources from the MOA and HDR shows that for Upper DeArmoun Road, a long term build out volume to capacity ratio is 0.25. This means that even after long term final build out, DeArmoun Road will be at only 25% of it's designed capacity. For further detail, please refer to the enclosed Traffic Analysis by Mr. Randy Kinney and Mr. Will Webb of Kinney Engineering, and refer to the attached report by Triad Engineering titled "Upper DeArmoun Road Condition Assessment."

7. The proposed rezoning is not likely to result in significant adverse impacts upon adjacent land uses, or such impacts shall be mitigated through stipulations.

There will be no adverse impacts to neighboring properties. For further detail, please refer to the report from Mr. David Grenier and Mr. Brandon Marcott of Triad Engineering titled 'Preliminary Drainage Impact Analysis', enclosed with this application. Their summary states: "Conclusion: As mentioned in Section 2.c., one of the primary concerns for this development will be the contributing offsite runoff from properties to the north and east of the project. Area upstream of the project generates approximately half of the total runoff that flows through the site. This runoff will be collected and routed through vegetated drainage ways and directed to Rabbit Creek, closely matching the existing drainage path on site. No grading will be done outside of the property boundary, and MOA-identified drainage ways will remain in place downstream of the project. The overall existing drainage pattern of the surrounding area will not change or be negatively affected with the development of this parcel.

Increasing the density from R-8 to R-6 zoning (limited to 30 lots) creates a minimal change in peak runoff, with an increase in the range of 3-7%. This minor increase can be safely managed by sizing drainage ways and culverts accordingly. The increase in impervious

area is also minimal, increasing from 3.3% impervious under R-8 zoning to 6.1% impervious with a 30-lot R-6 development. As proposed, the project site will remain at a low density with an average lot size greater than 1&1/2 acres, with over 80% of the parcel predicted to remain as heavily vegetated brush and trees. Glaciation concerns will be addressed by keeping shallow ground water along the roadways below the ground surface. No adverse impacts to neighboring properties are anticipated under the proposed R-6 zoning designation and 30-lot limitation."

8. The rezone does not extend or exacerbate a land use pattern that is inconsistent with the comprehensive plan.

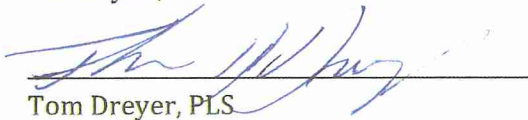
This rezone's R-6SL is consistent with the land use patterns in the area and is consistent with the comprehensive plan as stated above.

9. The rezoning does not result in a split-zoned lot.

Lewis & Clark will not create any split-zoned lots.

If you have any questions or need further clarifications, please email me at tom@s4ak.com.

Thank you,



Tom Dreyer, PLS

S4 Group

ASHBURN & MASON P.C.

LAWYERS

MATTHEW T. FINDLEY • EVA R. GARDNER • REBECCA E. LIPSON • DONALD W. MCCLINTOCK III
JEFFREY W. ROBINSON • JESSICA J. SPÜHLER • THOMAS V. WANG
OF COUNSEL JULIAN L. MASON III • A. WILLIAM SAUPE

February 23, 2017

Re: Conformity of Proposed Rezoning to Anchorage 2020
Our File No.: 11558.001

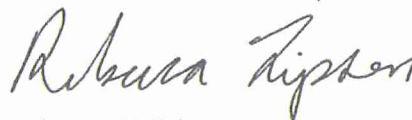
Dear Chairperson:

We represent Big Country Enterprises, LLC. Enclosed is our correspondence to Terry Schoenthal advancing the position that the specific language of Policy 1-C (or 1-B) of the Hillside District Plan should not be read in and of itself to preclude consideration of the rezone. Electronic correspondence we received in response from Mr. Schoenthal is also enclosed for your consideration.

We look forward to working with you during this process.

Sincerely,

ASHBURN & MASON, P.C.



Rebecca E. Lipson

REL:haw
Encl.

ASHBURN & MASON P.C.

LAWYERS

MATTHEW T. FINDLEY • EVA R. GARDNER • REBECCA E. LIPSON • DONALD W. MCCLINTOCK III
JEFFREY W. ROBINSON • JESSICA J. SPÜHLER • THOMAS V. WANG
OF COUNSEL JULIAN L. MASON III • A. WILLIAM SAUPE

December 30, 2016

Via Electronic and US Mail

Terry Schoenthal
Municipality of Anchorage
4700 Elmore Road
Anchorage, Alaska 99507
SchoenthalTN@ci.anchorage.ak.us

Re: Conformity of Proposed Rezoning to Anchorage 2020
Our File No. 11558.001

Dear Terry:

Big Country Enterprises, LLC seeks to rezone approximately 80 acres in the Central Hillside Residential Area from a R-8 (rural residential—large lot) designation to a R-6SL (suburban residential—large lot, special limitations) designation.¹ In the past, the Planning and Zoning Commission has cited the Hillside District Plan (“HDP”), specifically Policy 1-C, as one of the grounds to deny a rezone for the subject property.

¹ The legal description is: The North One-Half of the Southeast One-Quarter (N1/2 SE 1/4) of Section 25, Township 12 North, Range 3 West, Seward Meridian, located in the Anchorage Recording District, Third Judicial District, State of Alaska. Excepting therefrom the Northwest One-Quarter of the Northwest One-Quarter of the Southeast One-Quarter (NW1/4 NW1/4 SE 1/4) of Section 25, Township 12 North, Range 3 West, Seward Meridian, located in the Anchorage Recording District, Third Judicial District, State of Alaska and Lots 1 & 2 Vergason-Jones Subdivision, according to the official plat thereof filed under Plat No. 98-178, in the records of the Anchorage Recording District, Third Judicial District, State of Alaska. Although Big Country is the lead petitioner, the owners of Lots 1 and 2 are expected to join in this request.

ASHBURN & MASON P.C.

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This letter sets forth our legal analysis of why Policy 1-C² does not present a legal impediment to the rezone of this property; in summary, we offer the following:

- (i) Recent soils, septic and well studies have established that assumed topographic limitations that were used to establish the R-8 zoning are not present to preclude R-6SL development;
- (ii) A rezone to R-6SL will allow the imposition of special limitations that will further advance other policies and goals of the comprehensive plan;
- (iii) Consideration of a rezone in this area would be consistent with past precedent; and
- (iv) Policy 1-C's statement to maintain current zoning should not be read as a legal impediment to rezoning, the purpose of which will meet the goals and policies of the comprehensive plan.

The factual issues discussed below are for context to our legal analysis. We are mindful that the factual issues need to be addressed in the proper proceedings. However, taking the time to address the legal effect of Policy 1-C (or as discussed below Policy 1-B) now, and obtaining the administration's legal concurrence with what we believe are clear legal principles, will avoid the confusion and the risk of wasting considerable staff and client resources in the future.

Question Presented:

Policy 1-C provides: "Maintain the same land use designations and zoning in this area as were established prior to the beginning of this plan." Does this policy preclude consideration of a rezone from R-8 to R-6 SL even if the special limitations further other policies and goals of the HDP as a component of the Anchorage 2020—Anchorage Bowl Comprehensive Plan ("Anchorage 2020") and there is no change in the land use designation?

Short Answer:

Land use planning inherently requires balancing competing and sometimes

² We focus our discussion on Policy 1-C as that is the analysis that staff used in the prior rezone review. However, as will be addressed subsequently, this rezone is more properly governed by Policy 1-B.

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inconsistent policies and goals. Alaska case law and cases from other jurisdictions permit selection of one use over another following a balancing of relevant comprehensive plan goals and policies. The specific language of Policy 1-C (or 1-B) therefore should not be read in and of itself to preclude consideration of the rezone. Instead, the rezone request must be evaluated in light of all of the policies and goals of the HDP and Anchorage 2020 as a whole. This is particularly true in the present instance, where the development as proposed under R-6SL zoning is more in conformity and more fully furthers the goals and policies of the HDP than R-8 development.

Discussion:

1. Historical Efforts to Rezone the Property.

Big Country Enterprises, LLC (“Big Country”) and its co-petitioners own approximately 80 acres of property located in the Central Hillside Residential Area zoned R-8 (rural residential—large lot) fronting on Upper Dearmoun Road. Past efforts to rezone the Property to R-6SL (suburban residential—large lot) have been hindered by perceptions of natural conditions, topographical challenges and nonconformity to comprehensive planning. While this last issue is the focus of this letter, a background discussion of the Property’s topography and natural conditions is necessary to understand why the Property is suitable for rezoning.

The Property is located squarely among developments of large-lot residential homes.³ Neighboring zoning designations range from R-6 to R-8, with many parcels being platted and developed prior to current zoning implementation. Efforts to maintain the same land use designation, but rezone the Property to allow for residential in-fill, have been ongoing since the 1970s. As early as 1976, the then-Acting Planning Director Daniel Wilkerson noted that the Property’s zoning may have been based on an erroneous pollution level rating and suggested that the Property might be suitable for a subdivision of two and a half acre lots, while recommending against R-6 zoning.⁴ Presently, with the R-8 designation, the maximum permissible number of lots ranges between sixteen to

³ See Attachment 1.

⁴ See Attachment 2. Assembly Memorandum 430-76C, dated August 24, 1976 at 2. Wilkerson reports the Property is graded as having low pollution danger, which is “the same USGS rating as other R-6 lands and that all other land zoned R-9 and R-8 have high pollution ratings.”

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twenty lots based upon varying Code interpretations not necessary to explore here.⁵ A rezone to R-6SL could increase this number to about 30 when the wetlands and waterways are placed in separate tracts as required to meet the special limitations discussed below. None of this discussion changes the land use designation for the Property—which remains residential limited intensity with a density below 1 du per acre, the least dense designation in the comprehensive plan.⁶

Big Country brought forth the most recent rezoning effort in 2015 with AO No. 2015-102. The proposal sought to rezone the Property from R-8 to R-6SL, allowing for the development of a thirty-two (32) lot subdivision. Open questions relating to the following areas were identified as precluding a rezone at that time: (1) soil permeability for well installation, (2) on-site septic system compatibility, (3) number of permissible lots, (4) management of surface water run-off, (5) traffic volume, and (6) compatibility of rezone to the HDP, particularly Policy 1-C.

In response to the above identified issues, Big Country engaged in extensive data collection through soil sampling, hydrologic research, and traffic studies, as well as revising their subdivision design to incorporate innovative and ecologically minded development strategies, including utilization of two special limitations.⁷ One such development strategy is the allocation of seventeen (17) acres of the Property into a separate tract of wetlands and water way to better protect it from development.

A conversation about the facts addressing issues (1) through (5) identified above is more appropriately left for discussion during the rezone process. However, the legal question of whether Policy 1-C (or Policy 1-B) remains a legal bar to consideration of the rezone deserves attention now.

⁵ See e.g., Table 21-06-01 at 6-6. Tom Dreyer of the S4 Group, LLC is assisting Petitioners and can explain the varying internal conflicts in the Code that affect this calculation.

⁶ See HDP Land Use Map at 2-8. As noted in Policy 1-E at 2-17, this land use designation “provides for large-lot, single family residences in a rural environment, much of which is served by private wells and septic systems.” This land use designation is implemented by R-6, R-8, R-9 and R-10 zones. Thus the question before us does not involved a question involving a change in the land use designation, which remains the same whether it is zoned R-6 or R-8.

⁷ The two proposed Special Limitations are (1) limiting the maximum number of lots to thirty (30), and (2) requiring the use of a Category III Nitrogen Reducing wastewater system for the development of each subdivision lot.

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2. Policy 1-B is the proper Policy to apply.

A map of the three Hillside Districts was not included in the final HDP. However the 2009 map that was in the draft plan shows a clear intent to have Glen Alps road as the northern line for the Southeast District. A copy is attached as Attachment 3. The final plan relies on a somewhat ambiguous narrative description; however reading the descriptors in context of the draft map, it seems clear that the Property is located in the Southeast Hillside Residential District rather than the Central Hillside Residential District. A drawing is attached as Attachment 4 showing where the subject tract is located along with a drawing of how we interpret the districts.

The Southeast Hillside Residential District is defined as the area “generally above Hillside Drive, south of Glen Alps and south of Rabbit Creek Road. This area takes in much or all of the Rabbit Creek and Potter Creek watersheds (shown on Map 1.5).”⁸ To the extent there is any ambiguity, the reference to the Rabbit Creek watershed should be determinative as the Property clearly is linked to the Rabbit Creek watershed.

The first significance to this is that Policy 1-B, unlike Policy 1-C, does not textually reference maintaining existing zoning; instead it provides in relevant part: “Maintain policies for the amount of development as allowed under current land use designations.” This is significant as this rezone does not change the land use designation and the development of the tract under the proposed R-6SL, like the neighboring lots, will remain well below the 1 du per acre called for by the Limited Intensity Residential designation applicable here.

We note that the discussion under Policy 1-B does provide: “This plan maintains existing residential land use designations and zoning in the southeast Hillside.” There is no real clarification as to the distinction between this sentence and its absence in the Policy itself. One could infer there is less of a restriction on rezoning in the southeast district if the natural condition issues are adequately addressed. However as discussed below, the best interpretation is that Policies within the HDP do not in and of themselves prohibit rezoning, but rather any rezone application must be evaluated in the context of all of the goals and policies of the HDP.

⁸ HDP at 2-9 to 2-10.

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Because this question originally came up under Policy 1-C, the remainder of this analysis continues with that language and issue. However, the discussion is equally applicable to Policy 1-B and should be read to address both Policies, especially to the extent staff and the Commission construe the discussion under Policy 1-B to carry the same weight as the language of the policy itself.

3. Policy 1-C is just one of many components influencing comprehensive planning decisions made pursuant to the HDP and Anchorage 2020.

The Municipality of Anchorage is required by state statute to adopt a comprehensive development plan and implement land use regulations in accordance with the plan.⁹ The current Anchorage comprehensive plan, Anchorage 2020, is intended to set “forth the goals, objectives, strategies, and policies governing land use development of the municipality.”¹⁰ The HDP is one adopted element of the comprehensive plan.¹¹ To help ensure statutory compliance, the Anchorage Municipal Code (“Code”) states “rezonings, conditional uses, subdivisions and other related discretionary actions under this title shall be consistent with the comprehensive plan, including the goals, objectives, policies, and strategies” of the individual plan elements.¹²

As the HDP recognizes, different planning documents use terms such as “goals, objectives, policies, standards” for different purposes and the line between terms is not always precise.¹³ The HDP uses the terms goal, strategy, policy, and standard, which range from the broadest (goals) to the most specific (standards). Policy, which is not defined in the Code for comprehensive planning purposes, is defined by the HDP as “a rule for action on a specific issue” and recognizes that the “term takes in a range of measures, including land use classifications, development standards, capital improvements.”¹⁴ While the HDP identifies thirteen (13) sets of goals, with implementation *policies* for each distinct goal—including Policy 1-C—the HDP also describes its most fundamental actions as being contained in five sets of *policies*,

⁹ AS 29.40.030.

¹⁰ AMC 21.01.080(A).

¹¹ Id. at (B).

¹² Id. at (D)(4).

¹³ HDP 1-22.

¹⁴ Id.

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suggesting those five policies are even broader than the outlined goals.¹⁵

The five overarching policies are (1) maintain the Hillside's existing low-density, rural residential character, (2) maintain and improve the functioning of on-site water and wastewater systems; establish a well water protection program; (3) establish new district-wide approaches to infrastructure funding and management; (4) improve roads, trails, and access to Chugach State Park, and (5) establish new approaches to development.¹⁶ As will be discussed below, the proposed rezone will not adversely affect policies (1), (3) and (4), and will advance policies (2) and (5) by allowing a more environmentally protective development through its special limitations and segregation of sensitive lands.

As mentioned above, in addition to the five overarching policies the HDP identifies thirteen (13) sets of goals, with each goal having an area-specific implementation policy.¹⁷ Goal 1 is "Location and Intensity of Development", which seeks to guide the amount and location of future development while maintaining the quality and diversity of the Hillside District as a place to live, ranging from low-density rural areas, to single-family suburban neighborhoods, to areas with duplexes and multifamily housing."¹⁸ Policy 1-C is the implementing policy for Goal 1 for the Central Hillside Residential District.¹⁹

Policy 1-C states: "[m]aintain the same land use designations and zoning in this area as were established prior to the beginning of this plan."²⁰ Notably, five of the six adjacent developed subdivisions surrounding the Property have far greater densities than that proposed for the Property.²¹ Big Country is not proposing a change in the applicable land use designation. Limited intensity residential is implemented by R-6, R-8, R-9, and R-10 zoning.²² Thus, the only question is whether Policy 1-C legally precludes rezoning from R-8 to R-6SL regardless of maintaining the same land use designation.

¹⁵ Appendix B to the HDP, A3-12.

¹⁶ HDP, 1-21 to 1-22.

¹⁷ Appendix B to the HDP, A3-12.

¹⁸ Id. at A-3.

¹⁹ Policy 1-B is the implementing policy for Goal 1 for the Southeast Hillside Residential District.

²⁰ HDP on page 2-11 and page A-3.

²¹ Attachment 1.

²² HDP, 2-17.

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Both R-8 and R-6 zones are considered limited intensity residential districts. Under the new Title 21 revision, the purposes of R-8 and R-6 zoning are as follows:

Purpose. The R-6 district is intended primarily for single- and two-family large-lot residential areas, with gross densities of up to one dwelling unit per acre. The R-6 is designed to encourage low-density residential development. This district is intended to protect and enhance those physical and environmental features that add to the desirability of large-lot residential living. The availability of infrastructure and municipal services is varied.²³

...

Purpose. The R-8 district is intended primarily for single- and two-family large-lot residential areas with gross densities less than one dwelling unit per four acres, where topographic or other natural conditions are such that higher-density development would be unfeasible. In addition to topography, some of the natural conditions which could exist to render land desirable for the densities proposed in this zone are wind hazards, marginal soils, landslide susceptibility, potential for groundwater pollution, and groundwater availability.²⁴

Thus, the main distinction between R-6 versus R-8 zoning is topography and the ability of the land to handle higher-density development. Technological advances since the establishment of Hillside's zoning, such as the rise of advanced wastewater treatment systems, have gone far to address previous impediments to development. Assuming Big Country is able to demonstrate that the Property's topography or other natural conditions do not preclude higher-density development, the remaining question is whether the language of Policy 1-C alone precludes rezoning.

4. Legal Standard.

The authority tasked with reviewing a proposed land action must consider whether

²³ AMC 21.04.020(K).

²⁴ AMC 21.04.020(M).

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the proposed action is in accordance with the applicable comprehensive plan.²⁵ The Code requires rezoning decisions “be consistent with the comprehensive plan, including the goals, objectives, policies, and strategies” of the HDP.²⁶ While the Code states that where “comprehensive plan elements conflict, the most recently adopted shall govern” the Code is silent as to how to deal with contradictions within the governing document itself.²⁷ In fact, the HDP contemplates that its own planning devices may contradict one another.²⁸ Dealing with these conflicts is presumably one of the main reasons the Code requires pre-application conference attendees discuss the “appropriateness of the development with respect to the policies set forth in the comprehensive plan and the regulations in this title.”²⁹ The fact that different policies may support different outcomes makes it imperative that the reviewing authority utilize the comprehensive plan as a planning tool, rather than as an inflexible document.

Case law supports use of the comprehensive plan as a sounding board for evaluating the strengths and weaknesses of competing uses. The *Native Village of Eklutna v. Board of Adjustment* involved a challenge to the issuance by the Planning and Zoning Commission (“Commission”) of a conditional use permit for a granite mining operation by the Native Village of Eklutna. Issuance of the permit furthered the identified goal of supporting an economic base for the community; however, the Supreme Court found that since preservation of “historic and archeological sites determined to have local and/or State significance” was also a listed comprehensive plan goal that the Commission was required to evaluate the conditional use permit in light of that goal as well.³⁰ To that effect the Supreme Court stated:

The Commission should first determine the extent to which cultural resources would be adversely affected by the proposed quarry. Then, the Commission should weigh the goal of preserving historic and archeological resources against the goal of supporting an economic base for the community. If the adverse effects to archaeological and historic resources

²⁵ *Native Vill. of Eklutna v. Bd. of Adjustment for Municipality of Anchorage*, 995 P.2d 641, 643–44 (Alaska 2000).

²⁶ AMC 21.01.080(D)(3)

²⁷ *Id.* at (D)(5).

²⁸ HDP, 1-22 (“[N]o single goal has priority over others and there may be conflicts between individual goals.”)

²⁹ AMC 21.03.020(4)(b)(ii).

³⁰ *Native Village of Eklutna v. Board of Adjustment for...*, 995 P.2d 641, 644-45 (2000).

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outweigh the economic advantage gained by the proposed conditional use, the Commission should deny the conditional use permit. If the economic gains outweigh the cultural losses, then the Board should grant the permit.³¹

This recognition that the deliberating body must weigh and balance competing interests in general land use plans is followed in other jurisdictions. In California, courts routinely acknowledge that because “policies in a general plan reflect a range of competing interests, the governmental agency must be allowed to weigh and balance the plan’s policies when applying them, and it has broad discretion to construe its policies in light of the plan’s purposes.”³²

The concurring opinion in *RDNT, LLC v. City of Bloomington*, a recent Minnesota Supreme Court decision, provides a helpful survey of the role of comprehensive plans in the history of land use planning across the country.³³ The survey found courts have historically “construed comprehensive plans as advisory documents that cannot guide specific land-use decisions.”³⁴ To the extent certain modern courts deviated from this approach those courts were acting in perceived accordance with state specific statutory

³¹ *Id.* at 645.

³² *Napa Citizens for Honest Gov’t v. Napa Cty. Bd. of Supervisors*, 91 Cal. App. 4th 342, 361, 110 Cal. Rptr. 2d 579, 592 (2001), as modified (Aug. 7, 2001), as modified on denial of reh’g (Sept. 4, 2001)(citing *Save Our Peninsula Committee v. Monterey County Bd. of Supervisors* (2001) 87 Cal.App.4th 99, 142 (2001)); *Sequoiah Hills Homeowners Assn. v. City of Oakland*, 23 Cal. App. 4th 704 (1993); *Greenebaum v. City of Los Angeles* 153 Cal. App. 3d 391, 407 (1984)).

³³ 861 N.W.2d 71, 86 (Minn. 2015) (Upholding the city’s denial of a conditional use permit).

³⁴ *Id.* at 80 (citing the following in support “*See, e.g., City of Gainesville v. Cone*, 365 So.2d 737, 739 (Fla.Dist.Ct.App.1978) (“[The comprehensive plan was] to serve merely as a guide for future decisions relating to rezoning petitions and growth and development of the City.”); *Urrutia v. Blaine Cnty.*, 134 Idaho 353, 2 P.3d 738, 742–43 (2000) (“[A] comprehensive plan does not operate as legally controlling zoning law, but rather serves to guide and advise the governmental agencies responsible for making zoning decisions.”); *Borsuk v. Town of St. John*, 820 N.E.2d 118, 121 (Ind.2005) (“A comprehensive plan is ‘a guide to community development rather than an instrument of land-use control.’” (quoting 4 Young, *supra*, § 23.15)); *Iverson v. Zoning Bd.*, 22 Md.App. 265, 322 A.2d 569, 571 (1974) (“A master or general plan ... is but a guide or scheme recommended to the legislative branch in order to enable them to make intelligent decisions with respect to the adoption of zoning classifications.” (citing *Pattey v. Bd. of Cnty. Comm’rs*, 271 Md. 352, (1974))); *Forks Twp. Bd. of Sup’rs v. George Calantoni & Sons, Inc.*, 6 Pa.Cmwlth. 521, 297 A.2d 164, 166–67 (1972) (“The comprehensive plan is a general guideline to the legislative body of the municipality for its consideration of the municipality’s program of land utilization and the needs and desires of the community.”).

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authority.³⁵

Indeed, we are aware of at least two times in the past when the Assembly has not interpreted the HDP as a strict limitation on its rezoning authority. Specific instances in which deviation was permitted include: A.O. 2012-46 (Mountain Air Estates—a rezone of 12 acres from R-9 to R-6SL); and A.O. 2011-82 (Potter Highlands—a rezone of 80 acres from R-3SL to R-6SL).³⁶ Presumably, these actions occurred because the rezone conformed to and furthered the goals and policies of the Anchorage 2020, and thus provide precedent for not construing Policy 1-C as a legal barrier to consideration of this rezone.

5. A rezone to R-6SL more fully furthers the goals and policies of the HDP than R-8 development.

As discussed above, the HDP establishes five sets of overarching policies. Each set of policies is explored below with respect to R-6SL verses R-8 development.³⁷

(1) Maintain the hillside’s existing low-density, rural residential character. The R-6SL zone will in fact further this goal. First, the actual density of a proposed R-6SL development will be comparable or less dense than the surrounding neighborhoods as shown on Attachment 1. Moreover, placing the wetlands and a delineated water course into separate tracts will provide large areas of open space, which is more compatible with the nearby public lands in appearance and feel.

(2) Maintain and improve the functioning of on-site water and wastewater systems; establish a well water protection program. Each lot will be developed with on-site water and wastewater systems. Provided R-6 SL development is permitted, Big Country agrees to a Special Limitation that all septic systems must use a Category III Nitrogen reducing wastewater system for each lot. Extensive hydrological and soil testing performed by hydrologist Dan Young of Terrasat, Inc. and soils engineers Steve Eng PE, PH, of North Rim Engineering and Jeffrey Garness, PE, MS, of Garness Engineering

³⁵ *Id.* at 81, *see* fn. 2.

³⁶ Both of these developments were covered by the Southeast Policy 1-B which provides that “This plan maintains existing residential land use designations and zoning in the southeast Hillside.” (HDP at 2-9 through 2-10).

³⁷ HDP, 1-21 to 1-22.

Terry Schoenthal
Page 12
December 30, 2016

Group support a finding that the proposed subdivision can meet the MOA subdivision standards. Hydrological testing included measuring water levels in 32 existing piezometers weekly to determine the highest water level in autumn 2016, evaluating water well yields from the surrounding community, drilling three exploratory water wells and conducting aquifer testing, and evaluating and modeling nitrate migration from three proposed lots.³⁸ The three water wells were drilled to determine adequacy and availability of groundwater. All three wells produce more than adequate water supplies, with one well producing more than 10 gallons per minute. A total of 61 test holes were used to evaluate percolation rates. The soils were found to support conventional septic systems; however, the developer remains committed to the use of advanced nitrate reducing septic systems in order to maximize stewardship of the subsurface environment. Finally, water levels were monitored throughout the autumn season and the results show that leach field designs are well above potential high water table levels.

(3) Establish new district-wide approaches to infrastructure funding and management. Although not applicable, this policy is not adversely affected by the proposed rezone.

(4) Improve roads, trails, and access to Chugach State Park. While not directly applicable given the location of the Property, responsible development of land on an important approach to Chugach State Park provides for more neighborhood stewardship of the road and advocacy for its maintenance. A report from Will Webb, PE, PTOE of Stantec Consulting Services, Inc. projected that the increased potential traffic generation associated with a lot density of thirty-two (32) lots (a number greater than currently proposed) would remain well below the maximum volumes appropriate for a neighborhood collector road. Both Upper DeArmoun Road and Canyon Road are classified as neighborhood collectors in the 2014 Official Streets and Highways Plan.

(5) Establish new approaches to development. The Lewis & Clark re-zone uses innovative design to maximize protection of wetlands, make lots self-sufficient through advanced waste water management, provides for two lengthy cul-de-sacs with minimal grading reducing the need for pedestrian activity along DeArmoun, and increases green space and trails within the development itself. The segregation of wetlands into separate

³⁸ Further explanation of testing is contained within correspondence from S4 to Terry Schoenthal, dated September 20, 2016 as well as a 70 page soils study report by Garness previously submitted to the Planning & Zoning Commission. Copies of both documents are available upon request.

ASHBURN & MASON P.C.

Terry Schoenthal
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December 30, 2016

tracts is called out by the HDP as a more protective approach to preserving sensitive lands.³⁹ Keeping the property as R-8 precludes tracting out separate wetlands as the 4 acre lot size limits any real subdivision flexibility. Taking out 17 acres as a wetlands tract reduces the number of lots to the extent that development is economically infeasible. A rezone to R-6SL allows the imposition of greater lot requirements such as the specification of higher technology septic units while keeping the lots commercially reasonable in price. The separate wetlands tract is significant not just visually and to improve the neighborhood feel (largely because the adjacent neighborhoods do not have these amenities as they were all subdivided much earlier), but also because these wetlands serve as an important buffer for drainage that continues down the Valley to Rabbit Creek.


Conclusion

Although we cover much of the background policy, all that is needed now is the concurrence of your legal staff that the Policy 1-C (or Policy 1-B) reference to maintain current zoning does not impair the deliberative bodies from considering a rezone to R-6SL if they determine, after weighing all of the facts in light of the goals and policies of the HDP that a rezone better serves the goals of the comprehensive plan. We look forward to your response and are available to respond to questions.

Sincerely,

ASHBURN & MASON, P.C.


for Donald W. McClintock


Rebecca E. Lipson

DWM:haw

³⁹ See generally, HDP 2-40 "Why is Open Space Important?"
{11558-001-00376014;10}

MUNICIPALITY OF ANCHORAGE

ASSEMBLY MEMORANDUM

No. AM 430-74C

Meeting Date: August 24, 1976

From: Mayor

Subject: ORDINANCE NO. 137-76: REZONING FROM R-8 TO R-6, 70
ACRES ON UPPER DEARMOUR ROAD, (Case 2-1258)

The Assembly requested more information about this rezoning petition for 70 acres on Upper Dearmour Road. In particular, Administrative Staff was directed (a) to consult with the U.S. Geological Survey about its general analysis of the petition site locale and (b) to design a hypothetical subdivision for the 70 acres. The subdivision is shown in attached Memo AM 430-76B from Public Works and generally discussed below, along with a note about U.S. Geological Survey's advice.

The subdivision research by Public Works and Environmental Protection leads the Administration to now recommend that the rezoning to R-6 is not ideal and that a combination of continued R-8 for a portion of the site and R-9 for the remainder is more appropriate.

SEWAGE DISPOSAL:

It has been concluded, by cooperative study between Public Works and Environmental Protection, that the R-6 (14 acres) zoning is not ideal because that zoning would have to be dependent on a complete on-site tertiary sewer treatment facility to satisfy Municipal Standards.

R-6 without a community treatment facility would be satisfactory if the actual platting of the 70 acres were for lot sizes of an average size closer to 2 1/2 acres than to 1 1/4. However, conventional on-site sewage disposal is what should be expected, and R-9 (2 1/2 acres) is more appropriate because there would be more area on a given lot for alternative septic tank locations. Accordingly, R-9 is the more realistic zoning for public health and safety.

The southwest portion of the tract includes a cilly area roughly 7,400 feet by 600 feet. This 33-acre strip could be safe at 2 1/2-acre sizes (or 1 1/4 with a sewer plant), but is thought by Public Works and Environmental Protection engineers to be better guided by the existing R-8 (5 acre) zoning because silt is not a good soil for on-site sewer disposal systems.

U.S. Geological Survey Maps showing the petition site and locale were debated by witnesses at the last Assembly discussion. Administrative staff have met with the USGS Officers. They advise that the summary description of the site characterizing it as predominantly "low" pollution susceptibility from septic tank systems is incorrect as reported to the Assembly on July 27th. The description has been corrected to "very low" susceptibility to septic tank pollution. The "summary description" is a factoring of water level, soils, and slope.

Attachment 2

110
Memo AM 430-75C
Page 2
August 24, 1976

OTHER PLANNING CONSIDERATIONS:

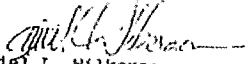
Other factors affecting the suitability of this rezoning are need, effect on other properties and housing stock, amount of similarly-zoned land, and relationship to the Comprehensive Plan.

The density at R-6 or R-9 would be in accord with the Comprehensive Plan, which designates the Hillside at the standard of "less than one dwelling per acre". There is other R-6 zoning in the general area yet to be fully developed, but it is neither harmed by the rezoning nor should it be considered precedent for any further R-6. There is no adjacent R-9 zoning. This area has, according to USGS, data characteristics similar to other R-6 properties on the Hillside and is graded as having low pollution danger. The rezoning would be a precedent bringing a larger population with possible demands for utilities and road services, costs for which would be shared by property owners along DeArmon Road, not simply those within the petition site. Rezoning to R-6 or R-9 would not address the public need for more affordable housing.

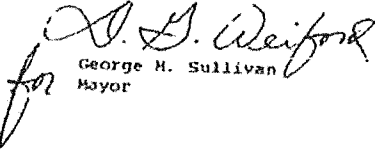
The original recommendation to approve R-6 provided the findings mentioned above, but was based primarily on the USGS ecological rating. Further, there was the finding that this site has the same USGS rating as other R-6 lands and that all other land zoned R-9 and R-8 have high pollution ratings. Those USGS ratings became available after the Hillside was zoned.

However, after further analysis by Environmental Protection and the hypothetical subdivision design by Public Works, it is recommended that R-6 not be approved. Except for the southwest area (2,400 feet from west to east and 600 feet south to north) which should be continued as R-8, the more appropriate zoning is R-9.

Recommended by:

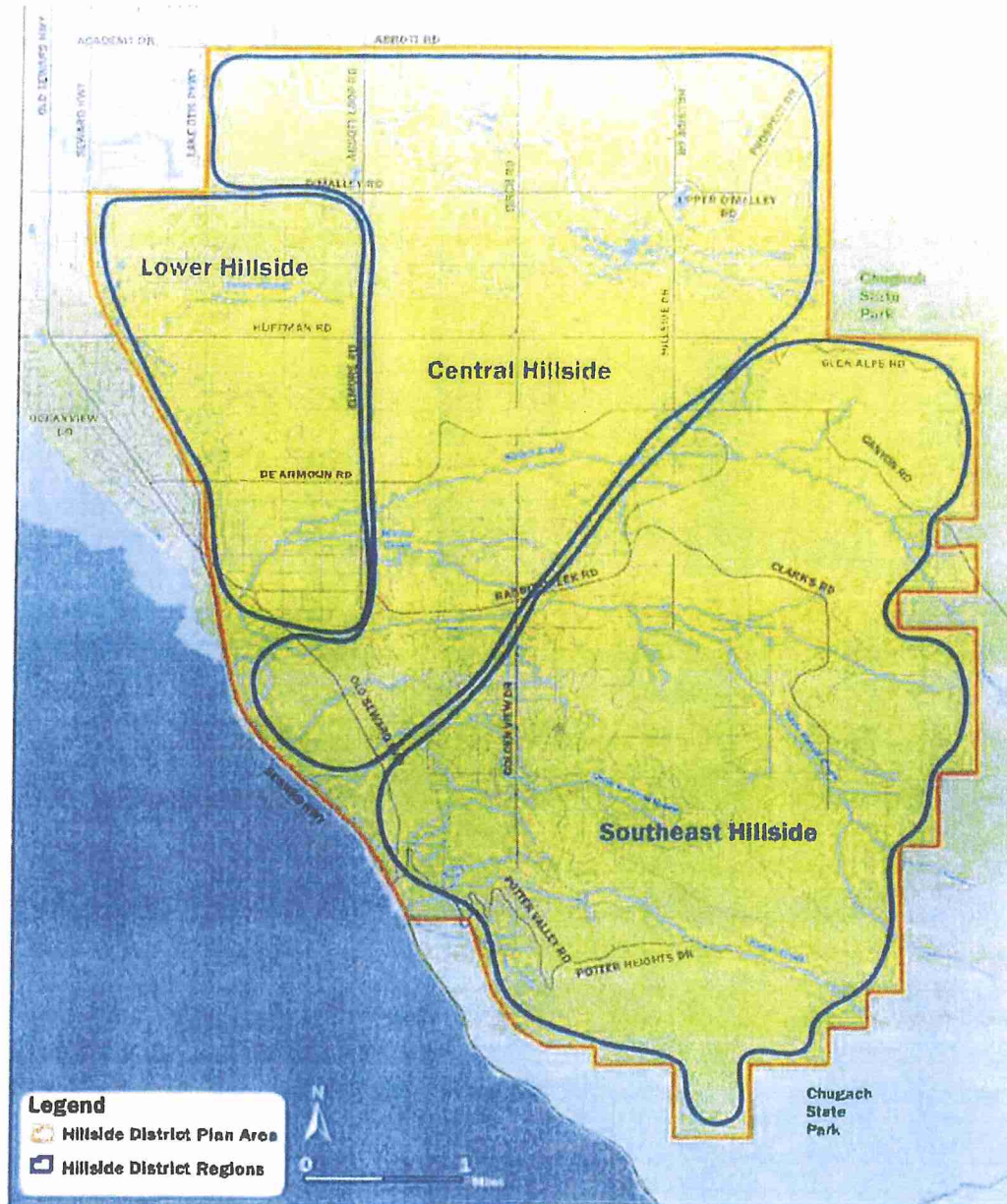

Daniel L. Wilkerson
Acting Director of Planning

Respectfully submitted:


George H. Sullivan
Mayor

Attachment 2

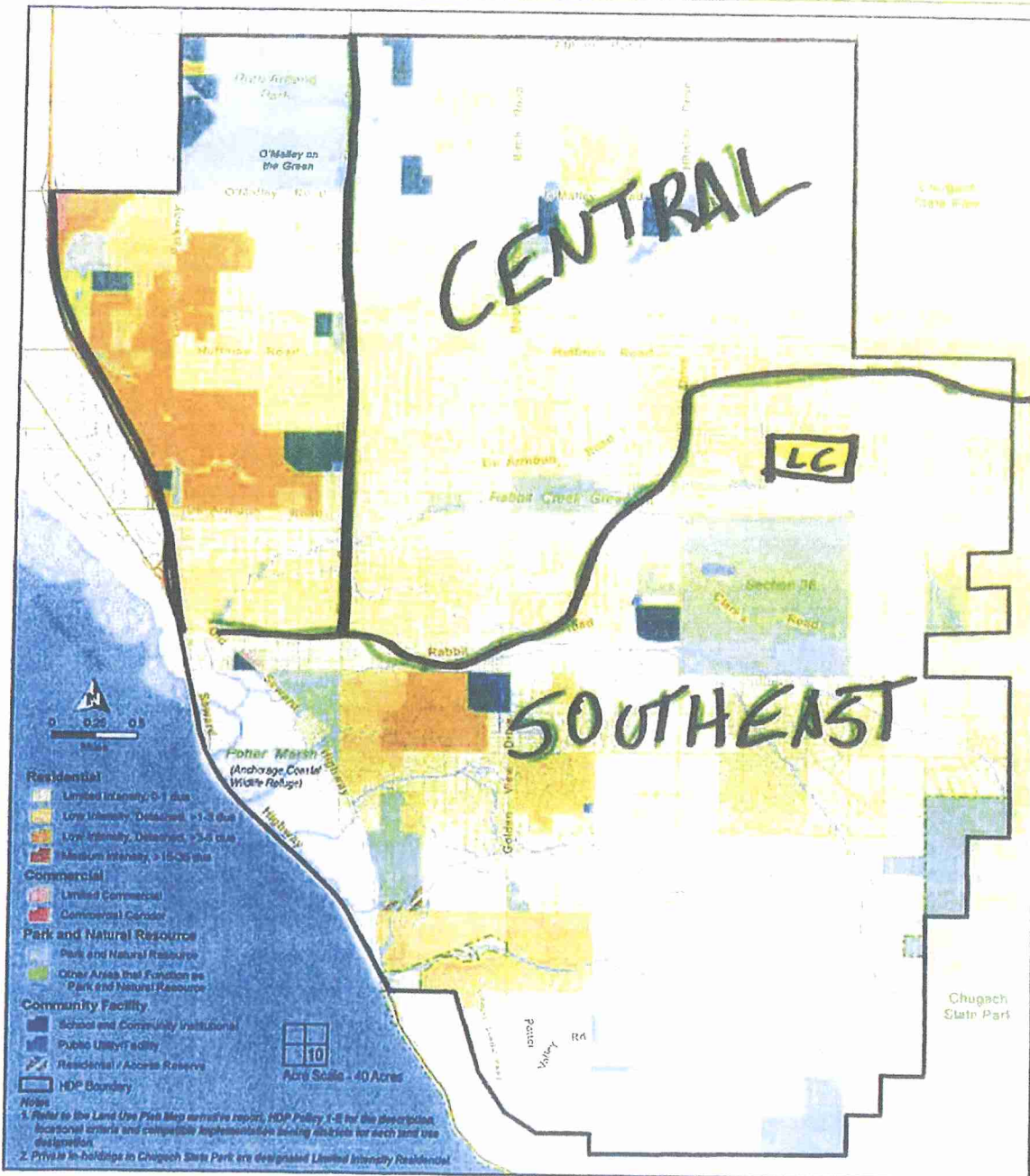
Map 2.1
Hillside District Regions



The qualities Hillside residents value include open space, vegetation, quiet, dark night skies, access to trails, the presence of wildlife, privacy and other qualities associated with living in a less urban environment. While sharing these characteristics, different portions of the Hillside also have some important differences.

Map 2.1

Hillside Land Use Plan



Heidi A. Wyckoff

From: Schoenthal, Terry N. [SchoenthalTN@ci.anchorage.ak.us]
Sent: Wednesday, January 18, 2017 11:54 AM
To: Becky Lipson
Cc: Wong, Carol C.; Hart, Hal H; Whitfield, David R.; Tom Dreyer (tom@s4ak.com)
Subject: RE: Lewis & Clark: HDP Policy 1-B/1-C

Hello Becky,

Members of the Long-Range Planning Division and the Current Planning Division have reviewed the materials you supplied regarding the Lewis and Clark Subdivision and we recently met to discuss the issues you raised in your December 30 letter. In short, we concur with your premise that the owners of the property have a right to request a rezone and that if the unique characteristics of the property support such a rezone and if the rezone is consistent with the approval criteria identified in Section 21.03.160 E. of AMC Title 21, it would be supported by the Planning Department.

As you note in your letter, this property is zoned R-8 (Rural Residential – Large Lot). Title 21 further describes the R-8 zone as follows:

The R-8 district is intended primarily for single and two-family large-lot residential areas with gross densities less than one dwelling unit per four acres, where topographic or other natural conditions are such that higher-density development would be unfeasible. In addition to topography, some of the natural conditions which could exist to render land desirable for the densities proposed in this zone are wind hazards, marginal soils, landslide susceptibility, potential for groundwater pollution, and groundwater availability.

In essence, the lower density assigned to this district is based on environmental concerns. Zoning districts in Anchorage are typically, (but not always) based on generalized data and mapping information. The Municipality cannot afford to obtain complete detailed analysis for all properties within our boundaries. In the event that detailed analysis suggests that a parcel or tract categorized as environmentally sensitive is, in fact, not so sensitive, then a suitable zoning category might be one that is more consistent with surrounding zoning and that better fits other goals identified in the Comprehensive Plan. Every parcel or tract of land in Anchorage is unique and should be judged of its own qualities as to whether proposed uses are either detrimental or supportive of community goals.

Policy 1-C of the Hillside District Plan, "Maintain the same land-use designations and zoning in this area as were established prior to the beginning of this plan" would appear to remove any consideration for any rezone in the Hillside District. It is our belief that this policy, strictly observed, is overly restrictive and should not be an acceptable policy for any neighborhood in Anchorage, because it denies any potential for change.

All of this said, the Municipal Planning Department is not prepared, at this point to support the proposed rezone. Our support will be dependent on the applicant demonstrating that the assumed environmental constraints of the property are either not present or can be adequately mitigated to avoid impacts on surrounding property. Further it will be the responsibility of the petitioner to clearly articulate how the rezone addresses the approval criteria identified in Title 21.

In short, the Municipal Planning Department will give a proposed rezone of the Lewis and Clark subdivision a fair hearing, based on the specific merits of the argument. We cannot, at this point, support a rezone, because the case for that rezone has yet to be made.

I hope this adequately explains our position and I would encourage you to contact me if you have any questions.

Sincerely,



January 20, 2017

Todd Brownson
Big Country Enterprises, LLC
4700 E 147th Avenue
Anchorage, Alaska 99516

Subject: Lewis and Clark Subdivision Rezone Traffic Letter

Dear Todd:

The Lewis & Clark Subdivision is proposed on an 80-acre parcel in Anchorage, south of Upper DeArmoun Road and east of Canyon Road. We understand you have requested a rezone from R-8 to R-6 zoning. The rezone would increase the number of residential lots on the site from a maximum of 20 to the proposed 30 lots shown on your preliminary plat.

The proposed lots (the preliminary plat from S4 is attached) access the road system by two proposed cul de sacs extending south from Upper DeArmoun. Three of the parcels also abut Canyon Road. Canyon Road and Upper DeArmoun are both classified as neighborhood collectors in the 2014 Official Streets and Highways Plan (OSHP). Neighborhood collectors are designated to carry 2,000 to 10,000 vehicles per day. Upper DeArmoun is paved with one 11-foot lane in each direction and is posted at 40 miles per hour. Canyon Road is a two-lane gravel road. Canyon Road, east of the subject parcel, is scheduled to be upgraded in 2017. Alaska Department of Transportation and Public Facilities (DOT&PF) reports the annual average daily traffic (AADT) on Upper DeArmoun as 789 vehicles per day in 2014. Similar data is not available for Canyon Road, however since Canyon Road only connects to DeArmoun, the AADT will likely be less than 789.

Traffic to and from the site is expected to use DeArmoun Road, since that is the most efficient way to get to the commercial areas of Anchorage, and to area schools.

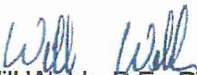
According to the Institute of Transportation Engineers' *Trip Generation Manual* (9th Edition), single family homes typically generate 9.52 trips per day. The old Anchorage Municipal Code Title 21 recommended a trip generation rate of 8.2 trips per day, indicating a lower trip generation rate for the Anchorage area than the national *Trip Generation Manual* suggests. Increasing the housing density in the project parcel from 20 to 30 would increase expected traffic generation from 190 trips per day to 286, based 9.52 trips per day. Adding 286 trips to the existing traffic on Upper DeArmoun results in an AADT of 1,075, well below the appropriate volumes for a neighborhood collector.

There are approximately 440 undeveloped acres that will access Canyon Road in the event they are developed. Land in the area is zoned R-8, R-9, or R-10. Terrain and topography will limit the development potential of much of this land. However, assuming it all develops at a conservative density of 2 acres per unit, the area could potentially generate 2,100 additional trips. Added to

the existing traffic and new traffic generated by the Lewis & Clark Subdivision, total traffic on DeArmoun would be 3,175, well within the appropriate volume of traffic to be carried by a neighborhood collector.

A concern raised by neighbors has been the poor condition of the pavement on DeArmoun Road. That is not possible to field-assess given the current snow conditions and lack of as-built information. Alaska DOT&PF does not have condition data for Upper DeArmoun Road east of Hillside Drive, but does have data on DeArmoun Road to the west, Hillside Drive, Clarks Road, and Upper Huffman. The data reveal low rutting but high roughness. This combination of observations is indicative of pavements that are old or suffering from seasonal movement and cracking, but not necessarily overloaded. Furthermore, Clarks Road, upper Huffman Road, and DeArmoun Road all feature similar cross sections as Upper DeArmoun Road, and carry more traffic than is projected for Upper DeArmoun Road. This all leads to the conclusion that, while Upper DeArmoun is in poor condition, the condition is not a result of the traffic loads on the road and would not be significantly impacted by the additional 96 residential trips per day caused by rezoning this parcel.

Sincerely,
Kinney Engineering, LLC


Will Webb, P.E., PTOE
Senior Civil Engineer

Z:\PROJECTS\00452-LewisClark\Reports\Lewis Clark Letter.docx



GEOTECHNICAL SOILS REPORT

FOR

LEWIS & CLARK SUBDIVISION

FOR S4 GROUP

ANCHORAGE, ALASKA

Submitted by:

NorthRim Engineering
P.O. Box 770724
Eagle River, AK 99577-0724
(907) 694-7028

Steve Eng, PE, PH
SteveEng.com

February, 2017

CIVIL

ENVIRONMENTAL

HYDROLOGY



Lewis & Clark Subdivision, February 2017

SOILS SUMMARY

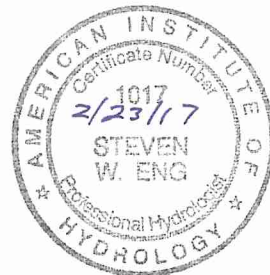
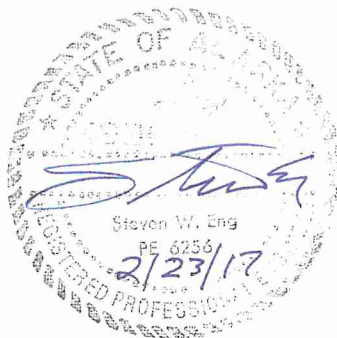
Lewis & Clark Subdivision is planned for the Upper De Armoun area. The proposed subdivision is surrounded by developed subdivisions. These surrounding subdivisions utilize on-site water wells and septic systems. Lewis and Clark Subdivision will also utilize on-site systems.

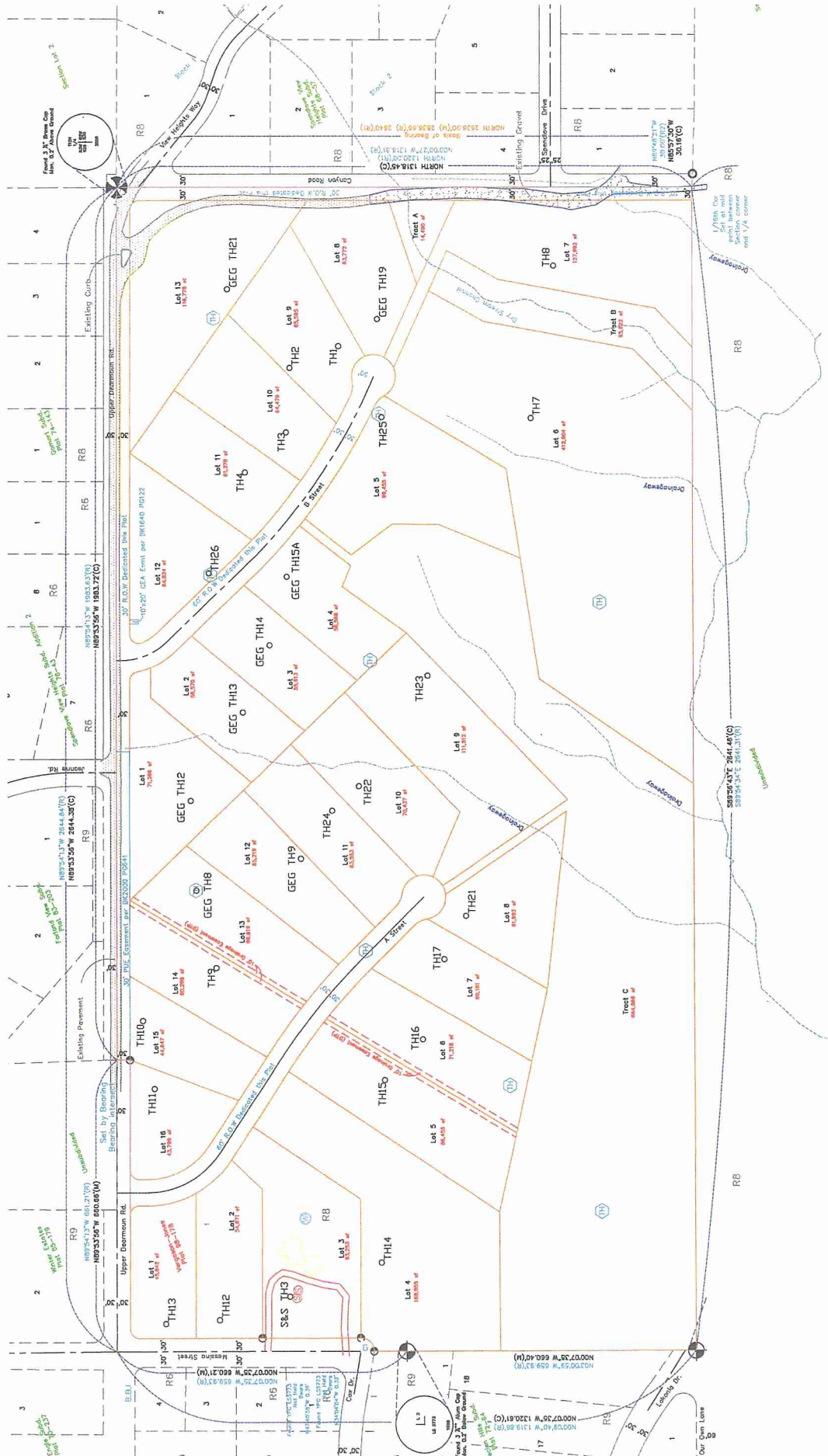
A large number of test holes have been completed the past several years within the proposed subdivision. Test holes were completed in the fall of 2016. Recent test hole logs are included in this soils report, as well as previous test holes. A location map for these test holes is included at the end of the report.

The soils in Lewis & Clark Subdivision have generally been found to be consistent with the soils in the surrounding subdivisions. The soils were placed as glacial till, and are predominately sand, silty sand, silts, and gravel. Bedrock was not encountered in the test holes. Groundwater is not an issue; all the test holes have adequate separation to groundwater. Most test holes exhibited no groundwater.

Drainages have been mapped for the subdivision. Drainages consist of small rills and seeps, associated with riparian vegetation. Several test holes required relocation after interference from these surface seeps.

The soils logs in this report have been found to be consistent with MOA requirements for on-site systems. We are prepared to complete additional drawings demonstrating that each lot has the prescribed area for on-site systems.





FIELD NOTES		LOCATION		BLK		DATA		DATE		SHEET	
										1	
CONSTRUCTION RECORD		VERTICAL DATUM		PLAN CHECK		DATE		SHEET		1	
										1	

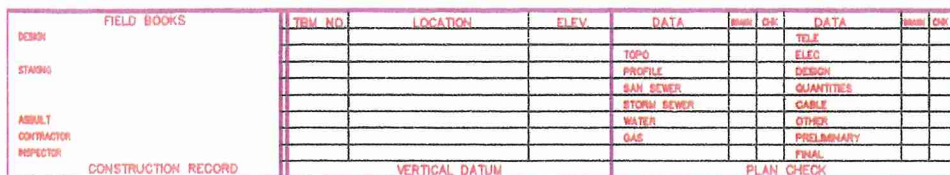
NORTH RIM
ENGINEERING
P.O. Box 770724
Eagle River, Alaska 99577
907.694.7028

In Association With
S4 GROUP
BIG COUNTRY
ENGINEERING, LLC
3640 E 65th Ave
Anchorage AK 99507

TEST HOLE LOCATIONS
FOR SOILS REPORT

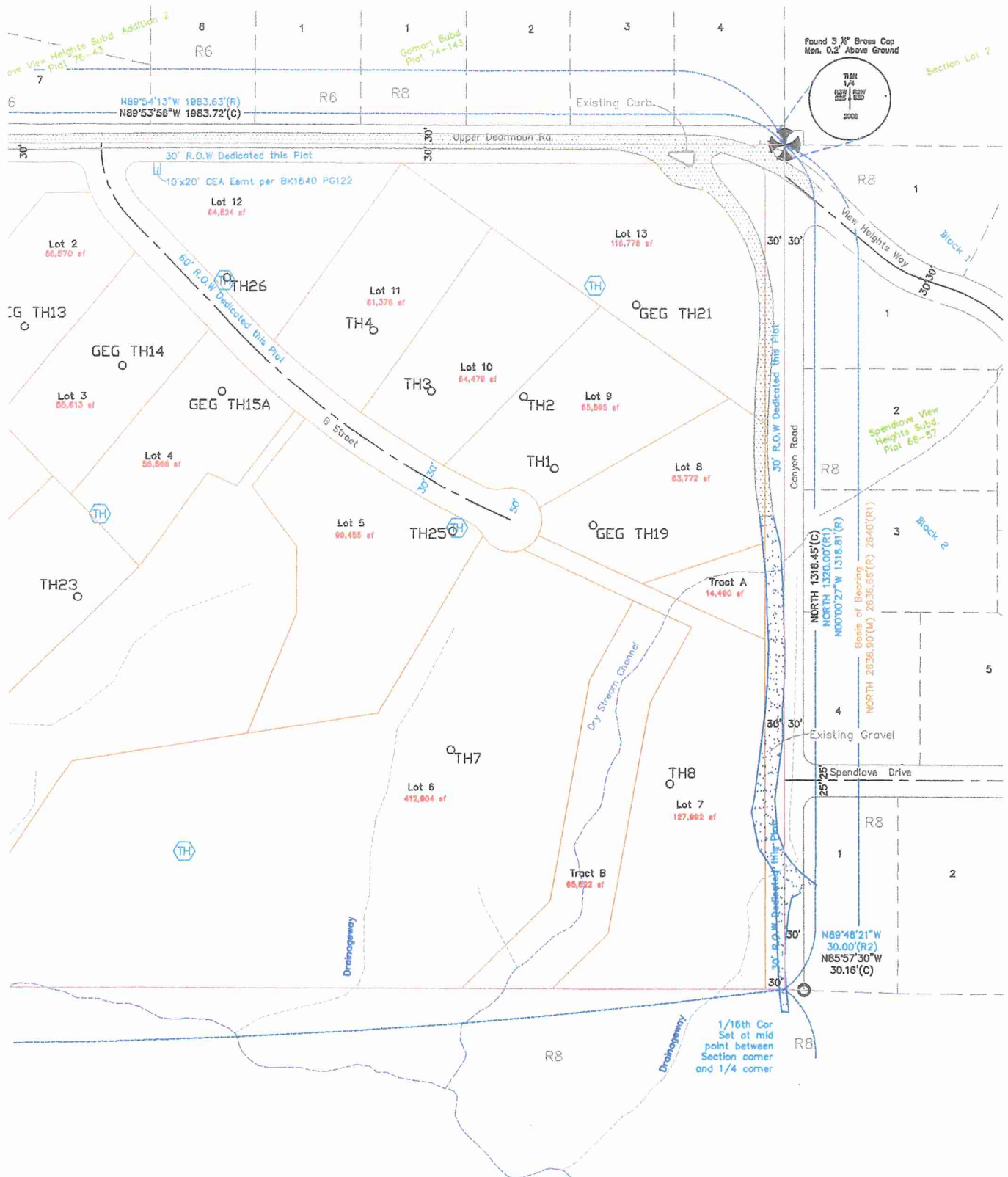
LEWIS & CLARK SUBDIVISION
ANCHORAGE, ALASKA

1" = 200'
DATE: 2/23/17
SHEET: 1



P.O. Box 770724
Eagle River, Alaska 99577
907.694.7028





TEST HOLE LOCATIONS
FOR SOILS REPORT

In Association With
S4 GROUP

BIG COUNTRY
ENTERPRISES, LLC
3640 E 65th Ave
Anchorage AK 99507

1" = 200'

LEWIS & CLARK SUBDIVISION
ANCHORAGE, ALASKA

DATE: 2/23/17 SHEET: 1



SOILS LOG - PERCOLATION TEST

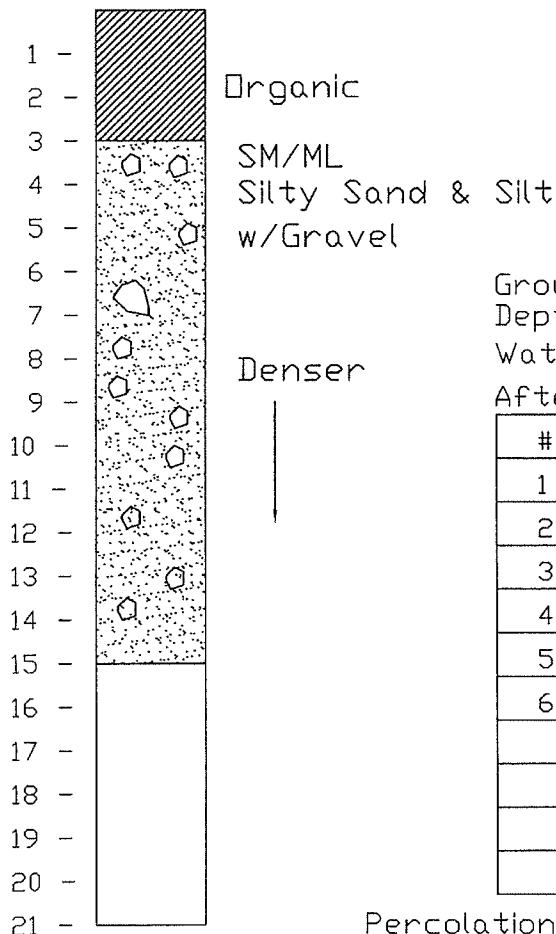
Date Performed: 9/14/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 9- North Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring: None Date: 10/14/16

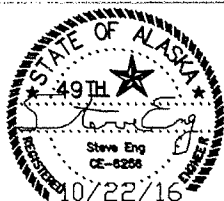
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3	9/14	32	--	2"	--
4	9/14	62	30 min.	4.5"	2.5"
5	9/14	65	--	2"	--
6	9/14	95	30 min.	4.5"	2.5"

Percolation Rate 12 min./Inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

**NORTHRIM
ENGINEERING**
PO Box 770724
Eagle River, Alaska 99577
907.694.7028



TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 9 - NORTH

TH1

Date: 10/22/16 SHEET: 1 of 26



SOILS LOG - PERCOLATION TEST

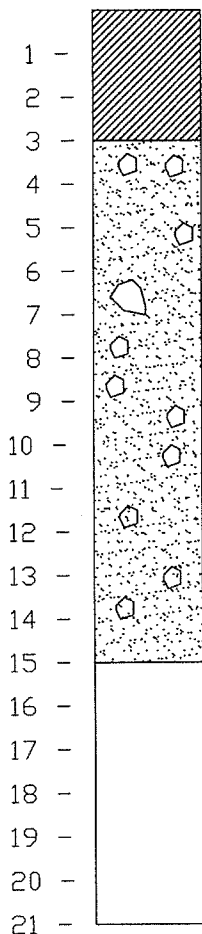
Date Performed: 9/14/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 9- North Side

DEPTH
(FEET)

T.H. Location: See Location Map



Organic

SM/ML
Silty Sand & Silt
w/Gravel

Denser

Groundwater? No

Depth --

Water Depth

After Monitoring None Date: 10/14/16

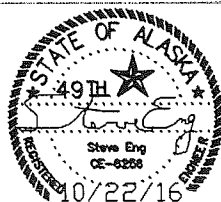
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5	9/14	65	--	2"	--
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Percolation Rate 10 min./inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
Performed In Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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Eagle River, Alaska 99577
907.694.7028



TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 9 - NORTH

TH2

Date: 10/22/16 SHEET: 2 of 26



SOILS LOG - PERCOLATION TEST

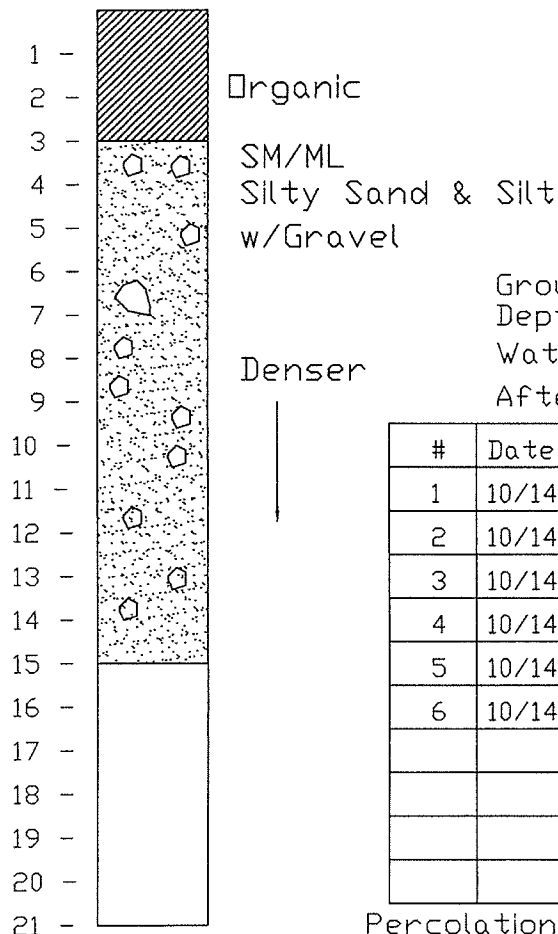
Date Performed: 9/14/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 10- North Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring: None Date: 10/14/16

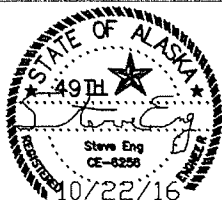
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5	10/14	65	--	3"	--
6	10/14	95	30 min.	4.5"	1.5"

Percolation Rate 20 min./inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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ENGINEERING**
PO Box 770724
Eagle River, Alaska 99577
907.694.7028



TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 10 - NORTH

TH3

Date: 10/22/16 SHEET: 3 of 26



SOILS LOG - PERCOLATION TEST

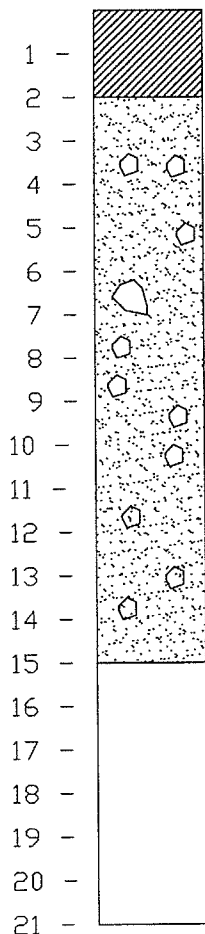
Date Performed: 9/14/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 11- North Side

DEPTH
(FEET)

T.H. Location: See Location Map



Organic

SM/ML
Silty Sand & Silt
w/Gravel

Denser

Groundwater? No

Depth --

Water Depth

After Monitoring None Date: 10/14/16

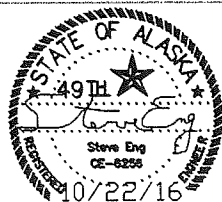
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Percolation Rate 15 min./inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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ENGINEERING**
PO Box 770724
Eagle River, Alaska 99577
907.694.7028



TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 11 - NORTH

TH4

Date: 10/22/16 SHEET: 4 of 26



SOILS LOG - PERCOLATION TEST

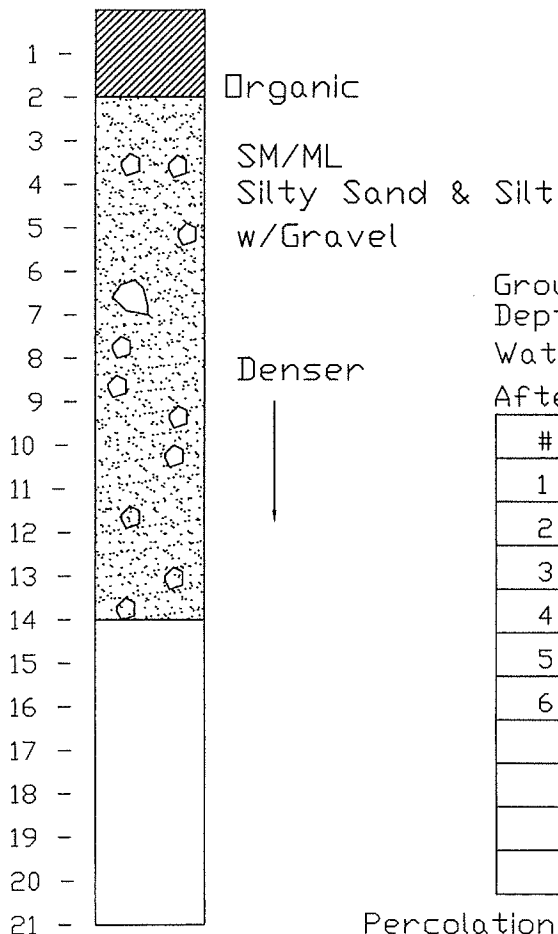
Date Performed: 9/16/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 6- North Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

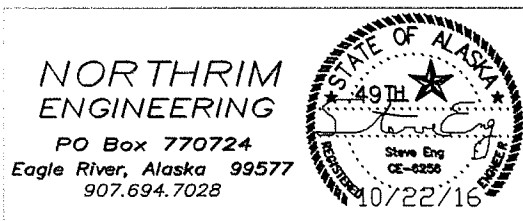
After Monitoring None Date: 10/14/16

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5	9/16	65	--	2.5"	--
6	9/16	95	30 min.	8.5"	6"

Percolation Rate 5 min./inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked

Performed By NorthRim Eng. I SS CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16



TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 6 - NORTH

TH7

Date: 10/22/16 SHEET: 7 of 26



SOILS LOG - PERCOLATION TEST

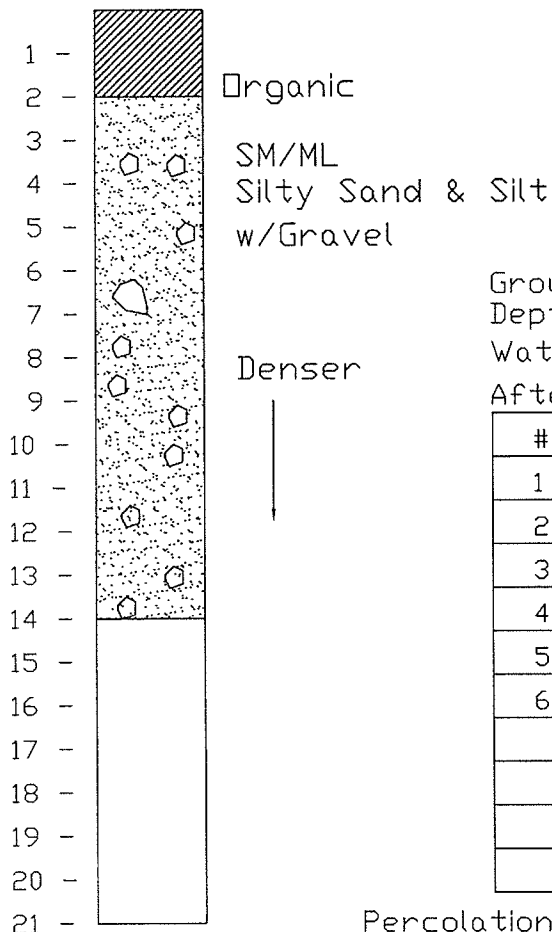
Date Performed: 9/16/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 7- North Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring: None Date: 10/14/16

#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/16	0	--	2.5"	--
2	9/16	30	30 min.	6.5"	4"
3	9/16	32	--	2.5"	--
4	9/16	62	30 min.	6.5"	4"
5	9/16	65	--	2.5"	--
6	9/16	95	30 min.	6.5"	4"

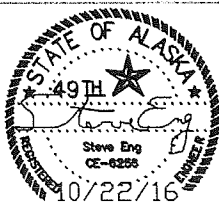
Percolation Rate 7.5 min./inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE, DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 7 - NORTH

TH8

Date: 10/22/16 SHEET: 8 of 26



SOILS LOG - PERCOLATION TEST

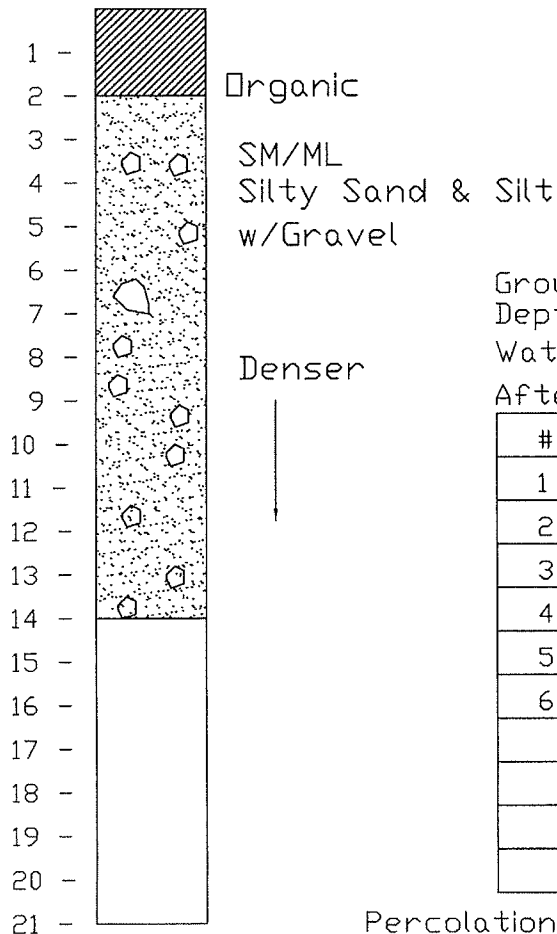
Date Performed: 9/16/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 14

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring: None Date: 10/14/16

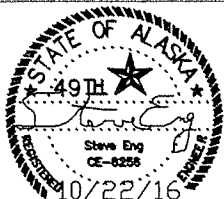
#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/16	0	--	3"	--
2	9/16	30	30 min.	6.5"	3.5"
3	9/16	32	--	3"	--
4	9/16	62	30 min.	6.5"	3.5"
5	9/16	65	--	3"	--
6	9/16	95	30 min.	6.5"	3.5"

Percolation Rate 8.6 min./inch Perc Hole Diameter 6"
Test Run Between 3' and 4'

Comments: Presoaked.

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 14

TH9

Date: 10/22/16 SHEET: 9 of 26



SOILS LOG - PERCOLATION TEST

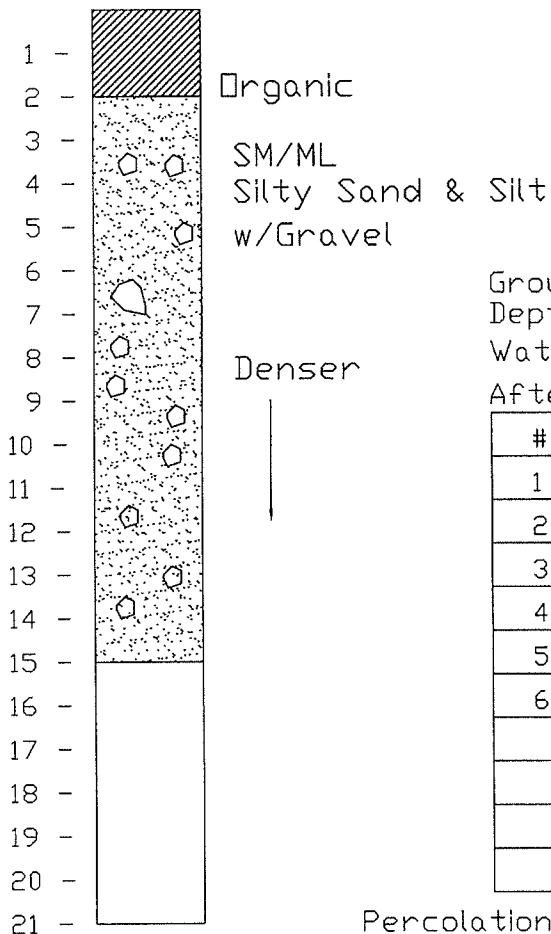
Date Performed: 9/16/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 15

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring: None Date: 10/14/16

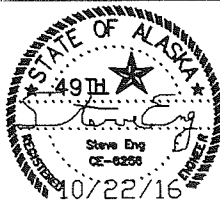
#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/16	0	--	2"	--
2	9/16	30	30 min.	4.5"	2.5"
3	9/16	32	--	2"	--
4	9/16	62	30 min.	4.5"	2.5"
5	9/16	65	--	2"	--
6	9/16	95	30 min.	4.5"	2.5"

Percolation Rate 12 min./Inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked.

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 15

TH10

Date: 10/22/16 SHEET: 10 of 26



SOILS LOG - PERCOLATION TEST

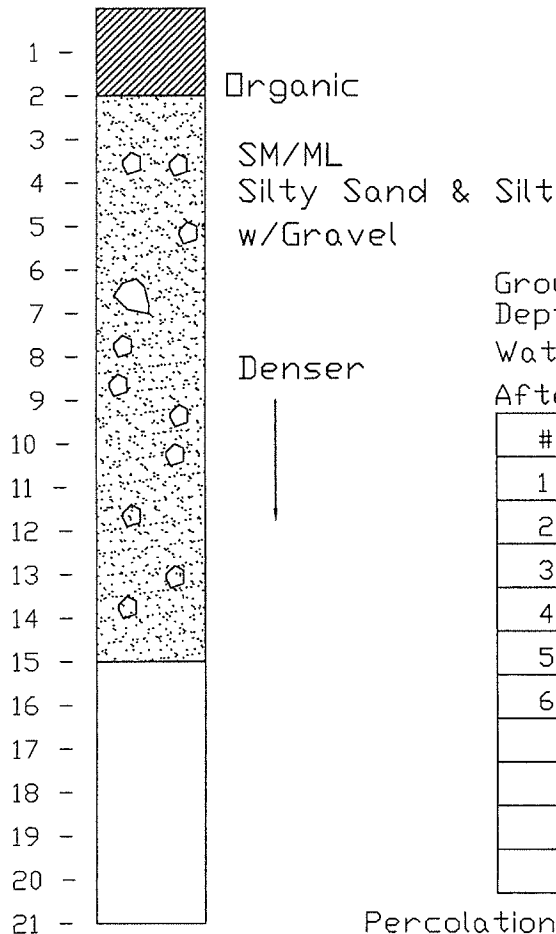
Date Performed: 9/16/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 16

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring None Date: 10/14/16

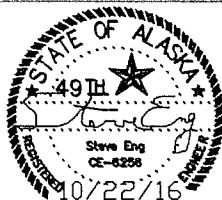
#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/16	0	--	2"	--
2	9/16	30	30 min.	5"	3"
3	9/16	32	--	2"	--
4	9/16	62	30 min.	5"	3"
5	9/16	65	--	2"	--
6	9/16	95	30 min.	5"	3"

Percolation Rate 10 min./Inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked.

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 16

TH11

Date: 10/22/16 SHEET: 11 of 26



SOILS LOG - PERCOLATION TEST

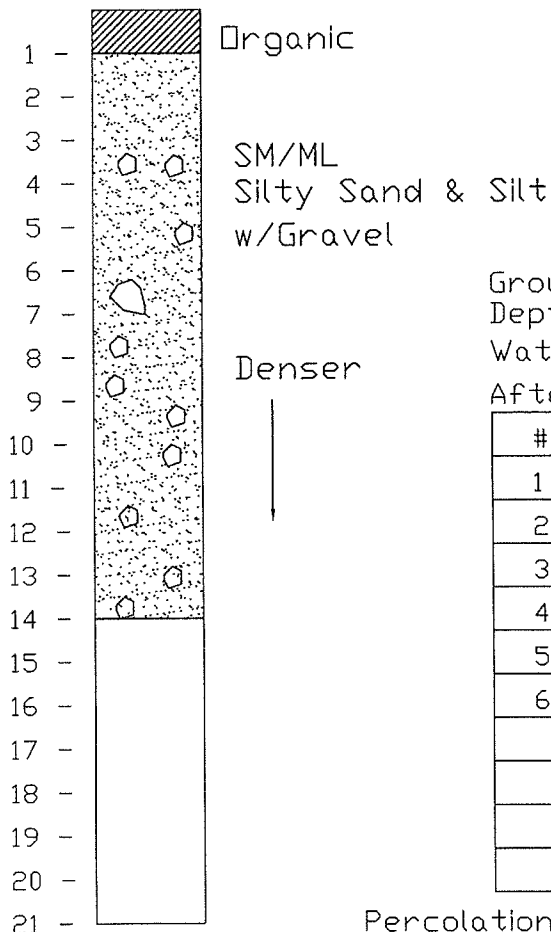
Date Performed: 9/17/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 2- West Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring None Date: 10/14/16

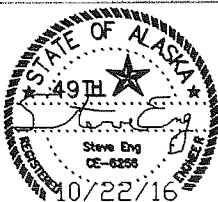
#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/17	0	--	2.5"	--
2	9/17	30	30 min.	5"	2.5"
3	9/17	32	--	2.5"	--
4	9/17	62	30 min.	5"	2.5"
5	9/17	65	--	2.5"	--
6	9/17	95	30 min.	5"	2.5"

Percolation Rate 12 min./inch Perc Hole Diameter 6"
Test Run Between 3' and 4'

Comments: Presoaked

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
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ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 2 - WEST

TH12

Date: 10/22/16 SHEET: 12 of 26



SOILS LOG - PERCOLATION TEST

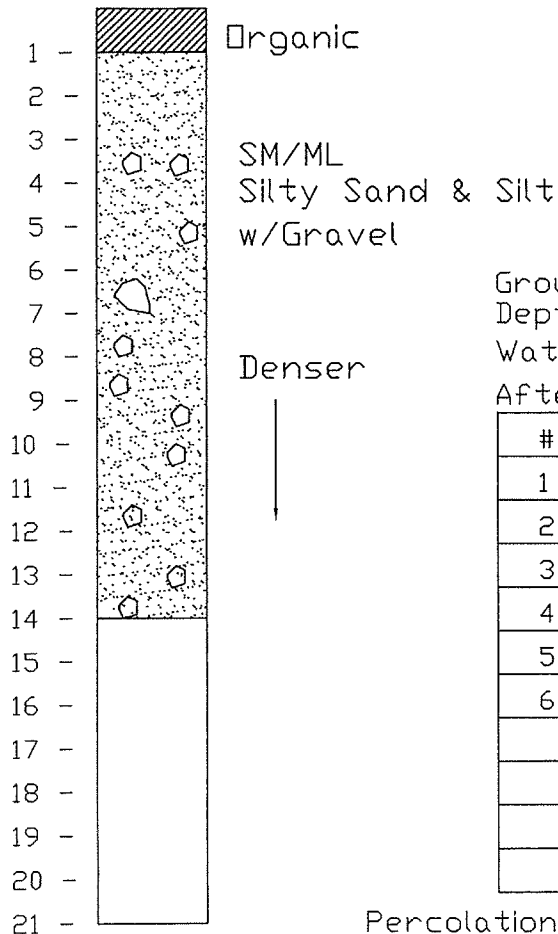
Date Performed: 9/17/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 1- West Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring None Date: 10/14/16

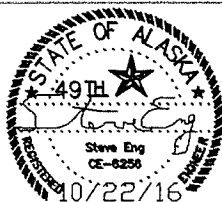
#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/17	0	--	2.5"	--
2	9/17	30	30 min.	5"	2.5"
3	9/17	32	--	2.5"	--
4	9/17	62	30 min.	5"	2.5"
5	9/17	65	--	2.5"	--
6	9/17	95	30 min.	5"	2.5"

Percolation Rate 12 min./inch Perc Hole Diameter 6"
Test Run Between 3' and 4'

Comments: Presoaked.

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
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ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 1 - WEST

TH13

Date: 10/22/16 SHEET: 13 of 26



SOILS LOG - PERCOLATION TEST

Date Performed: 9/17/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 4- West Side

DEPTH
(FEET)

T.H. Location: See Location Map

1 - Organic

2 -
3 - SM/ML
4 - Silty Sand & Silt
5 - w/Gravel
6 -
7 -
8 -
9 -

Denser

Groundwater? No

Depth --

Water Depth

After Monitoring, 11' Date: 10/14/16

#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/17	0	--	2.5"	--
2	9/17	30	30 min.	4"	1.5"
3	9/17	32	--	2.5"	--
4	9/17	62	30 min.	4"	1.5"
5	9/17	65	--	2.5"	--
6	9/17	95	30 min.	4"	1.5"

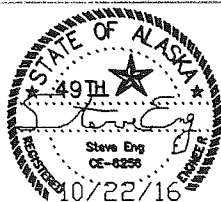
Percolation Rate 20 min./inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked.

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 4 - WEST

TH14

Date: 10/22/16 SHEET: 14 of 26



SOILS LOG - PERCOLATION TEST

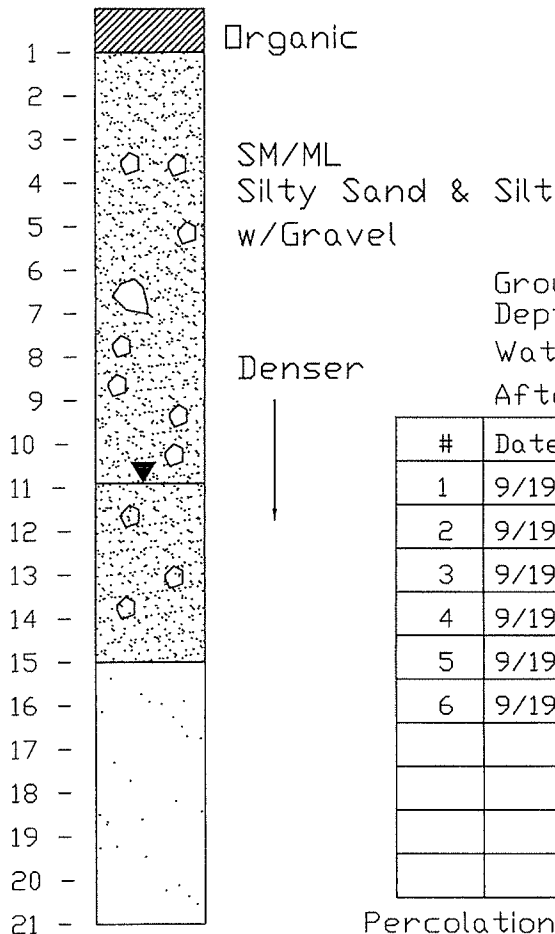
Date Performed: 9/19/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 5- South Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring, 11' Date: 10/14/16

#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/19	0	--	2"	--
2	9/19	30	30 min.	4.5"	2.5"
3	9/19	32	--	2"	--
4	9/19	62	30 min.	4.5"	2.5"
5	9/19	65	--	2"	--
6	9/19	95	30 min.	4.5"	2.5"

Percolation Rate 12 min./inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
Performed In Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

NORTHRIM ENGINEERING PO Box 770724 Eagle River, Alaska 99577 907.694.7028		TESTHOLE LOG GEOTECHNICAL LEWIS & CLARK S/D LOT 5 - SOUTH	TH15 Date: 10/22/16 SHEET: 15 of 26
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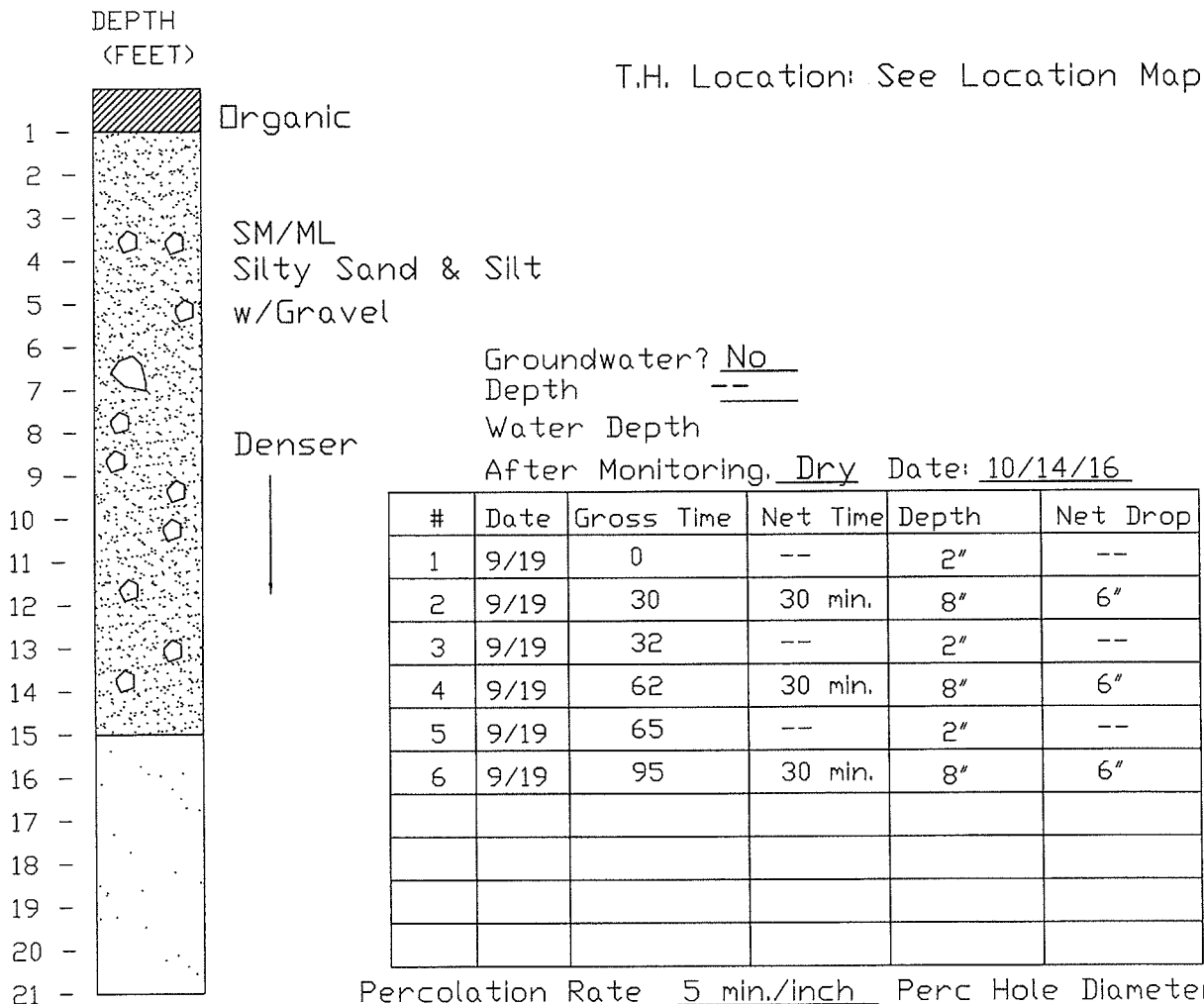


SOILS LOG - PERCOLATION TEST

Date Performed: 9/19/16

Performed For: Todd Brownson

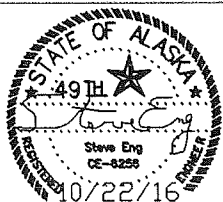
Legal Description: Lewis & Clark S/D, Lot 6- South Side



Comments: Presoaked.

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
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ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 6 - SOUTH

TH16

Date: 10/22/16 SHEET: 16 of 26



SOILS LOG - PERCOLATION TEST

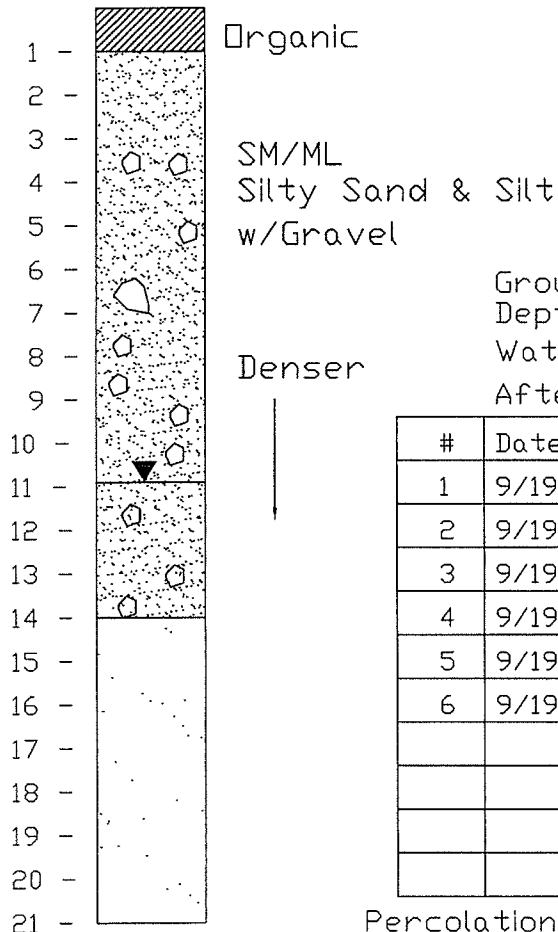
Date Performed: 9/19/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 7- South Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring, 11' Date: 10/14/16

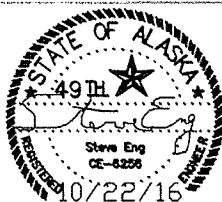
#	Date	Gross Time	Net Time	Depth	Net Drop
1	9/19	0	--	2"	--
2	9/19	30	30 min.	5"	3"
3	9/19	32	--	2"	--
4	9/19	62	30 min.	5"	3"
5	9/19	65	--	2"	--
6	9/19	95	30 min.	5"	3"

Percolation Rate 10 min./Inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked.

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 7 - SOUTH

TH17

Date: 10/22/16 SHEET: 17 of 26

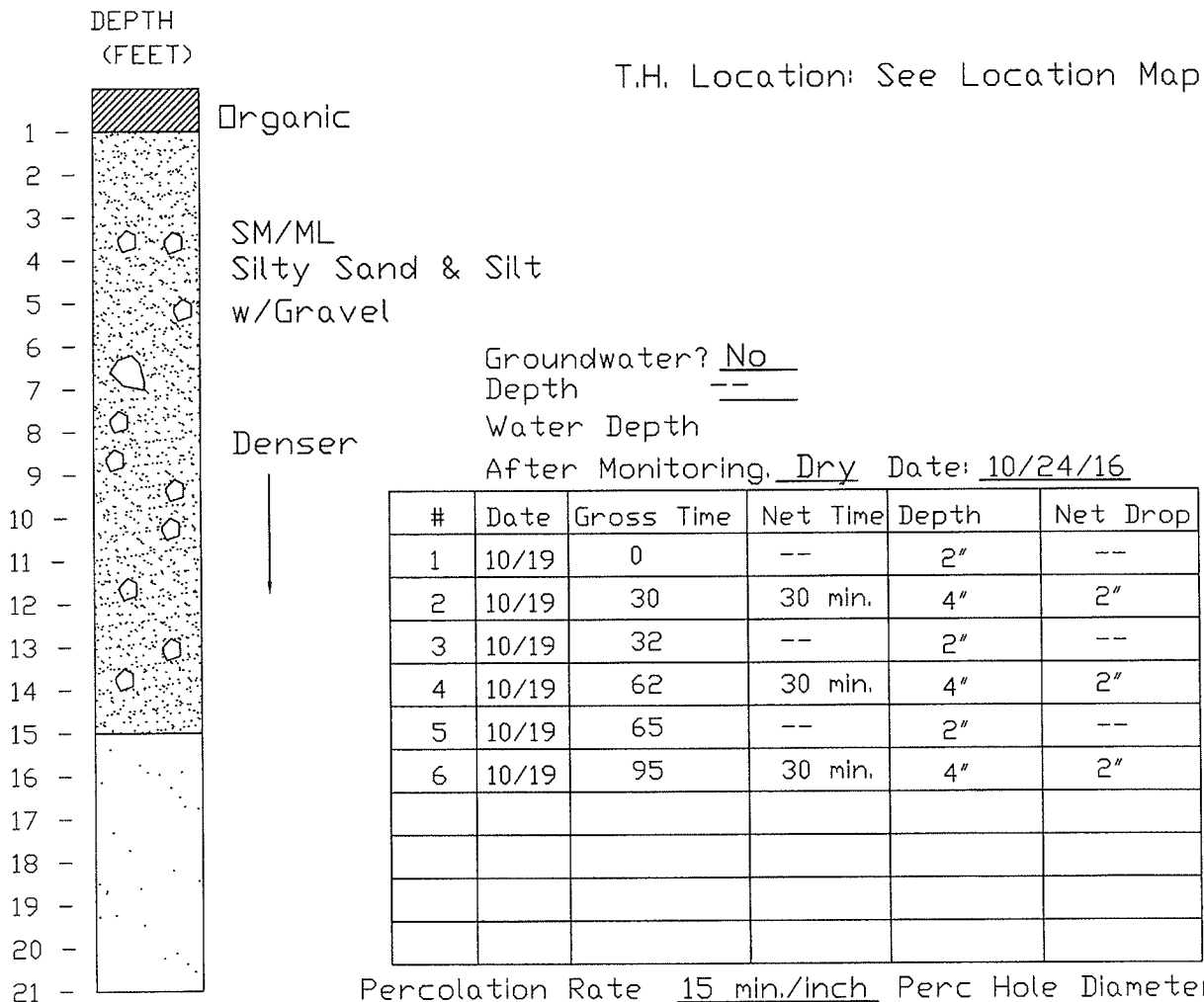


SOILS LOG - PERCOLATION TEST

Date Performed: 10/14/16

Performed For: Todd Brownson

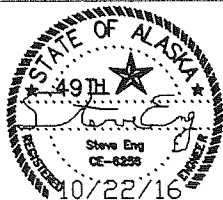
Legal Description: Lewis & Clark S/D, Lot 8- South Side



Comments: Presoaked.

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 8 - SOUTH

TH21

Date: 10/22/16 SHEET: 21 of 26



SOILS LOG - PERCOLATION TEST

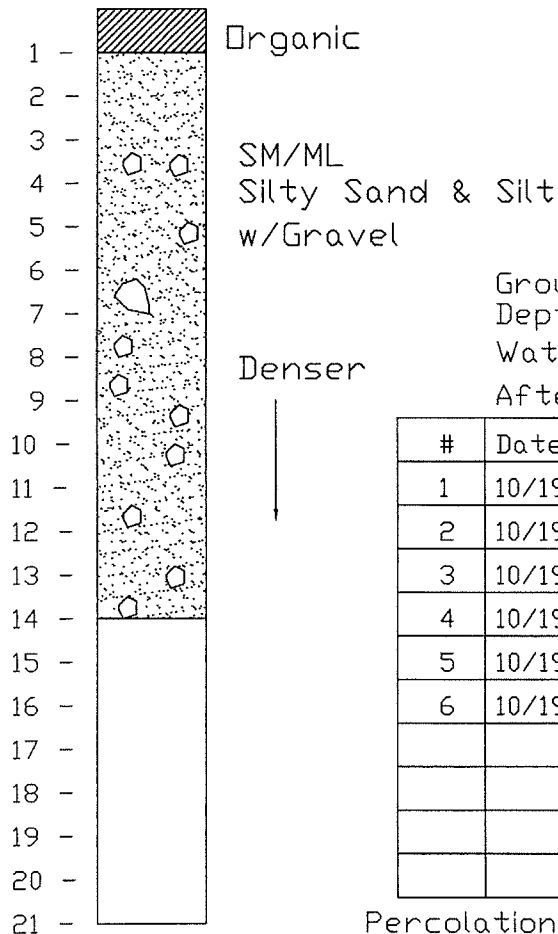
Date Performed: 10/14/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 10- South Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring, Dry Date: 10/24/16

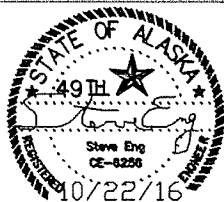
#	Date	Gross Time	Net Time	Depth	Net Drop
1	10/19	0	--	2"	--
2	10/19	30	30 min.	5"	3"
3	10/19	32	--	2"	--
4	10/19	62	30 min.	5"	3"
5	10/19	65	--	2"	--
6	10/19	95	30 min.	5"	3"

Percolation Rate 10 min./inch Perc Hole Diameter 6"
Test Run Between 3' and 4'

Comments: Presoaked

Performed By Northrim Eng. I SEE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 10 - SOUTH

TH22

Date: 10/22/16 SHEET: 22 of 26



SOILS LOG - PERCOLATION TEST

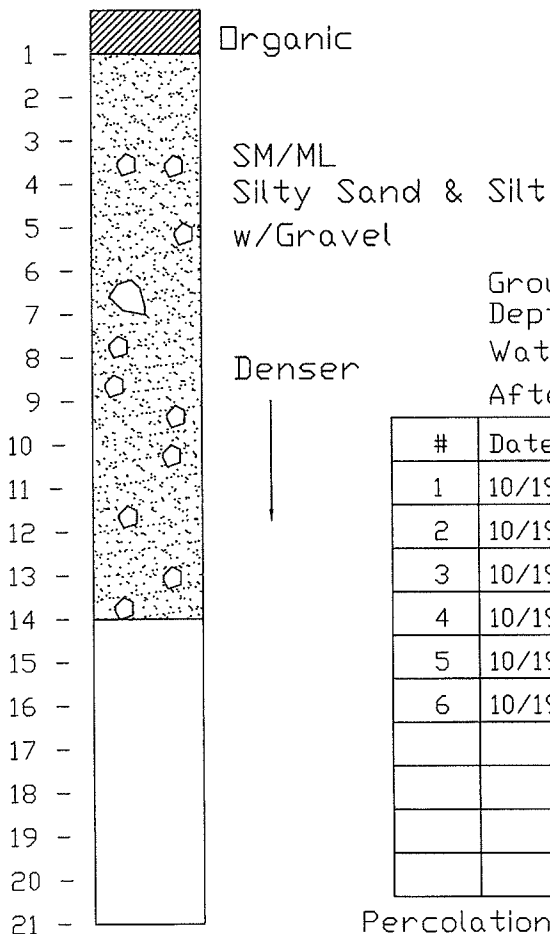
Date Performed: 10/14/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 9- South Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring, Dry Date: 10/24/16

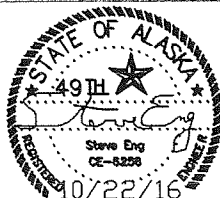
#	Date	Gross Time	Net Time	Depth	Net Drop
1	10/19	0	--	2"	--
2	10/19	30	30 min.	4.5"	2.5"
3	10/19	32	--	2"	--
4	10/19	62	30 min.	4.5"	2.5"
5	10/19	65	--	2"	--
6	10/19	95	30 min.	4.5"	2.5"

Percolation Rate 12 min./inch Perc Hole Diameter 6"
Test Run Between 3' and 4'

Comments: Presoaked

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 9 - SOUTH

TH23

Date: 10/22/16 SHEET: 23 of 26



SOILS LOG - PERCOLATION TEST

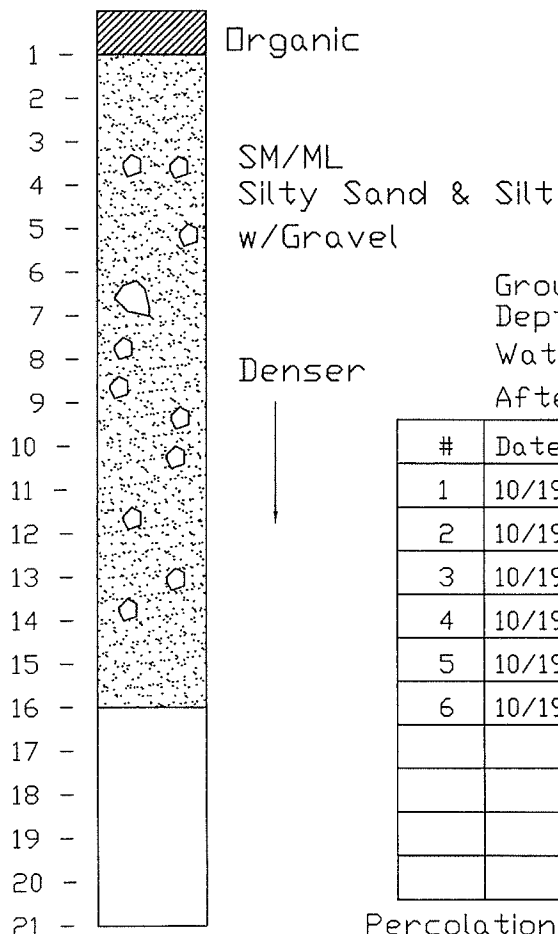
Date Performed: 10/19/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 11- South Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? No

Depth --

Water Depth

After Monitoring, Dry Date: 10/24/16

#	Date	Gross Time	Net Time	Depth	Net Drop
1	10/19	0	--	2"	--
2	10/19	30	30 min.	8"	6"
3	10/19	32	--	2"	--
4	10/19	62	30 min.	8"	6"
5	10/19	65	--	2"	--
6	10/19	95	30 min.	8"	6"

Percolation Rate 5 min./inch Perc Hole Diameter 6"
Test Run Between 4' and 5'

Comments: Presoaked.

Performed By NorthRim Eng. I SEE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16



TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 11 - SOUTH

TH24

Date: 10/22/16 SHEET: 24 of 26



SOILS LOG - PERCOLATION TEST

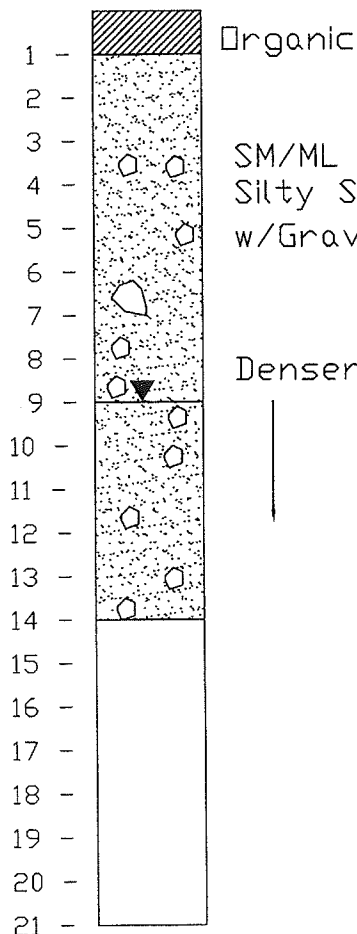
Date Performed: 10/19/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 5- North Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? Yes

Depth 9'

Water Depth

After Monitoring, 9' Date: 10/24/16

#	Date	Gross Time	Net Time	Depth	Net Drop
1	10/19	0	--	2"	--
2	10/19	30	30 min.	4"	2"
3	10/19	32	--	2"	--
4	10/19	62	30 min.	4"	2"
5	10/19	65	--	2"	--
6	10/19	95	30 min.	4"	2"

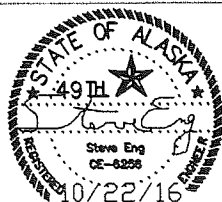
Percolation Rate 15 min./inch Perc Hole Diameter 6"
Test Run Between 3' and 4'

Comments: Presoaked

Performed By NorthRim Eng. I SE CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

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TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 5 - NORTH

TH25

Date: 10/22/16 SHEET: 25 of 26



SOILS LOG - PERCOLATION TEST

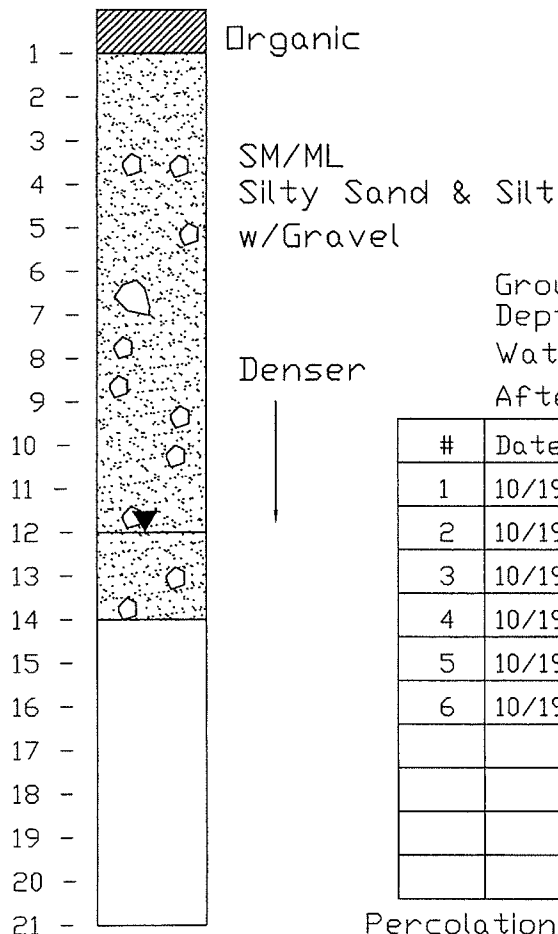
Date Performed: 10/19/16

Performed For: Todd Brownson

Legal Description: Lewis & Clark S/D, Lot 12- North East Side

DEPTH
(FEET)

T.H. Location: See Location Map



Groundwater? Yes

Depth 9'

Water Depth

After Monitoring, 9' Date: 10/24/16

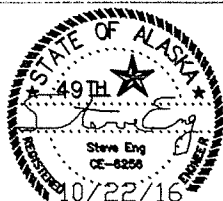
#	Date	Gross Time	Net Time	Depth	Net Drop
1	10/19	0	--	2"	--
2	10/19	30	30 min.	4"	2"
3	10/19	32	--	2"	--
4	10/19	62	30 min.	4"	2"
5	10/19	65	--	2"	--
6	10/19	95	30 min.	4"	2"

Percolation Rate 15 min./Inch Perc Hole Diameter 6"
Test Run Between 3' and 4'

Comments: Presoaked.

Performed By NorthRim Eng. I SS CERTIFY THAT THIS TEST WAS
Performed in Accordance with All State/Municipal Guidelines in Effect
ON THIS DATE. DATE: 10/22/16

NORTHRIM
ENGINEERING
PO Box 770724
Eagle River, Alaska 99577
907.694.7028



TESTHOLE LOG
GEOTECHNICAL

LEWIS & CLARK S/D
LOT 12 - NORTHEAST

TH26

Date: 10/22/16 SHEET: 26 of 26

GARNESS ENGINEERING GROUP, Ltd

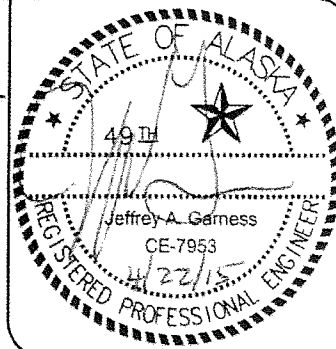
CIVIL & ENVIRONMENTAL ENGINEERS


100 E. TUODER ROAD SUITE 101 • ANCHORAGE, AK 99507 • PHONE (907) 337-6178 • FAX (907) 338-3245 • WEBSITE: www.demoss-engineering.com

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 9)

PERFORMED FOR: BIG COUNTRY ENTERPRISES, LLC / S4 GROUP DATE: 1/7/2015



DEPTH (feet)  ORGANICS

TEST HOLE #9

SOIL CLASSIFICATIONS

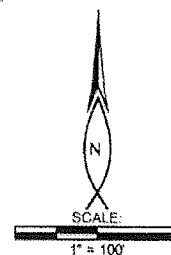
Figure 1 shows a vertical legend for soil texture. It consists of 12 rows, each with a patterned box and a label to its right. The patterns are as follows: GW (dotted), GP (dotted with horizontal lines), GM (dotted with vertical lines), GC (dotted with diagonal lines), SW (dotted with wavy lines), SP (dotted with small circles), SM (dotted with larger circles), SC (dotted with triangles), ORG (horizontal dashed lines), ML (vertical solid lines), CL (diagonal solid lines), OL (horizontal solid lines), MH (vertical dashed lines), CH (diagonal dashed lines), and OH (horizontal dashed lines with dots).

GM WITH
OCCASIONAL
LENSES OF ML

DEPTH TO GROUNDWATER	DATE
DRY	1/7/2015
DRY	1/16/2015
DRY	4/17/2015

SITE PLAN

SEE ATTACHED SITE PLAN

[illegible]

PERCOLATION RATE 20 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 4.5 FT. AND 5.5 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

LOGGED BY: JODY MAUS

PERCOLATION TEST PERFORMED BY: DAVID GARNES

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNES, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: 4/22/15

GARNESS ENGINEERING GROUP, Ltd

CIVIL & ENVIRONMENTAL ENGINEERS

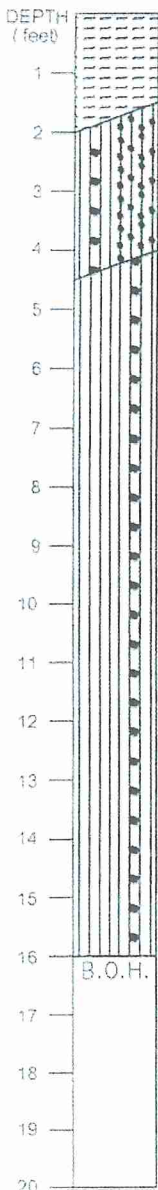
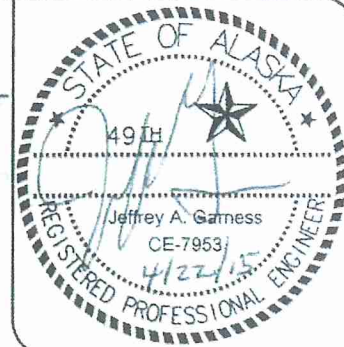
3711 E. TUDOR ROAD, SUITE 101 ANCHORAGE, AK 99507 * PHONE (907) 537-6179 * FAX (907) 538-3248 * WEBSITE: www.garnessengineering.com

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 12)

PERFORMED FOR: BIG COUNTRY ENTERPRISES, LLC / S4 GROUP

DATE: 1/2/2015



ORGANICS

GM TO SM
W/ SOME SILT

(SMEARING)

ML TO GM
(HARDPAN)

B.O.H.

TEST HOLE #12

PAGE 1 OF 2

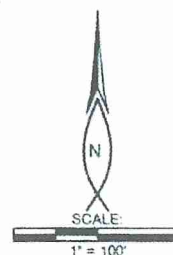
SOIL CLASSIFICATIONS

GW	ORG
GP	ML
GM	CL
GC	OL
SW	MH
SP	CH
SM	OH
SC	

DEPTH TO GROUNDWATER	DATE
DRY	1/2/2015
DRY	1/15/2015
DRY	4/17/2015

SITE PLAN

SEE ATTACHED SITE PLAN



	DATE	READING	CLOCK TIME	NET TIME (MINUTES)	WATER LEVEL READING	NET DROP (INCHES)
LOWER BENCH	1/2/2015	1/4" DROP IN 3 HOURS - DID NOT PERK (RC)				
	1/5/2015	DEEPEMED BENCH - RESET PERK - 1/8" DROP AFTER PRE-SOAK (DG)				

PERCOLATION RATE >120 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 4.5/6.5 FT. AND 5.5/7.5 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

SOILS LOGGED BY: JODY MAUS

PERCOLATION TEST PERFORMED BY: ROB CAMPBELL/DAVID GARNESS

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNESS, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: 4/22/15

GARNESS ENGINEERING GROUP, Ltd

CIVIL & ENVIRONMENTAL ENGINEERS

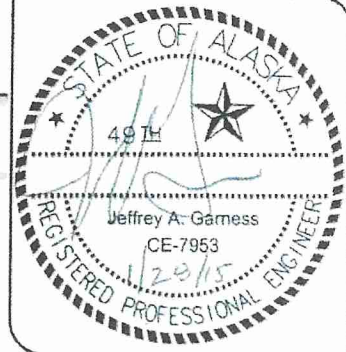
3701 E. TUDOR ROAD, SUITE 101 • ANCHORAGE, AK 99507 • PHONE (907) 337-6179 • FAX (907) 338-3246 • WEBSITE: www.garnessengineering.com

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 12)

PERFORMED FOR: BIG COUNTRY LLC / S4 GROUP

DATE: SEE PAGE 1 OF 2



DEPTH
(feet)

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

SEE PAGE 1 OF 2 FOR SOILS CLASSIFICATION

TEST HOLE #12

PAGE 2 OF 2

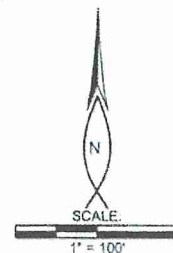
SOIL CLASSIFICATIONS

GW	ORG
GP	ML
GM	CL
GC	OL
SW	MH
SP	CH
SM	OH
SC	

DEPTH TO GROUNDWATER	DATE
SEE PAGE 1 OF 2	

SITE PLAN

SEE ATTACHED SITE PLAN



DATE	READING	CLOCK TIME	NET TIME (MINUTES)	WATER LEVEL READING	NET DROP (INCHES)
1/14/2015	1	3:00	-	6"	-
	2	3:08	8	0"	6"
	3	3:08	-	6"	-
	4	3:17	9	0"	6"
	5	3:17	-	6"	-
	6	3:36	19	0"	6"
	7	3:36	-	6"	-
	8	3:56	20	0"	6"
	9	3:56	-	6"	-
	10	4:16	20	0"	6"

UPPER BENCH

PERCOLATION RATE 3.3 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 2 FT. AND 3 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

SOILS LOGGED BY: SEE PAGE 1 OF 2

PERCOLATION TEST PERFORMED BY: ANDREW GRAY

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNESS, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: 1/28/15

GARNESS ENGINEERING GROUP, Ltd

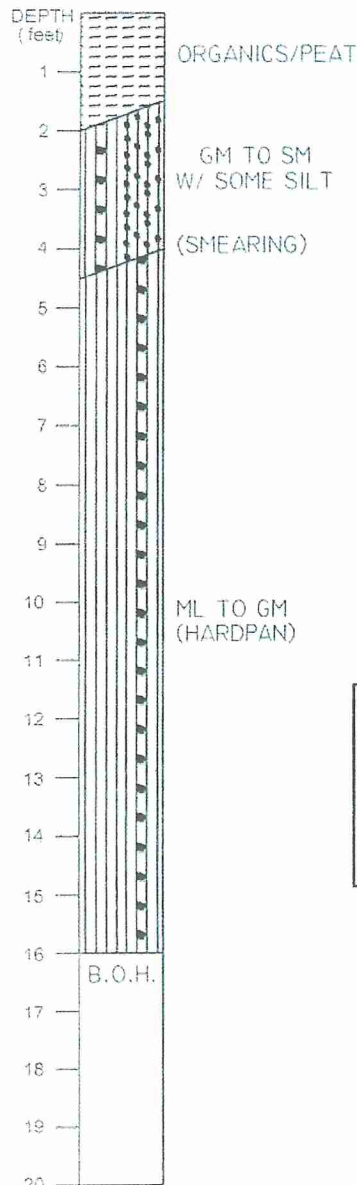
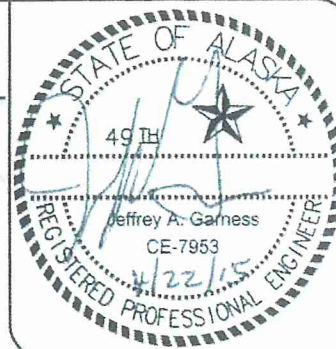
CIVIL & ENVIRONMENTAL ENGINEERS

1521 E TUDOR ROAD, SUITE 101 • ANCHORAGE, AK 99507 • PHONE (907) 337-6179 • FAX (907) 338-3245 • WEBSITE: www.garnessengineering.com

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 13)

PERFORMED FOR: BIG COUNTRY ENTERPRISES, LLC / S4 GROUP DATE: 1/2/2015



TEST HOLE #13

PAGE 1 OF 2

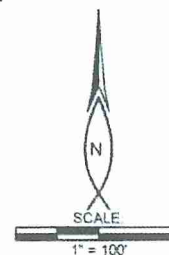
SOIL CLASSIFICATIONS

GW	ORG
GP	ML
GM	CL
GC	OL
SW	MH
SP	CH
SM	OH
SC	

DEPTH TO GROUNDWATER	DATE
DRY	1/2/2015
DRY	1/15/2015
DRY	4/17/2015

SITE PLAN

SEE ATTACHED SITE PLAN



DATE	READING	CLOCK TIME	NET TIME (MINUTES)	WATER LEVEL READING	NET DROP (INCHES)
1/2/2015	1/4" DROP IN 3 HOURS - DID NOT PERK (RC)				
1/5/2015	DEEPEMED BENCH - RESET PERK - NO DROP DURING PRE-SOAK (DG)				

PERCOLATION RATE >120 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 4.5/6.5 FT. AND 5.5/7.5 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

SOILS LOGGED BY: JODY MAUS PERCOLATION TEST PERFORMED BY: ROB CAMPBELL/DAVID GARNESS

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNESS, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: 4/22/15

GARNESS ENGINEERING GROUP, Ltd

CIVIL & ENVIRONMENTAL ENGINEERS

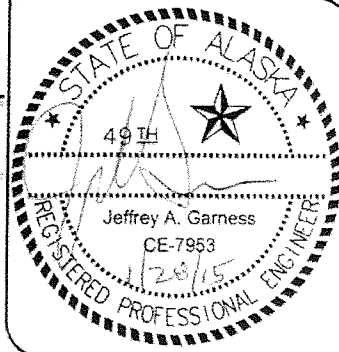
3701 E. TLOOR ROAD SUITE 101 * ANCHORAGE, AK 99507 * PHONE (907) 337-4178 * FAX (907) 338-3245 * WEBSITE: www.gammasiengineering.com

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 13)

PERFORMED FOR: BIG COUNTRY LLC / S4 GROUP

DATE: SEE PAGE 1 OF 2

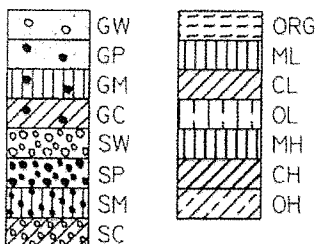
DEPTH
(feet)

SEE PAGE 1 OF 2 FOR SOILS CLASSIFICATION

TEST HOLE #13

PAGE 2 OF 2

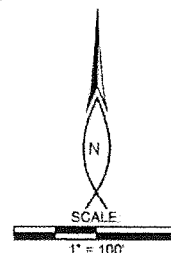
SOIL CLASSIFICATIONS



DEPTH TO GROUNDWATER	DATE
SEE PAGE 1 OF 2	

SITE PLAN

SEE ATTACHED SITE PLAN



	DATE	READING	CLOCK TIME	NET TIME (MINUTES)	WATER LEVEL READING	NET DROP (INCHES)
UPPER BENCH	1/14/2015	1	3:05	-	6"	-
		2	3:35	30	1-3/4"	4-1/4"
		3	3:35	-	6"	-
		4	4:05	30	1-7/8"	4-1/8"
		5	4:05	-	6"	-
		6	4:35	30	1-7/8"	4-1/8"

PERCOLATION RATE 7.3 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 2 FT. AND 3 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

SOILS LOGGED BY: SEE PAGE 1 OF 2

PERCOLATION TEST PERFORMED BY: ANDREW GRAY

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNES, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: 1/29/15

GARNESS ENGINEERING GROUP, Ltd

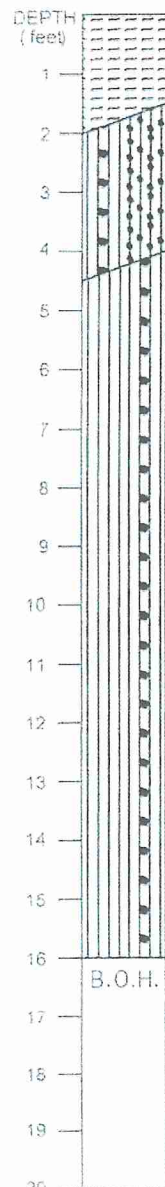
CIVIL & ENVIRONMENTAL ENGINEERS

101 E TUDOR ROAD, SUITE 101, ANCHORAGE, AK 99507 * PHONE: (907) 337-6179 * FAX: (907) 338-2246 * WEBSITE: www.garnessengineering.com

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 14)

PERFORMED FOR: BIG COUNTRY ENTERPRISES, LLC / S4 GROUP DATE: 1/2/2015



TEST HOLE #14

PAGE 1 OF 2

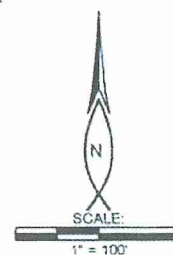
SOIL CLASSIFICATIONS

GW	ORG
GP	ML
GM	CL
GC	OL
SW	MH
SP	CH
SM	OH
SC	

DEPTH TO GROUNDWATER	DATE
DRY	1/2/2015
DRY	1/15/2015
DRY	4/17/2015

SITE PLAN

SEE ATTACHED SITE PLAN



	DATE	READING	CLOCK TIME	NET TIME (MINUTES)	WATER LEVEL READING	NET DROP (INCHES)
LOWER BENCH	1/2/2015	NO DROP DURING PRE-SOAK (RC)				
	1/5/2015	DEEPEMED BENCH - RESET PERK - NO DROP DURING PRE-SOAK (DG)				

PERCOLATION RATE >120 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 4.5/6.5 FT. AND 5.5/7.5 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

SOILS LOGGED BY: JODY MAUS PERCOLATION TEST PERFORMED BY: ROB CAMPBELL/DAVID GARNESS

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNESS, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: 4/22/15

GARNESS ENGINEERING GROUP, Ltd

CIVIL & ENVIRONMENTAL ENGINEERS

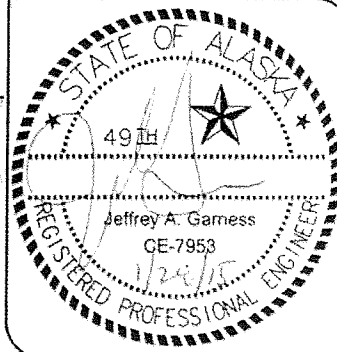
1701 E. TUDOR ROAD, SUITE 101 • ANGUS, ALASKA 99557 • PHONE (907) 337-4129 • FAX (907) 336-2246 • WEBSITE: WWW.DATAMARKING.COM

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 14)

PERFORMED FOR: BIG COUNTRY ENTERPRISES, LLC / S4 GROUP

DATE: SEE PAGE 1 OF 2



DEPTH
(feet)

SEE PAGE 1 OF 2 FOR SOILS CLASSIFICATION

TEST HOLE #14

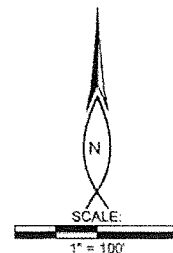
PAGE 2 OF 2

SOIL CLASSIFICATIONS

DEPTH TO GROUNDWATER	DATE
SEE PAGE 1 OF 2	

SITE PLAN

SEE ATTACHED SITE PLAN

[illegible]

PERCOLATION RATE 40 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 2 FT. AND 3 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

SOILS LOGGED BY: SEE PAGE 1 OF 2

PERCOLATION TEST PERFORMED BY: ANDREW GRAY

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNES, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: 1/28/15

GARNESS ENGINEERING GROUP, Ltd

CIVIL & ENVIRONMENTAL ENGINEERS

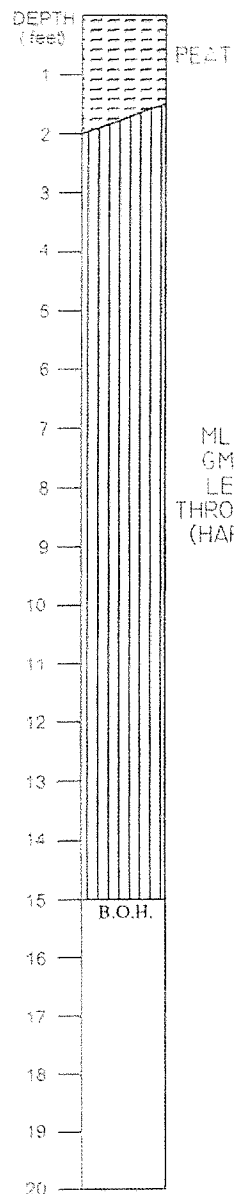
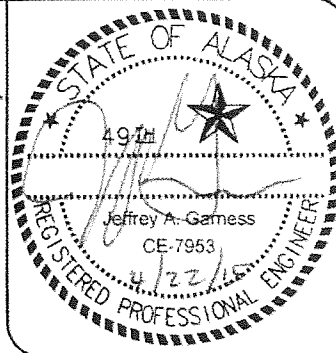
7734 E. INDIAN ROAD, SUITE 101 • ANCHORAGE, AK 99507 • PHONE (907) 337-8179 • FAX (907) 335-1245 • WEBSITE www.gamessengineering.com

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 15)

PERFORMED FOR: BIG COUNTRY ENTERPRISES, LLC / S4 GROUP

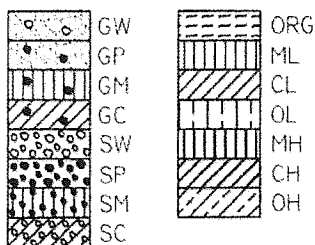
DATE: 10/17/2014



TEST HOLE #15A

OLD TH#5

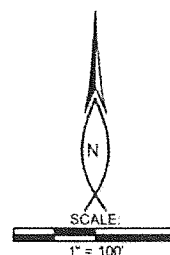
SOIL CLASSIFICATIONS



DEPTH TO GROUNDWATER	DATE
DRY	10/17/2014
DRY	10/27/2014
DRY	1/15/2015
DRY	4/17/2015

SITE PLAN

SEE ATTACHED SITE PLAN

[illegible]

PERCOLATION RATE 24 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 4.5 FT. AND 5.5 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

COPIES LOGGED BY: JODY MAUS

PERCOLATION TEST PERFORMED BY: PIERCE BLEWETT & DAVID GARNES

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNES, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: _____

GARNESSE ENGINEERING GROUP, Ltd

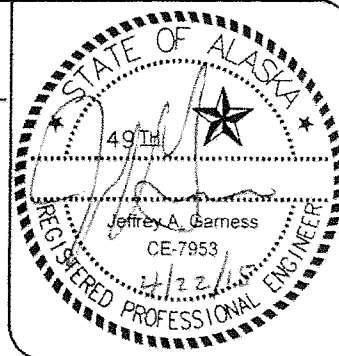
CIVIL & ENVIRONMENTAL ENGINEERS

1011 E. FUDOR ROAD, SUITE 101, ANCHORAGE, AK 99507 * PHONE (907) 537-6179 * FAX (907) 535-3248 * WEBSITE: www.garnessengineering.com

SOIL LOG - PERCOLATION TEST

LEGAL DESCRIPTION: LEWIS AND CLARK S/D (PROPOSED - LOT 19)

PERFORMED FOR: BIG COUNTRY ENTERPRISES, LLC / S4 GROUP DATE: 1/5/2015



DEPTH (feet) ORGANICS

TEST HOLE #19

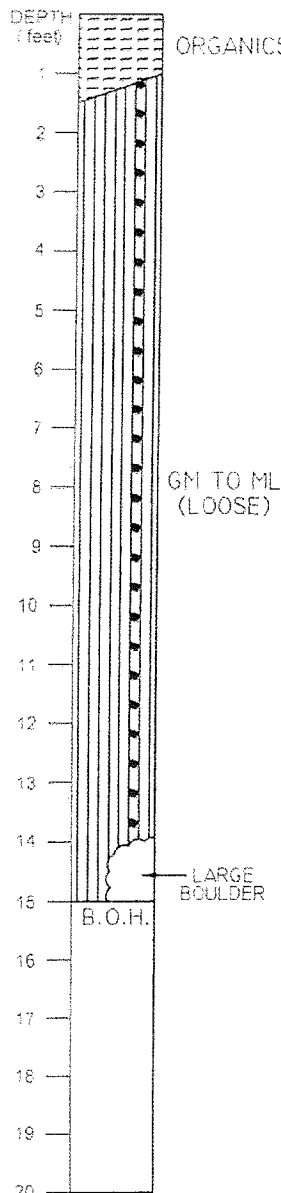
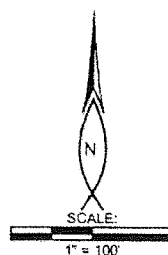
SOIL CLASSIFICATIONS

GW	ORG
GP	ML
GM	CL
GC	OL
SW	MH
SP	CH
SM	OH
SC	

DEPTH TO GROUNDWATER	DATE
DRY	1/5/2015
DRY	1/15/2015
DRY	4/17/2015

SITE PLAN

SEE ATTACHED SITE PLAN



DATE	READING	CLOCK TIME	NET TIME (MINUTES)	WATER LEVEL READING	NET DROP (INCHES)
1/5/2015	1	3:50	-	6"	-
	2	4:00	10	1"	5"
	3	4:00	-	6"	-
	4	4:10	10	1"	5"
	5	4:10	-	6"	-
	6	4:20	10	1"	5"
	7	4:20	-	6"	-
	8	4:30	10	1"	5"
	9	4:30	-	6"	-
	10	4:40	10	1"	5"
	11	4:40	-	6"	-
	12	4:50	10	1"	5"

PERCOLATION RATE 2 (MIN./INCH) PERC. HOLE DIA. 6 (INCHES)

TEST RUN BETWEEN 6 FT. AND 7 FT.

A FOUR HOUR PRESOAK WAS PERFORMED: ☒ YES ☐ NO

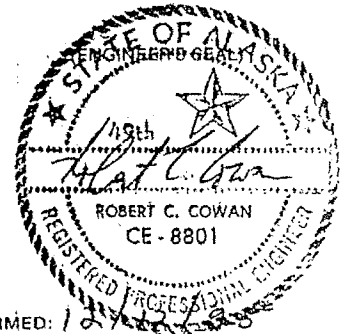
SOILS LOGGED BY: JODY MAUS PERCOLATION TEST PERFORMED BY: ROB CAMPBELL

COMMENTS: PERCOLATION READINGS ARE WITHIN 1/16 OF INCH.

PERFORMED BY GEG, Ltd. I, JEFFREY A. GARNESSE, CERTIFY THAT THIS WAS PERFORMED IN ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE: 4/22/15



Municipality of Anchorage
DEPARTMENT OF HEALTH & HUMAN SERVICES
825 "L" Street, Anchorage, Alaska 99502-0650
SOILS LOG — PERCOLATION TEST



PERFORMED FOR: BRUCE VERGASON

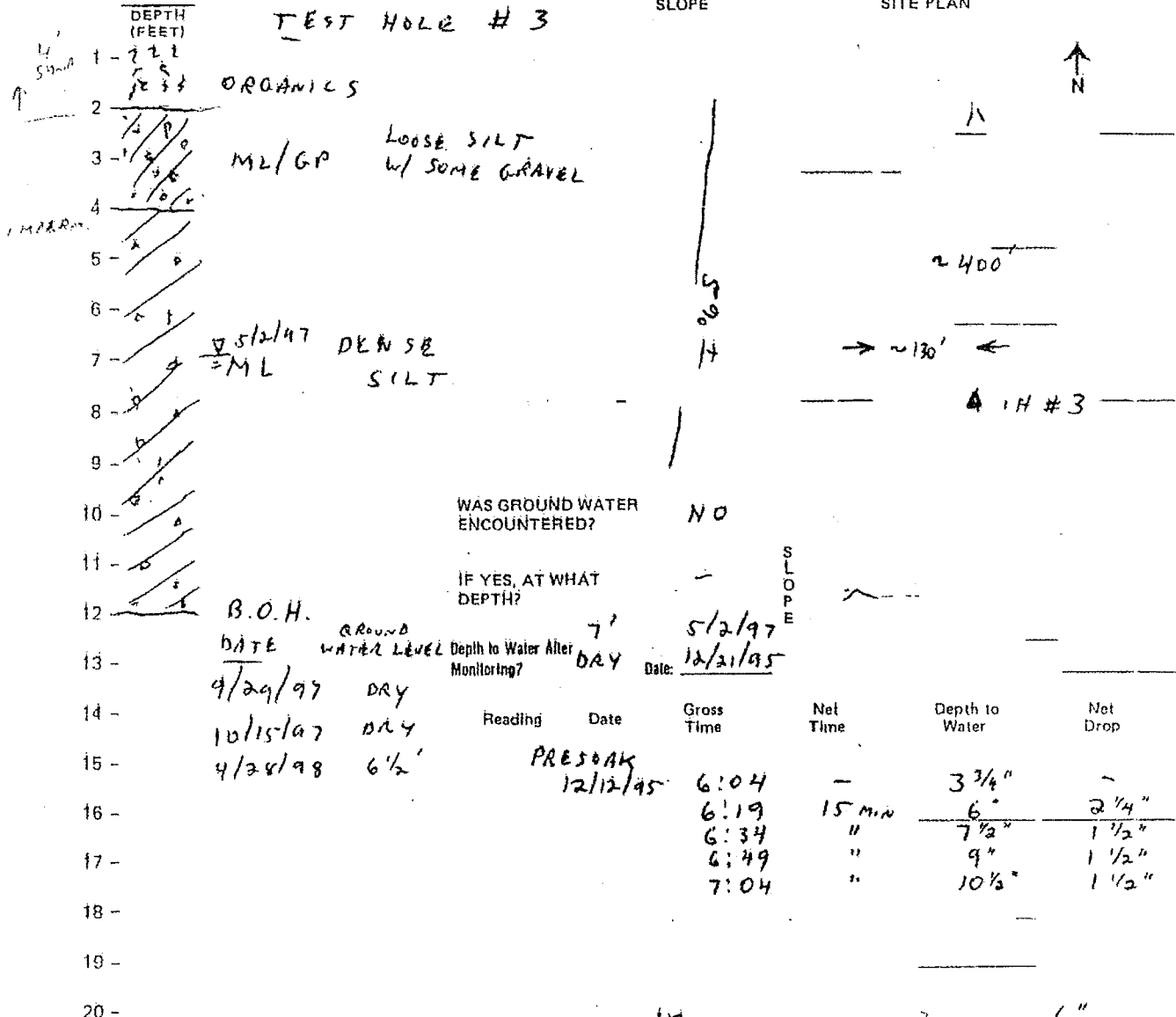
DATE PERFORMED: 12/21/95

LEGAL DESCRIPTION: NW 1/4, NW 1/4, SE 1/4 Township, Range, Section: T12N, R3W, SEC. 25

TEST HOLE # 3

SLOPE

SITE PLAN



WAS GROUND WATER ENCOUNTERED? NO

IF YES, AT WHAT DEPTH?

B.O.H.

DATE

GROUND WATER LEVEL

Depth to Water After Monitoring?

7'

5/2/97

Date: 12/21/95

9/29/97

DRY

10/15/97

DRY

4/28/98

6 1/2'

Reading

Date

Gross Time

Net Time

Depth to Water

Net Drop

PRESSURE

12/12/95

6:04

6:19

6:34

6:49

7:04

15 min

"

"

"

3 3/4"

6"

7 1/2"

9"

10 1/2"

2 1/4"

1 1/2"

1 1/2"

1 1/2"

PERCOLATION RATE 10 (minutes/inch) PERC HOLE DIAMETER 6"

TEST RUN BETWEEN 2 1/2 FT AND 3 1/2 FT

COMMENTS

PERFORMED BY: S & S ENGINEERING

17034 Eagle River Loop Road No. 204

ACCORDANCE WITH ALL STATE AND MUNICIPAL GUIDELINES IN EFFECT ON THIS DATE.

CERTIFY THAT THIS TEST WAS PERFORMED IN

DATE: 12/21/95

20 DBH (Rev. 4/95)

TERRASAT, INC.

4203 Iowa Drive Ave. Anchorage, AK 99517 (907) 344-9370 fax (907) 344-1490
Geological Consulting Environmental Restoration Regulatory Compliance

Ground Water Resource Evaluation for the Proposed Lewis and Clark Subdivision

Prepared for:
Big Country Enterprises, LLC.

Prepared by:
TERRASAT, Inc.
4203 Iowa Drive
Anchorage, AK 99517

February 16, 2017

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1.0 SUMMARY

(Big Country Enterprises, LLC. (Big Country) contracted TERRASAT, Inc. (TERRASAT) to conduct an investigation of hydrogeological conditions at the proposed Lewis and Clark Subdivision (see Figures 1 & 2). In addition, TERRASAT supervised the installation of three new wells and conducted aquifer testing and evaluation as part of the overall study objectives.

The proposed Lewis and Clark subdivision is comprised of approximately 80 acres of undeveloped land on the Hillside area of Anchorage, Alaska. Ten acres of the land in the northwest corner of the parcel may be not included in the final plat for the development. The parcel is bordered on the north by Upper DeArmoun Road, on the east by Canyon Road, on the west by Messinia Street on the south by undeveloped land that lies 500 to 1000 feet up gradient of a segment of Rabbit Creek. Figure 1 shows the site general location and Figure 2 shows the specific site location.

Our investigation of the area water budget concluded that sufficient sustainable ground water is available to supply the proposed Lewis and Clark subdivision land development. An evaluation of area well data suggests at least five separate aquifers exist in the local area. TERRASAT proposes that at least two aquifers will likely be used to extract groundwater for the various lots in the Lewis and Clark development.

Average yield per well for 124 residential wells in an approximate 1/2 mile area around Lewis and Clark subdivision that were evaluated in this study is 5.09 gallons/minute. Aquifer test results suggest that the average well in the Lewis and Clark subdivision may produce between 7 to as much as 135 gallons/minute. Hydrogeological modeling of the new wells show that the largest impact to a property 200 feet away ranges between 0.0 and 3.08 feet when a well is pumped for up to three hours at 2 gallons per minute, a typical rate. Most of the neighboring wells have more than 200 feet of available static water level in their wells. Therefore, the neighboring wells will continue to function without a significant impact.

2.0 METHODS

TERRASAT conducted a comprehensive groundwater investigation of the area in and around the proposed Lewis & Clark Subdivision using available well logs from the MOA and from the ADNRS WELTS databases that were within 1/2 to 3/4 miles from the property of interest. Figure 3 shows the locations of 124 private residential wells whose records were analyzed during the site evaluation conducted by TERRASAT for the proposed Lewis and Clark subdivision.

3.0 GEOLOGY

3.1 Background Information

Several State and Federal reports have documented the generalized geology of the area around and including the proposed Lewis and Clark subdivision. Much of the Upper Hillside area of Anchorage is part of the Chugach State Park and the boundary lies one mile east of the eastern boundary of the Lewis and Clark subdivision. A USGS map report "Generalized Geologic Map of Anchorage and Vicinity, Alaska" by Henry R. Schmoll and Ernest Dobrovolny 1972, shows the surficial geology types, not including a thin layer of organics that is found in many areas, include the following:

- Colluvium (c): Slope deposits on mountain sides and valley walls in lowlands. Consisting of diamicton and poorly sorted to well sorted gravel with some sand, silt or clay. Usually, and in this location, it is found downslope of bedrock.
- Lake and Pond Sediment (l): Near mountains it is chiefly silt and clay with some fine sand, and sand and gravel: it is accumulated in former ice-dammed lakes. In this case, from ice-dammed water flowing down the modern Rabbit Creek channel as seen in Figure 4 south of the property of interest.
- Alluvial Fan Deposits (af): Deposits in alluvial fans or alluvial cones. In this case they are likely from alluvial fan or cone deposits that came down from mountain sides in the area. Consisting dominantly of gravel and may contain some silt and clay. Often, as here, they are found next to and grade into colluvium (c).
- Morainal Deposits (m): Deposits found generally in long ridges marking the merging of former glaciers. Chiefly till.

While beneath the surface, any of the above type deposits may also be found, ultimately at some depth bedrock will be located:

- Bedrock (b): Metamorphic rock, principally McHugh Complex metamorphosed siltstone, greywacke, arkose, conglomerate sandstone, and greenstone. Chert and argillite are often associated with these deposits. This type rock is surely to be found at the Lewis and Clark site, likely at depths no greater than 250 feet bgs.

Figure 4 is a map display of the information contained in the USGS geology map of the area. Figure 5 shows the topographic location of the site and includes the location of a drainage basin divide in the area. Figure 6 below, from Hydrology For Land-Use Planning: The Hillside Area, Anchorage, Alaska, Larry L. Dearborn and William W. Barnwell, USGS Open File Report 75-105 in cooperation with the Greater Anchorage Area Borough shows likely bedrock depths of the Hillside area including the Lewis and Clark site.

Note in Figure 6 that bedrock depths across the Lewis and Clark site range from 50 to 200 feet (below ground surface) bgs. This compares favorably to a statistical modeling evaluation by TERRASAT, based on well log data from area wells, that showed depths to bedrock likely will range from between 0 to 158 feet bgs for the up-gradient 2/3 of the property, with greater depths downgradient in a southwestern direction. Insufficient data was available to model the lower 1/3 of the Lewis and Clark site.

Subsequent data collected from the installation of the three new wells (see following sections) in December 2016 has compared favorable to the TERRASAT and USGS bedrock modeling of that specific area of the Lewis and Clark subdivision and confirms the actual bedrock depth at those locations ranges from 43 to 92 feet below ground surface.

3.2 Subsurface Investigations

3.2.1 Pre-Drilling Evaluations

Figure 4 shows the geology of in the area of interest consists of colluvium in the south and in the north, lake and pond sediments that run in the center of the property, and alluvial fan deposits on the east of the property. Percolation test hole logs show peat in the upper 1 to 2 feet, with silty or gravelly fine sands (colluvium or lake and pond sediments) predominant for several feet beneath the upper layers.

Wells in the area are known to be in bedrock in most locations, however to the west of Lewis and Clark several private wells in the Grecian Hills Subdivision are installed in unconsolidated material as is a private well (within the project area) located on the east side of Messina Street. These wells are likely located in the alluvial fan or morainal deposits that are shown in Figure 4, indicating that either or both of those type of deposits may extend further south than the generalized USGS map indicates. This is inferred from the fact that the residential wells directly north of the Lewis and Clark subdivision, which are located in colluvium, are bedrock wells according to well logs, while wells directly west of the Lewis and Clark subdivision are located in unconsolidated material. As one moves from higher to lower elevations in the Hillside area, bedrock is generally found deeper and the percentage of wells in unconsolidated material becomes greater. This effect may become evident within the Lewis and Clark parcel because the land there grades gently downward toward the Rabbit Creek valley which lies south of it.

TERRASAT reviewed the water well data from 124 local wells and reviewed static water levels and elevations, lithology, depths to bedrock, well aquifer type, and other available information including water quality. Appendix A contains much of that information.

3.2.2 Post Well-Drilling Geological Results

Three drinking water well boreholes were drilled in December 2016 through January 2017. Well logs (Appendix D) show that fractures in bedrock aquifers exist at several depths in the Lewis and Clark Subdivision at those specific locations. These water bearing fractures-zone aquifers are protected from surface activities by at least 100 feet of bedrock aquitard. Bedrock was initially encountered at depths of 43, 51 and 92 feet below ground surface in the three exploratory wells. Those wells were drilled to depths of 398, 256, and 236 feet below ground surface respectively. All three wells were completed in bedrock with water producing fracture zones encountered at several depth intervals. The bedrock was predominately greywacke with numerous hydrothermal veins of quartz and other minerals at various depths. Section 4.2 describes the results of aquifer testing at the three wells.

4.0 HYDROGEOLOGY

4.1 Subsurface and Previous Investigations

Several prior studies describe various aspects of the geology and hydrogeology of the area. TERRASAT used "Hydrology For Land-Use Planning: The Hillside Area, Anchorage, Alaska, Larry L. Dearborn and William W. Barnwell, USGS Open File Report 75-105" in cooperation with the Greater Anchorage Area Borough, to help define the water budget for the area. Another study that was referenced was "Emanuel and Cowing, USGS Open File Report 82-86, Hydrogeology for land-use planning; the Potter Creek Area, 1982, Anchorage, Alaska" in cooperation with the Greater Anchorage Area Borough.

Static water levels at the time of drilling from available well logs were converted to static water elevations above sea level for the area well logs used in TERRASAT's investigation. The static water elevations were then statistically evaluated to differentiate aquifers in the communities surrounding the Lewis and Clark subdivision. Five separate aquifers were delineated for the area.

The western area of the Lewis and Clark subdivision likely contains a thicker section of unconsolidated material above bedrock. At least one confined aquifer likely exists in this unconsolidated material that either does not exist further to the east, or if it exists, is too thin to produce sustainable water supplies. The one water well that currently exists in that area confirms this likelihood.

TERRASAT's investigation found that ancient channels of Rabbit Creek once crossed two locations within or very near the property of interest. Figure 7 shows the locations of these former stream channels. These ancient channels will have altered the subsurface and surface geology in those specific areas, likely creating deposits of alluvium that still exist. These will likely be encountered during development of the area and have a potential to serve as a high yield aquifer.

4.1.1 Local Aquifers and Availability of Water

According to the report; Hydrology For Land-Use Planning: The Hillside Area, Anchorage, Alaska, Larry L. Dearborn and William W. Barnwell, USGS Open File Report 75-105, the groundwater budget for the Anchorage Upper Hillside area containing the Lewis and Clark project area is approximately 10-16 Mgal/day. Figure 8, below depicts the general study area of that Hillside report which closely correlates with the 99516 area code area. Figure 9 shows the water budget in that area.

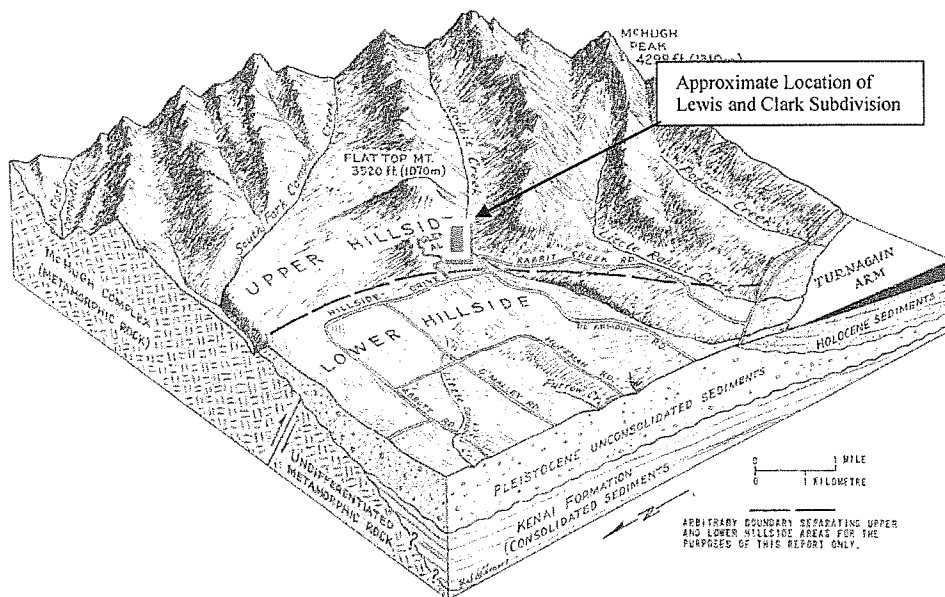


Figure 8. Upper Hillside Area (from Hydrology For Land-Use Planning: The Hillside Area, Anchorage, Alaska, Larry L. Dearborn and William W. Barnwell, USGS Open File Report 75-105 in Cooperation with the Greater Anchorage Area Borough.)

An average home in Anchorage uses approximately 450 gallons per day of water. The MOA census data from 2013 for the Upper Hillside, the area code 99516 area, lists a population of 20,781. If we are to assume that an average house contains four people, then we can assume that the area contains approximately 5195 houses. If 5195 homes use 450 gallons per day then the Upper Hillside area would use 2,337,750 gallons per days of the available 10-16 million gallons. This shows that availability of groundwater is not, at this time, an issue for the Upper Hillside area. The Lewis and Clark subdivision will have approximately 30 houses

or less. The daily water consumption for 30 houses at 450 gallons per house equals 13,500 gallons per day. This is a fraction of the 10-16 million gallons per day of available groundwater shown in Figure 9. We conclude that groundwater recharge is abundant for the Lewis and Clark subdivision and surrounding subdivisions.

One-hundred seventeen wells had available data regarding aquifer type for each well. Figure 10 shows the most current static water elevations measured for each well. Some are the measurement taken at the time of drilling and some are taken at a later date, often when the property ownership was being transferred. The results show that five separate aquifers likely exist in the area.

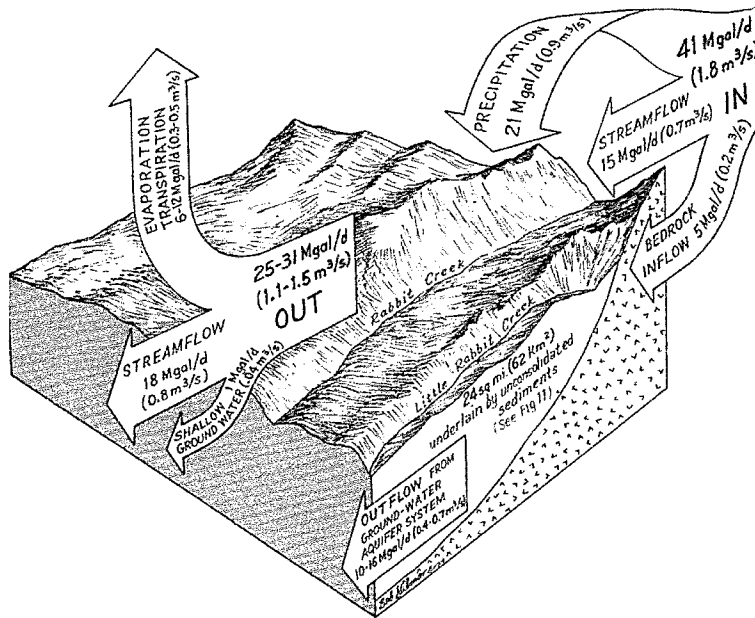


Figure 9. Water Budget of the Upper Hillside area containing the Lewis and Clark project site. (from Hydrology For Land-Use Planning: The Hillside Area, Anchorage, Alaska, Larry L. Dearborn and William W. Barnwell, USGS Open File Report 75-105)

Available well logs show 92 water wells are completed in consolidated rock (bedrock) and twenty-five are completed in unconsolidated (sand and gravel) aquifers. Figure 11 shows static water elevations at the time of drilling. These water levels differentiate aquifers.

Well yields for the 124 area wells show that 92 wells completed in bedrock have a mean yield of 2.7 gpm (see Figure 12). More than 97.5% of the consolidated rock wells produced more than 0.33 gallons per minute at the time of drilling. Figure 12 shows the well yield of all 124 wells, including the wells completed in unconsolidated material. Average yield per well for 124 residential wells in an approximate ½ mile area around Lewis and Clark subdivision that were evaluated in this study is 5.1 gallons/minute.

A four bedroom house requires about a third of a gallon per minute without the need for a holding tank. We conclude that adequate groundwater resources are available for the Lewis and Clark Subdivision with a planned density of R-6 lots.

Most homes use less than 450 gallons per day, or 0.3 gallons per minute, while most area wells produce more than 3 gallons per minute and, as Figure 12 shows, the area bedrock aquifer is capable of producing as much as 20 gallons per minute.

4.2 Well Installation and Aquifer Test Results at Lewis & Clark

Three wells were drilled on three contiguous lots in December of 2016 and January of 2017. The contiguous lots were selected so that aquifer tests could determine likely impacts to nearby wells. Wells were spaced approximately 180 feet apart. These lots are typical of lots within the subdivision. Wells were drilled to depths of 393, 256, and 236 feet below ground surface. These wells were completed in bedrock. Figure 13 shows the locations of three wells installed at Lewis and Clark. Initially, step tests were performed at each well to determine the maximum rate at which each could be pumped for the 24 or 6 hour tests, without causing rapid or significant drawdown to the observation wells. These observation wells acted as proxy wells for neighboring wells.

The wells were also monitored for diurnal-antecedent water level fluctuations. Well LCW-1 is an artesian flowing well and was constantly flowing during manual observations taken several times during the January to February well drilling and aquifer testing program. Only during pump testing of LCW-2 did the water level fall temporarily below the top of the casing. Wells LCW-2 and LCW-3 were instrumented with pressure transducers for one 24 hour period. Well LCW-2 showed 0.137 ft. (1.64 inches) of water level fluctuation while well LCW-3 showed 0.8 ft. (9.6 inches) of fluctuation. From past experience, these results were not deemed great enough to affect the AqteSolv data evaluation of the aquifer pump testing, and the dataset was therefore not modified before evaluating the results.

Aquifers were tested following ASTM standards. Two wells were tested with a 24-hour continuous discharge test and one well was tested with a 6-hour continuous discharge test. Each well was allowed to recover for the same duration as the drawdown testing. Aquifer test results show that each well is capable of providing adequate water supplies and that the impact to wells on adjacent lots will be

insignificant. The basic well and aquifer test results and information for each well are listed below.

LCW-1

- Total Depth (ft. top of casing) : 393
- Depth of Casing (ft. bgs) : 65
- Depth to Bedrock (ft. bgs) : 43 fractured/weathered – 62 fully consolidated
- Static Water Level (ft. top of casing) : Flowing
- Static Water Level Elevation (ft AMSL) :
- Diurnal Antecedent Water Fluctuation (ft.): 0
- Casing Height Above Ground Surface (ft.) : 2.0
- Maximum Potential Yield (gpm) : 135
- Drawdown at 200 Radial Feet (@3gpm/2Hrs.) (ft.) : 0
- Recovery After 6 Hours (ft.): 100%

LCW-2

- Total Depth (ft. top of casing) : 256
- Depth of Casing (ft. bgs) : 53
- Depth to Bedrock (ft. bgs): 52
- Static Water Level (ft. top of casing): 18.5
- Static Water Level Elevation (ft. AMSL) :
- Diurnal Antecedent Water Fluctuation (ft.) : 0.137
- Casing Height Above Ground Surface (ft.) : 2.6
- Maximum Potential Yield (gpm) : 34
- Drawdown at 200 Radial Feet (@3gpm/2Hrs.) (ft.) : 5.1
- Recovery After 24 Hours (ft.): 100%

LCW-3

- Total Depth (ft. top of casing) : 236
- Depth of Casing (ft. bgs) : 100
- Depth to Bedrock (ft. bgs) : 92
- Static Water Level (ft. top of casing) : 55
- Static Water Level Elevation (ft. AMSL)
- Diurnal Antecedent Water Fluctuation (ft.) : 0.8
- Casing Height Above Ground Surface (ft.) : 2.0
- Maximum Potential Yield (gpm) : 9.5
- Drawdown at 200 Radial Feet (@3gpm/2Hrs.) (ft.) : 0
- Recovery After 24 Hours (ft.) : 96%

The maximum potential yields listed above refers to the rate at which the well could be continuously pumped before 100% of the available drawdown would be reached. These test data show that abundant water is available for planned wells in the Lewis and Clark subdivision. The average Anchorage household well would need to be pumped at a rate of 0.31 gpm continuously, when equilibrating this rate to the average daily household usage of 450 gallons/day. The maximum rates listed for the wells above are therefore far above the range of expected normal rates. They indicate that much more water is available than will ever normally be used.

For the Lewis and Clark subdivision, 200 lateral feet is the approximate distance between planned wells on separate lots. That hydrogeological modeling of the new wells show that the largest drawdown impact to a property 200 feet away ranges between 0 and 3.08 feet when a well is pumped for up to three hours at 2 gallons per minute, a typical rate. The individual well data are listed below:

- Based on the aquifer test data for well LCW-1, pumping at 3 gpm for 2 hours will result in drawdown of 0.0 feet at a distance of 200 ft.
- Based on the aquifer test data for well LCW-2 pumping at 3 gpm for 2 hours will results in drawdown 3.08 ft. at a distance of 200 feet.
- Based on the aquifer test data for well LCW-3 pumping at 3 gpm for 2 hours will results in drawdown of 0.0 ft. at a distance of 200 feet.

Most wells in the Lewis and Clark Hillside area contain at least 200 feet of available drawdown. A well 200 feet away from well LCW-2 would draw down 3.08 feet, which leaves 98.46% of the available water. The drawdown is temporary and recharge begins as soon as pumping is discontinued. Pumping of the other two wells would have no drawdown effect for wells 200 feet away.

Recharge rates as listed above show that all three wells attain 96% to 100% recharge in the same amount of time or less time than they were pumped during aquifer testing. Well LCW-3 (96%) is the only well that did not achieve 100% recharge in the same time period as the pump test, and it is also the well with the highest (0.8 feet) amount of normal daily water level fluctuation.

Based on static water level elevations of the three new wells and laboratory water chemistry results (see Table 1), we conclude that at least two bedrock aquifers exist beneath the Lewis and Clark subdivision. Further, based on observations made during the aquifer testing procedures we conclude that partial connectivity exists between all three wells. Wells LCW-2 and LCW-3 exhibit a higher degree of connectivity than does LCW-1 to either of the other two wells.

5.0 ENVIRONMENTAL CONSIDERATIONS

5.1 Existing Contaminants

The proposed Lewis and Clark subdivision is an undeveloped forested parcel. Site inspections by TERRASAT have found no potential contaminants or environmental concerns that currently exist on the property. Potential contaminants and environmental considerations that are commonly associated with development are discussed below. A discussion of the potential for the Lewis and Clark development to affect adjoining or nearby properties is included for each topic of concern. The potential effect of potential contaminants on aquifers that supply drinking water is discussed in section 5.2.5.

5.1.1 Water Quality at Lewis and Clark

Water samples were collected from the three new wells drilled in January of 2017. The samples were analyzed for Calcium, Iron, Manganese, Total Dissolved Solids (TDS), and total Nitrogen by Nitrate-Nitrite. Table 1 lists the results of the water sampling. Water quality from the three wells complies with primary drinking water standards for the parameters tested. Iron and manganese exceeds the secondary drinking water standards in some wells, based on desirability of drinking water. Iron or manganese treatment could be employed to reduce these metals from the water supply.

Table 1. Results of Water Sampling in January 2017

	Sample Collection Date	Calcium (ug/L)	Iron (ug/L)	Manganese (ug/L)	TDS (mg/L)	Nitrate-Nitrite-N (mg/L)
Drinking Water Standard		NA	NA	NA	NA	10
Secondary Drinking Water Standard		NA	300	50	500	NA
Well ID						
LCW-1	1/31/17	27000	1330	57.3	246	1.12
LCW-2	1/25/17	54900	ND (DL=78.0)	4.67	286	1.83
LCW-3	1/30/17	43300	ND (DL=78.0)	59.0	291	0.0378
NA refers to non-applicable items. ND refers to an analyte that was analyzed for but was not detected at a level above the detection limit. Calcium is not a regulated or secondary parameter of water quality in Alaska. Secondary Standards are not regulated by law but are used to suggest good or desirable water quality. DL=Detection Limit						

5.2 Potential Contaminants

TERRASAT, Inc. considered potential contaminants that could be introduced to the property as a result of development. Contaminants typically associated with residential development include pesticides and herbicides, automotive wastes, de-icing chemicals, nutrients, and bacteria and viruses.

5.2.1 Pesticides and Herbicides

Pesticides and herbicides are likely to be used in small quantities in residential developments. Pesticide use in Anchorage is even less than other parts of the country because we have fewer pests and a short growing season. Both pesticides and herbicides have an affinity for carbon and, therefore, are not mobile in carbon-rich environments. This reduces their capability for overland flow and soil infiltration. This means that pesticides and herbicides will likely remain in root mass, leaf mass, or within the root zone, where they will be trapped and naturally degraded. In the Lewis and Clark development, large lawns or garden areas are not likely to be created by the new owners as the large lot concept that is planned retains most of the currently existing vegetation and trees. This will

result in even lower amounts of pesticides and herbicides than an average Anchorage home that is located in the bowl area.

5.2.2 Automotive Wastes

Several types of contaminants are commonly associated with automotive waste. These include hydrocarbons (gasoline or diesel fuels, oils, grease etc.), metals (lead, copper zinc, and cadmium), and antifreeze. These contaminants are typically released to driveways and roadways and are transported in storm water. Storm water in this development will be treated using grassy swales and bio-filtering, will follow Best Management Practices, and will follow the Municipality of Anchorage Storm Water Treatment Plan Review Guidance Manual. This type of treatment is common in other Upper Hillside subdivisions, where the Municipality of Anchorage's Municipal Separate Storm Sewer System (MS4) does not reach at this time.

The treated storm water will then be discharged into Rabbit Creek and eventually to Cook Inlet as does all of Anchorage's storm water. Stormwater monitoring in other, higher-density subdivisions within the Municipality of Anchorage show that contaminants from automotive waste seldom if ever reach major conveyances. The amount of automotive waste transported in storm water is expected to be minimal and insignificant.

5.2.3 De-Icing Chemicals

The Municipality of Anchorage uses Magnesium Chloride as an anti-icing and de-icing agent on some roadways in Anchorage. Common de-icing chemicals used by residents on walkways and driveways are sodium chloride and calcium chloride. These chemicals may be applied in small quantities and would be significantly diluted by melting snow and rainwater prior to entering the storm water outflow. Low concentrations of de-icing chemicals will be removed with bio filtration.

5.2.4 Nutrients

Based on the ADEC Guidance Manual for Class A Public Water Systems and the development plan for Lewis and Clark, we determined that the most likely sources for nutrients would be leaking septic systems, lawn fertilizer, and animal waste. The nutrients that could have the greatest impact on water quality are nitrogen and phosphorus. The fate and transport of nitrogen is described in section 5.3.2 below. Phosphorus, and phosphates, complex with calcium in soil and become insoluble, thus they are less mobile than nitrates. Likewise, nutrients will be filtered by soil or used by the lawns and will be taken up by plants or immobilized within the root zone.

5.2.4.1 *Septic Systems*

Although there is little evidence of the water table aquifer being used to supply drinking water in the general area, one does exist throughout the area. Septic

systems and leach fields within the Lewis and Clark subdivision will be installed above the shallow unconsolidated water table aquifer that exists there. The shallow water table aquifer is distinctly different from the confined unconsolidated or confined bedrock aquifers. The shallow water table aquifer is likely recharged in part from bedrock fractures. The shallow water table is not a known source of potable water for the surrounding community. Septic systems within the Lewis and Clark subdivision will use advanced treatment systems. The results are discussed in section 5.3. In summary, the shallow water table will be protected from microorganisms and nitrates.

5.2.4.2 Lawn Fertilizer

The Lewis and Clark development includes large lots that are likely to remain mostly forested with the original vegetation and small lawn space. Because of this, we expect that the nitrate loading to the water table aquifer due to leachate from lawn fertilizer and animal waste will be below laboratory detection limits. The process of fertilizer fate and transport in soil explains why ground water in the Upper Hillside area is not susceptible to nitrate contamination from lawn fertilizer.

The lawn fertilizer often contains a soluble form of nitrogen known urea. Urea is composed of carbon, oxygen, nitrogen and hydrogen. The urea is converted to ammonia and carbon dioxide. Some of the ammonia is lost as gas to the atmosphere. The remaining ammonia is converted to positively charged ions that attach to negatively charged soil grains. Soil bacteria then convert the ions into nitrate through a process called nitrification. The nitrogen, as nitrate, is now in a form that is useable by plants and soil microbes. Four main processes remove nitrogen from the soil. Most nitrogen is bound in organic matter, is used by plants, or is used by bacteria and released to the atmosphere as nitrogen gas. The remaining nitrogen, as nitrate, that escapes the root and humic zones is available to leach through the soil. The amount of nitrate available to leach through the soil is reduced further as some of it is immobilized by organic sources below the root zone. Tight soils that slow or prevent the infiltrations of water also prevent the vertical migration of nitrate to the aquifer.

The minimum uptake of nitrogen by nine common grass species is 125 pounds/acre/year (Croste, 1997). The minimum uptake of nitrogen by the most popular grass seed mix sold by Alaska Mill and Feed (Fescue and bluegrass) has a minimum uptake of 158 pounds/acre/year and an average uptake rate of 211 pounds/acre/year. According to several university extension services, typical nitrate application rates for urban lawn range from 43 to 174 pounds/acre/year. Hillside Lawn and Snow, an Anchorage lawn maintenance company, reported their normal nitrate application rate to be less than 70 pounds/acre/year. Alaska Mill and Feed recommends applying nitrogen at a rate of 194 pounds/acre/year. The average uptake rate is greater than the expected application rate of nitrate in lawn fertilizer for a typical Anchorage lawn. Furthermore, some nitrate will be immobilized by organic matter and some will be denitrified. This suggests that no

nitrate added during lawn fertilization will be able to reach the water table aquifer by leaching through soil in the root zone.

Several researchers have looked at nitrate leaching beneath urban lawns under various conditions. Gold *et al* (1990) looked at nitrate leaching from residential and agricultural land uses. He found that with an application rate of 218 pounds/acre/year only 4% of the applied nitrate leached in the first year of the study. The second year of the study less than 1% leached through the top 8 inches of the soil profile. Geron *et al.* (1993) looked at nitrogen leaching from seeded and sodded turf-grass under different fertilizer programs. Using an application rate of 194.5 pounds/acre/year, he found that in the first year after establishment 26% and 28% leaches from seeded and sodded plots respectively. By the second year of the study, leaching decreased to 3.5% and 11% respectively. He concluded that “the results for the second year are more representative of a stable turf-grass environment”. These studies demonstrate that even exceeding the recommended/average application rate, nitrate leaching from lawn fertilizer decreases rapidly as the sod/roots develop. A judiciously managed phased approach to fertilization during lawn establishment will greatly reduce first year nitrogen leaching.

5.2.5 Effect of Surface Contaminants on Water Supply Aquifers

The above descriptions of surface contaminant fate and transport show that most contaminants will not reach the water table. Lawns and the use of fertilizers are minimal on Anchorage R-6 zoned lots on most of the Upper Hillside. Pesticide and herbicide use on R-6 zoned lots will likely be minimal and completely insignificant. Thus, the limited use of these types of contaminants reduces the risks of water table contamination to nearly zero. Natural vegetation and soil microbes will further protect the upper water table aquifer.

Available well logs and data show that 92 water wells are completed in consolidated rock (bedrock) and twenty-five are completed in unconsolidated (sand and gravel) aquifers. Based on well static water elevations, at least five separate aquifers are being used to supply water to area wells. These do not include the water table aquifer. High static water levels in the surrounding subdivisions suggest the dominant recharge of the water table aquifer is from water migrating upward from rock fractures.

5.3 Nitrate Fate and Transport Modeling

5.3.1 ATS Systems

The Lewis and Clark development plans to use Advanced Treatment Systems (ATS) for the septic systems on all lots. These systems significantly reduce nitrate effluent using a filter media and biodegradation processes. The filter media reduces virus and bacteria outflow by 99% more than conventional systems. The likelihood of leachate migrating offsite is extremely low to non-existent. The

more relevant concern is migration within the Lewis and Clark development, specifically to water well aquifers on downgradient lots.

Nitrates from septic systems, as with other compounds, have distinct migration characteristics depending on the media and physical conditions through which it passes. TERRASAT used analytical mathematical modeling techniques to determine the distances and rates at which nitrates are likely to move through the soils at the proposed sites. Of particular concern are water well distances from nitrate sources. Surface water, such as Rabbit Creek, were also considered in the modeling process.

5.3.2 Nitrate Fate and Transport

TERRASAT evaluated existing percolation test results, surface topography, water well logs, distances to property boundaries, and distances to active drainages. Sixteen water well logs from surrounding subdivisions provided the basis to determine the thickness of the shallow water table aquifer. We created two appropriate mathematical models to evaluate the fate and transport of nitrogen from the proposed advanced nitrate reducing septic systems. We modeled total nitrogen, which includes nitrates. We found that nitrogen, at the local creek, 430 feet away from the nearest lot, would be less than 0.07 mg / liter. This model assumes that no biological processes denitrify the nitrate between the source and the receptor, in this case Rabbit Creek. Denitrification does occur in aquifers, breaking down the nitrate molecule into nitrogen gas and oxygen. Denitrification by heterotrophic bacteria will occur, with published removal rates in excess of 0.01 mg per liter per day and as much as 0.44 m/l per day. Travel time from the nearest leach field to Rabbit Creek is over 112 days. That means at least 1 milligram/liter of nitrogen will be denitrified, converted to nitrogen gas, before it reached the creek. Therefore, we conclude that measurable nitrates will not reach Rabbit Creek from septic systems within the Lewis and Clark subdivision. Appendix B contains the worksheets and results of the nitrate fate and transport model.

TERRASAT concludes that septic nitrate migration to other properties or to Rabbit Creek is highly unlikely, based on modeling results, the use of ATS systems, and taking into consideration the topographic slopes of the Lewis and Clark property.

5.4 Bacteria and Pathogen Removal Modeling

TERRASAT considered the potential migration of five different pathogenic bacteria from a proposed leach field. The bacteria are:

- *E. Coli* bacteria
- *Enterococci* bacteria
- Fecal *streptococci* bacteria
- *Salmonella* bacteria

- *Shingella* bacteria

Bacteria and viruses are primarily removed from ground water by the process of attachment and deactivation, where attachment (think straining) is the dominant process. The Manual of Design for Slow Sand Filtration (1999) states that 97% of coliform bacteria are removed within the first meter (approximately 3 feet) of sand filtration beneath a leach field. More recent studies (Morales, et al, 2014) found removal rates of 99.99% removal of bacteria and 99.99% removal of viruses for drinking water (Predicting Attenuation of Viruses During Percolation in Soils, August, 2002)

These studies suggest that more than 99.99% pathogenic organism are removed from septic leachate before the effluent reaches groundwater. Ignoring the primary attachment process, we calculate that 99% *E. Coli* bacteria that could reach groundwater will be deactivated within 51 feet of the leach field. We conclude that the MOA separation distance of 100 feet from a leach field to a domestic water well is much more than adequate. We also conclude that pathogenic organisms will be deactivated before they can reach a lot boundary.

In conclusion, the MOA separation distance of 100 feet from a leach field to domestic water well is adequate in this subdivision and the local stream is also protected. Most lots are at least 1,000 feet from the stream and the closest lot is more than 430 feet (leach field) to the stream. Appendix B contains the deactivation models for bacteria and pathogens.

6.0 AERIAL PHOTOGRAPHIC EVALUATION OF TERRAIN

TERRASAT evaluated aerial photographs of the area to interpret site drainage and topography.

6.1 Surface Drainage

Surface drainage of the Lewis and Clark parcel is currently overland in an approximate southwestern direction as it moves downgradient toward one of the branches of Rabbit Creek. This was also verified by onsite inspections. A historic segment of Rabbit Creek was discovered that existed along the eastern border area of the parcel. Figure 7 shows this segment. This was verified by investigating older maps and documents and TERRASAT found that this segment was likely changed when Canyon Road was constructed.

6.2 Site Topography

Lewis and Clark subdivision is situated in a low point topographically compared to properties northeast and east of it. Some properties to the northwest lie cross gradient (on the approximate same elevations) as portions of Lewis and Clark. A very small portions of land to the southwest lies downgradient of the property of interest. Finally, while no land is developed in that area, the land directly south of

Lewis and Clark is downgradient of the development. Rabbit Creek prevents surface flow from moving south beyond Rabbit Creek as it accepts any runoff from up-gradient areas.

Figure 5 shows this relationship.

7.0 CONCLUSIONS

TERRASAT was concerned about the sufficiency of groundwater to support the Lewis and Clark subdivision. We were also concerned about what impact water wells would have on the new subdivision and on the surrounding neighboring water wells. We found that more than 10 million gallons per day of groundwater flows through this area of the south Anchorage hillside, far in excess of what the existing community uses. We found that groundwater recharge is from several watersheds south and east of this proposed development. TERRASAT concludes that *recharge* is expected to remain abundant and far in excess of the demands of residential use.

Available water well logs and a statistical analysis show that the community within a half mile of the Lewis and Clark subdivision exploits groundwater from at least five different aquifers. Recharge for these aquifers are up-gradient from the Lewis and Clark subdivision. Therefore, TERRASAT also concludes that, drinking water *quality* is expected to remain unaffected by the new land development.

Based on static water level elevations of the three new wells and water chemistry laboratory results we conclude that at least two bedrock aquifers exist beneath the Lewis and Clark subdivision. Further, based on observations made during the aquifer testing procedures we conclude that partial connectivity exists between the three wells. Wells LCW-2 and LCW-3 exhibit a higher degree of connectivity than does LCW-1 to either of the other two wells.

Test data shows that maximum well yield is in the range of 7.4 gpm to 135 gpm for the three water wells recently completed. Wells in this subdivision are expected to use an average of 0.31 gallons per minute. We predict that the drawdown 200 feet away will be up to 3.08 feet, an insufficient amount to impact the neighboring lots. Recharge is expected to be complete within minutes to several hours after the pumps are off, meaning the small, insignificant impact will only last for several minutes. Therefore, we conclude that impact to wells on adjacent lots will be insignificant.

TERRASAT evaluated the concern that other nearby subdivisions have a significant nitrate problem in their aquifers. Two reports about nitrates exist for this area. Both reports state that nitrate levels are low and are not concerning. TERRASAT evaluated newer data from the Municipality of Anchorage. We found low levels of nitrate exist and conclude that the newer data is consistent with the previous reports. We found that nitrate concentrations increased in some

subdivisions and decreased in others. We further conclude that rates of increase are low and consistent with past information.

TERRASAT also evaluated the vulnerability of Rabbit Creek from development of the subdivision. Several community members expressed concern that nitrates from septic systems could have a negative impact to the water quality of the creek. We conducted mathematical modeling to evaluate the fate and transport of nitrates from proposed septic systems. Specifically, we modeled the septic system that would be closest to the creek. The results show that in a worst-case scenario, nitrate would reach the creek at a concentration of 0.07 milligrams per liter. However, this assumes that no denitrification occurs. Denitrification by heterotrophic bacteria will occur, with published removal rates¹ in excess of 0.01 mg per liter per day and as much as 0.44 mg/l. Travel time from the nearest leach field to Rabbit Creek is over 112 days. That means at least 1 milligram/liter of nitrogen will be denitrified, converted to nitrogen gas, before it reaches the creek. Therefore, we conclude that measurable nitrates will not reach Rabbit Creek from septic systems within the Lewis and Clark subdivision.

TERRASAT investigated the concern of several community members that nitrates from the Lewis and Clark subdivision could impact their water supply. Soils within the Lewis and Clark subdivision will, for the most part, support conventional septic systems. However, as good citizens and protectors of the environment, the developers are proposing to use advanced nitrate reducing septic treatment systems, reducing nitrate output by a factor of three from conventional systems. The ultimate fate of the nitrates after leaving the leach field is that they will ultimately reach the upper water table. In the upper water table, heterotrophic bacteria will denitrify the nitrates into nitrogen gas and nitrous oxide gas. We modeled nitrate migration to the nearest lot line in the water table. Nitrate concentrations will be less than 0.1 mg per liter at the lot boundary, minus the amount removed by denitrification, which could easily be 0.5 mg per liter. TERRASAT concludes therefore that nitrates will not likely reach an adjacent lot.

TERRASAT examined other potential impacts to the environment, such as stormwater runoff towards Rabbit Creek, pesticide use and the existence of wetlands. This low-density land development is expected to protect the natural resources and surrounding communities. We conclude that the preservation of the existing wetlands will allow the distinct existing biological communities to continue their function of treating stormwater and protecting Rabbit Creek water quality.

¹ Morales Parra, Ivan, "Modeling Onsite Wastewater Treatment System Contaminants in Current and Climate Changing Conditions" (2015). *Open Access Dissertations*. Paper 376. pg118.

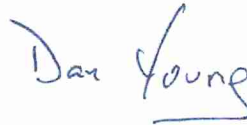
Please contact us at (907) 344-9370 if you have any questions or would like further information.

Prepared By:



Cali Swatlow (for Steven Smith)
Project Environmental Scientist

Approved By:



Dan Young
Principal,
CPG, #7811

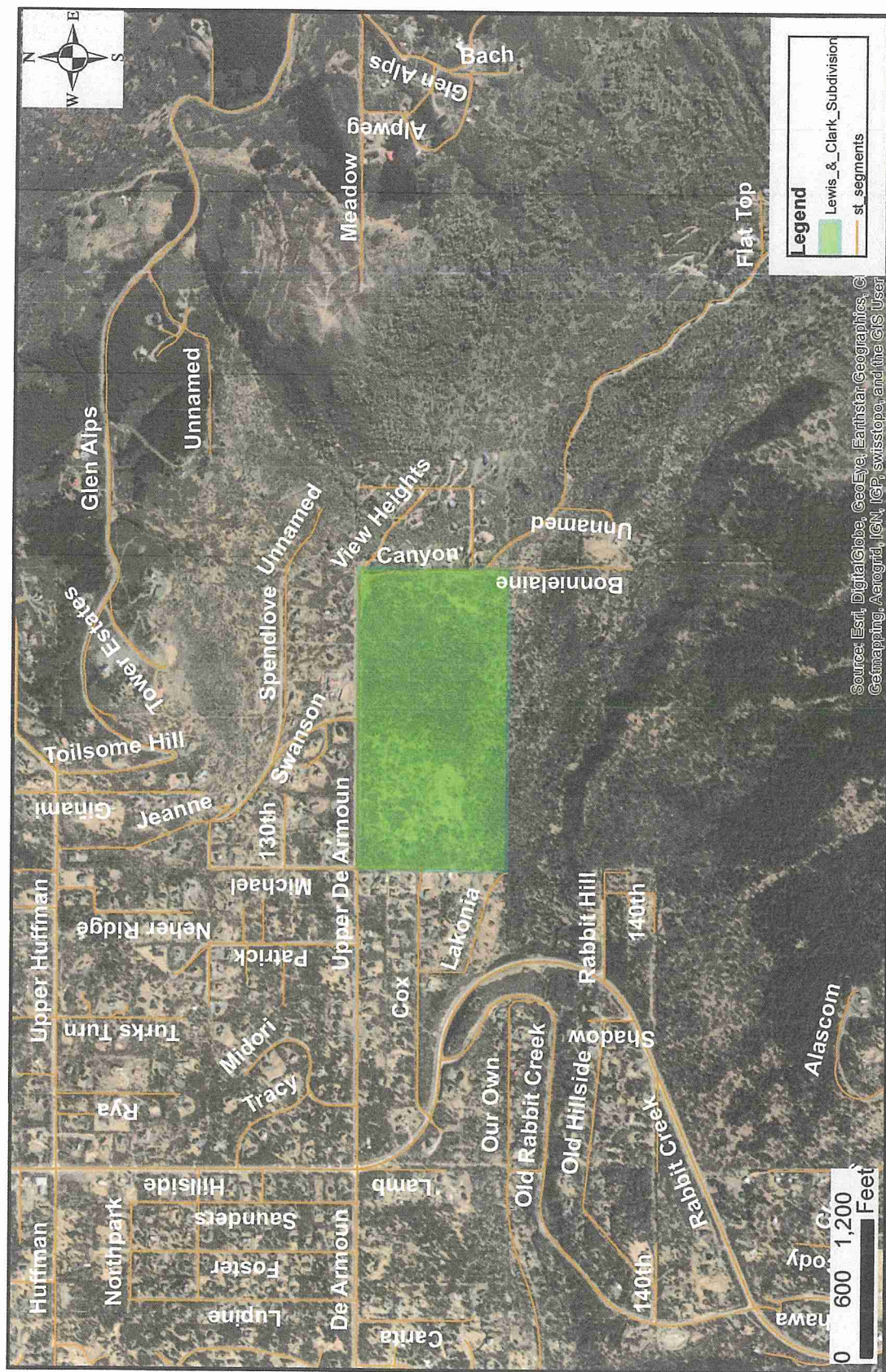


Figure 2
Specific Site Location of Proposed
Lewis and Clark Subdivision

For: Big Country
Enterprises, LLC.

By: Terrasat, Inc.
Date: 4/11/16



Figure 3.
Locations of Area Residential Water Wells Whose Records
Were Used in the Site Evaluation for Lewis and Clark

For: Big Country
Enterprised, LLC.

By: Terrasat, Inc.
Date: 11/4/16

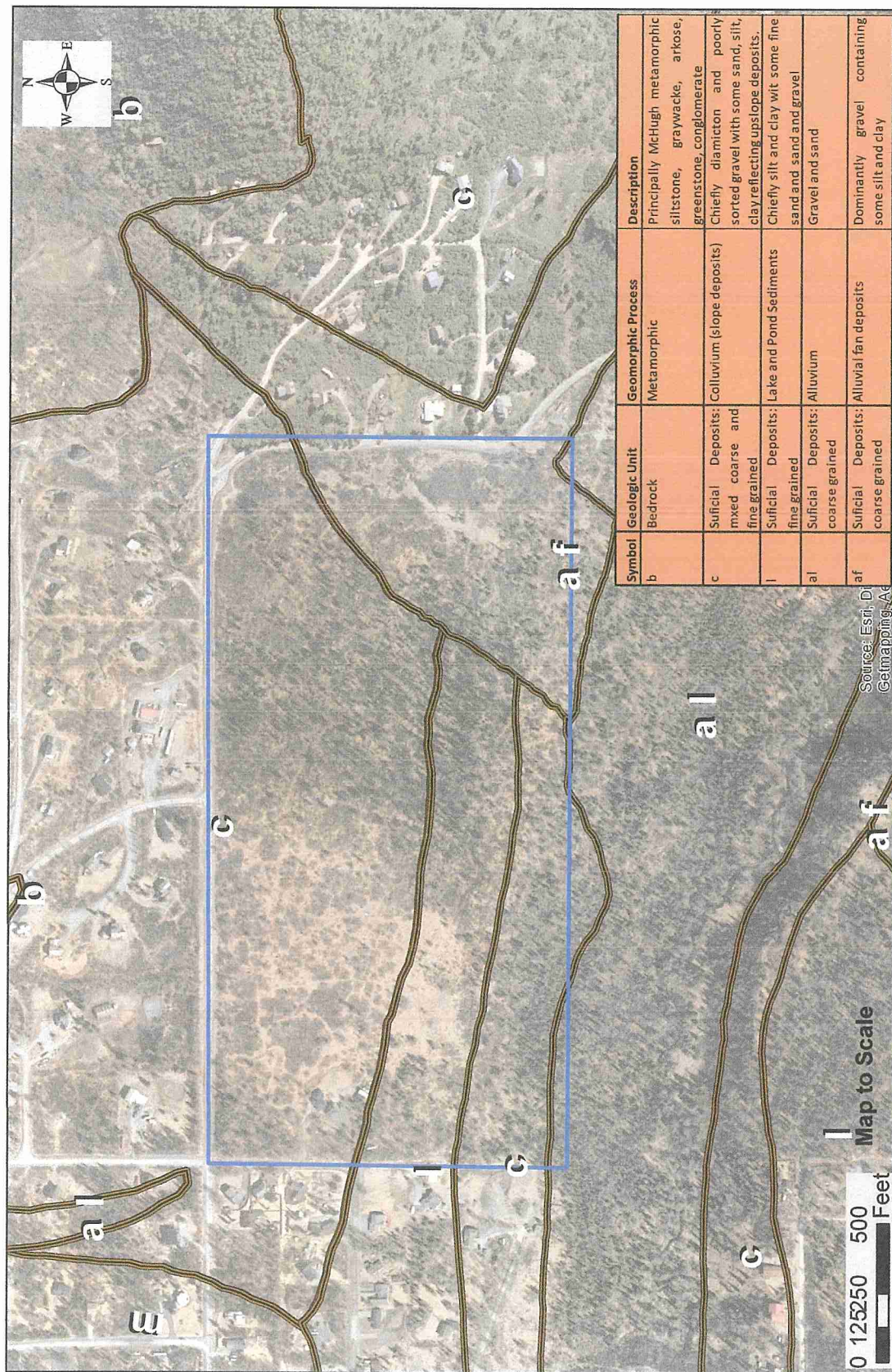


Figure 4

Geology of Proposed Lewis and Clark Subdivision and Surrounding Area

For: Big Country Enterprises, LLC.

**By: SCS
Terrasat, Inc.
Date: 10/11/16**

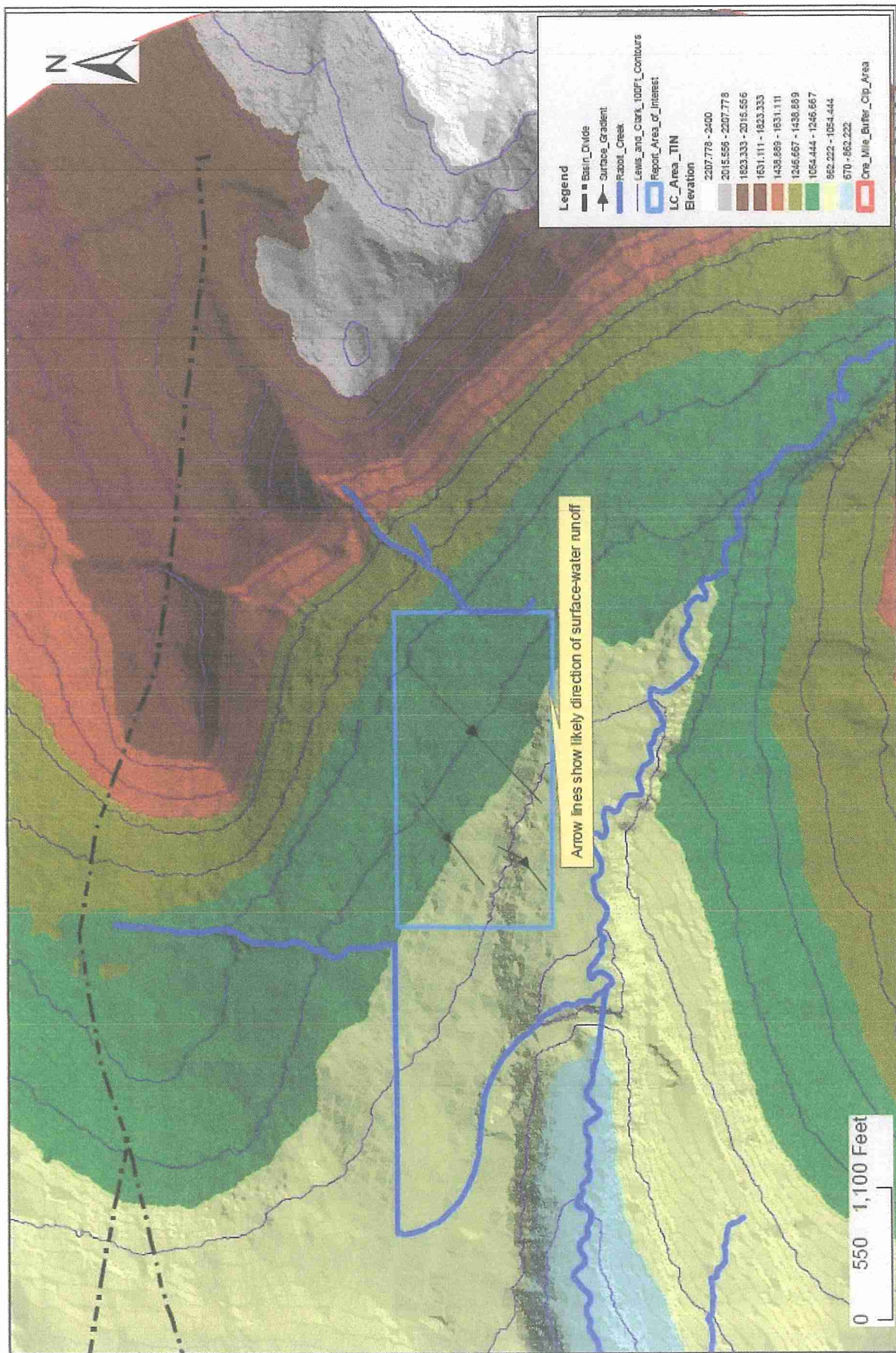


Figure 5

Shaded Relief Topographic Map Showing General Surface Gradient of the Project Area and a Nearby Water Basin Divide

For: Big Country Enterprises, LLC.

By: SCS
Terrasat, Inc.
Date: 10/11/16

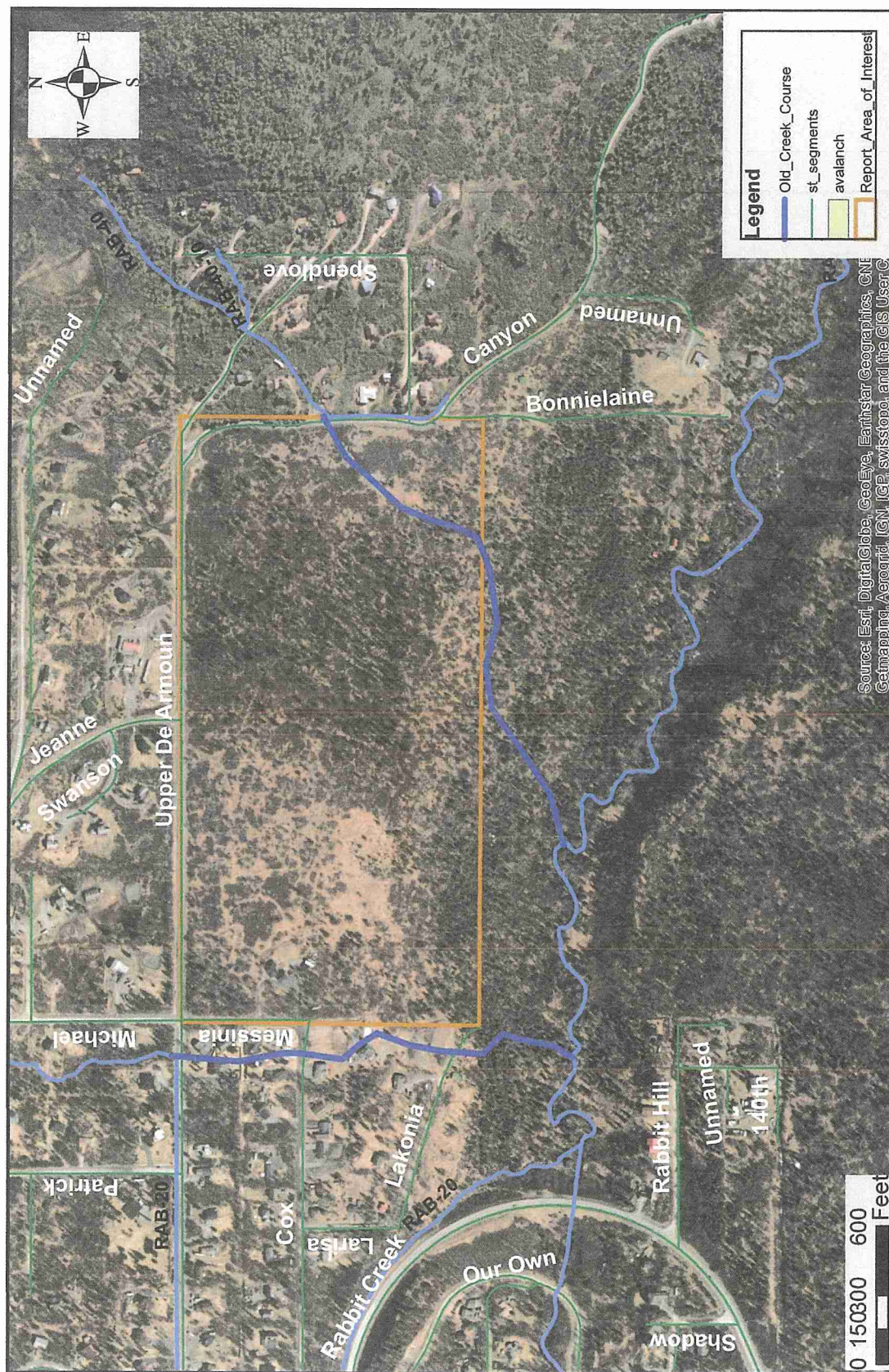


Figure 7

Ancient Channels of Rabbit Creek Through and Adjacent to Lewis and Clark Project Area

For: Big Country Enterprises, LLC.

**By: Terrasat, Inc.
Date: 8/26/2016**

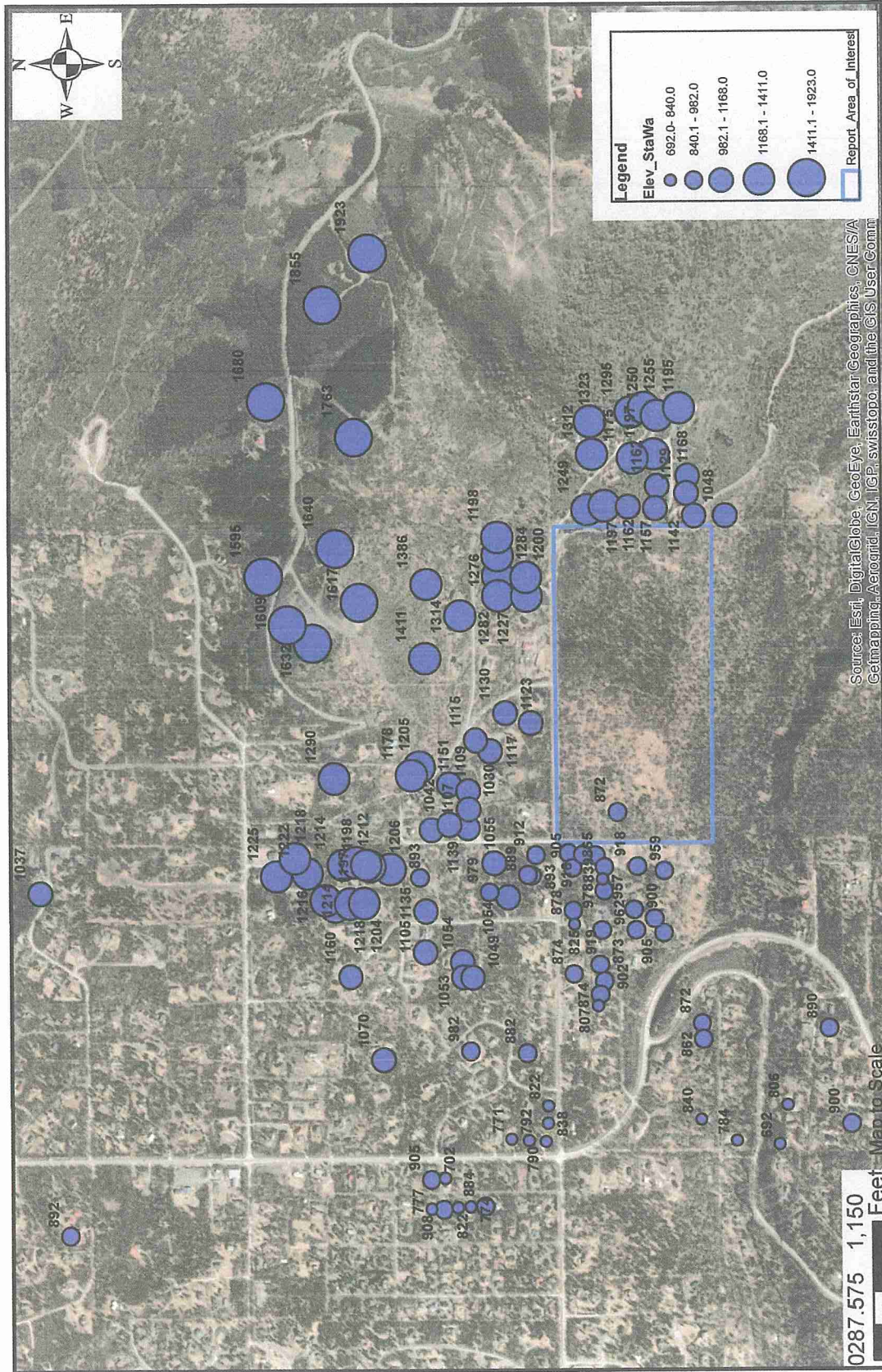


Figure 10
 Static Water Elevations of Private Wells in
 Study Area Showing Evidence of Multiple Aquifers

**For: Big Country
 Enterprises, LLC**

**By: SCS
 Terrasat, Inc.
 Date: 9/29/16**

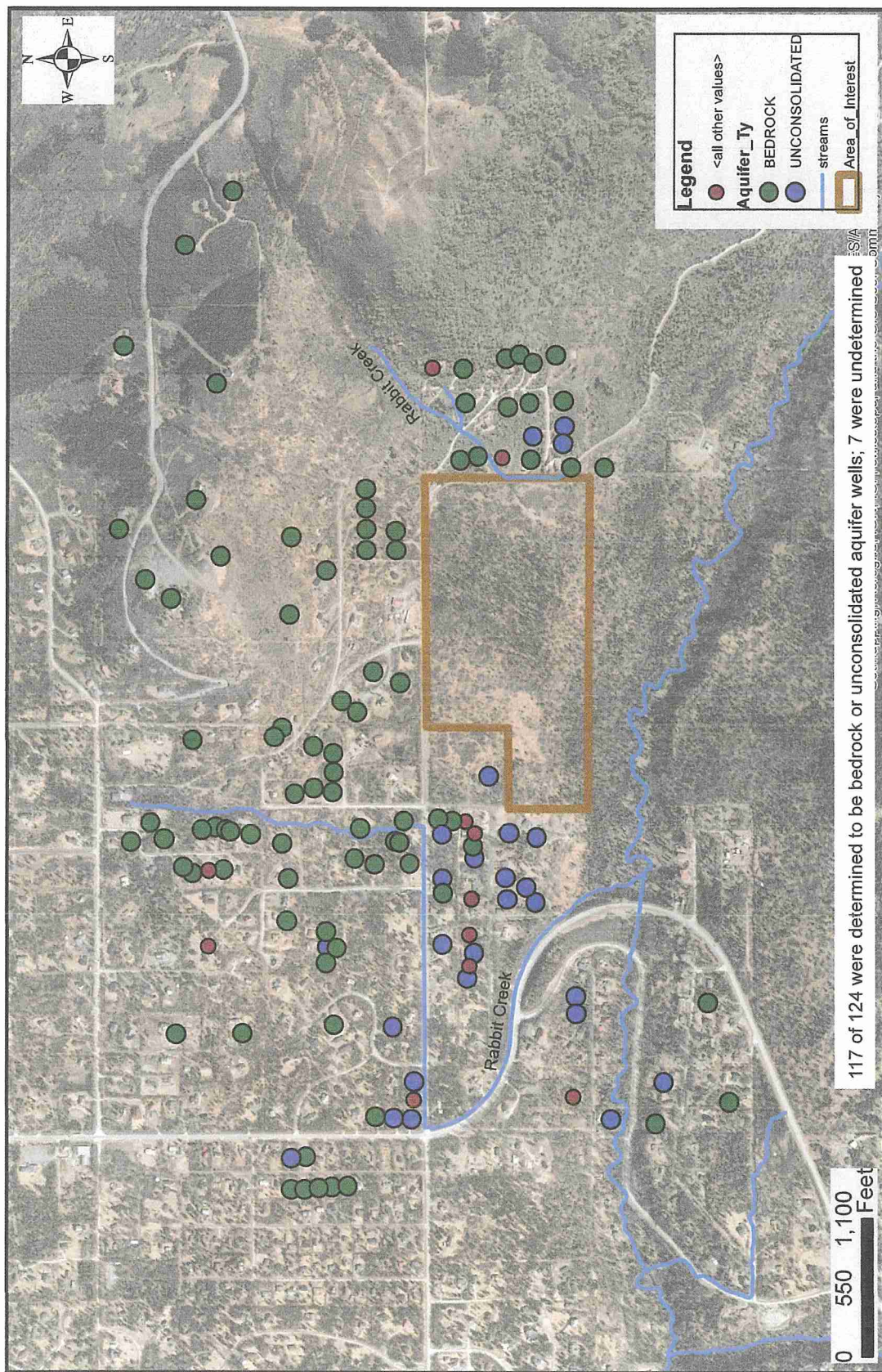


Figure 11

Aquifer Types for Water Wells in Project Area

For: Big Country
Enterprises, LLC.

By: Terrasat, Inc.
Date: 4/7/16

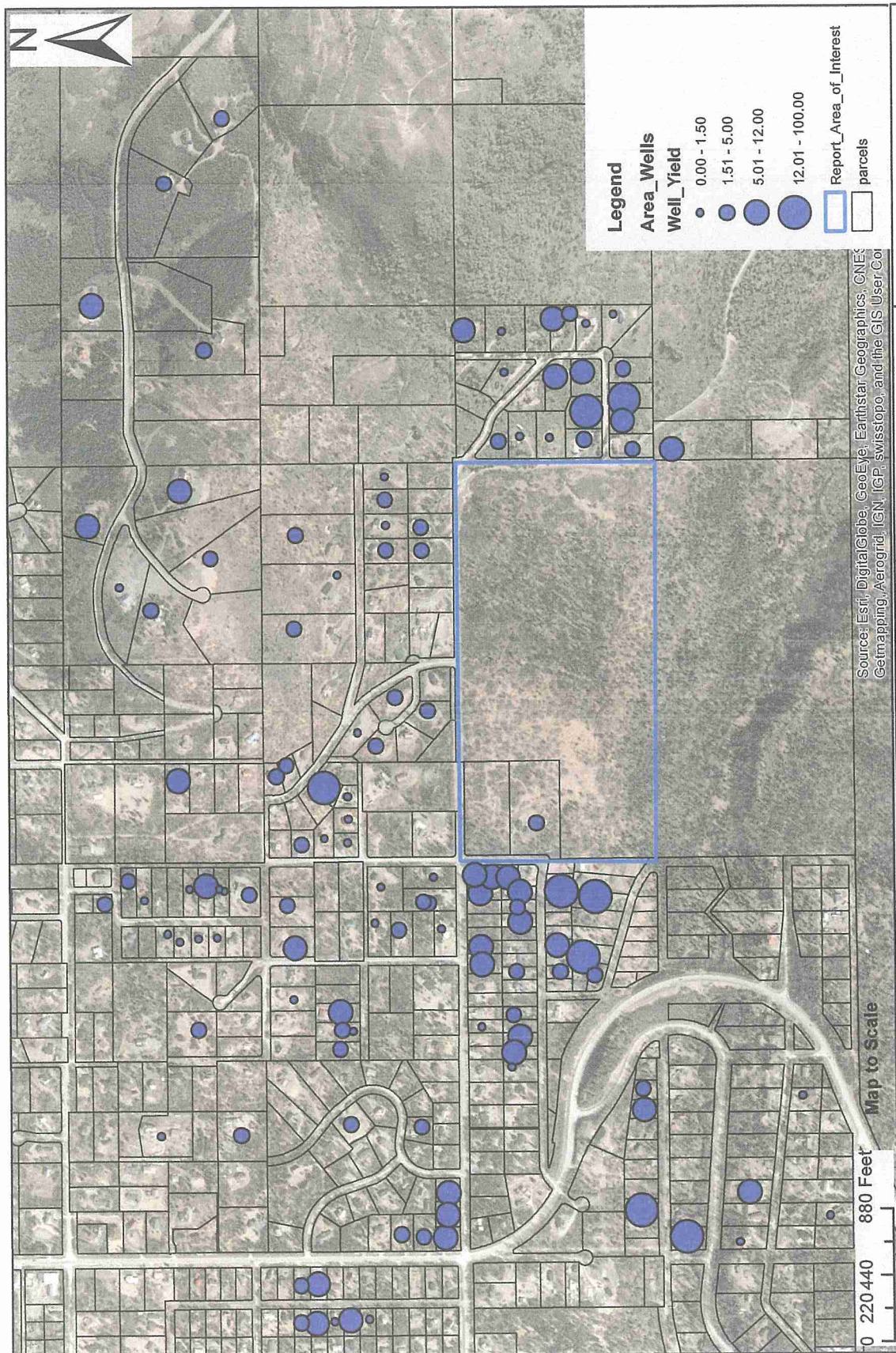
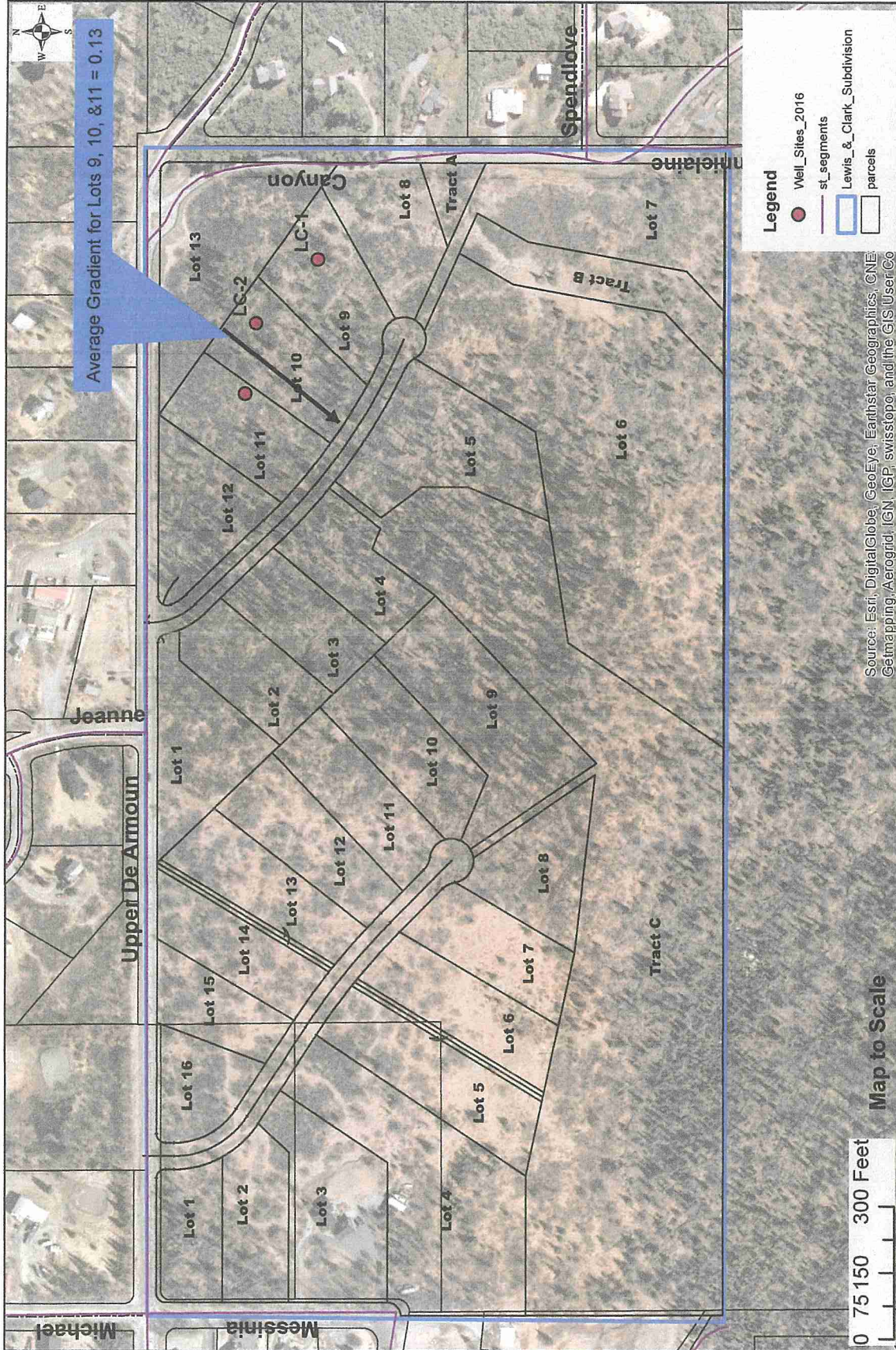


Figure 12
 Well Yields as Reported By Well Driller for
 Residential Wells in Area of Lewis and Clark

For: Big Country
 Enterprises, LLC

By SCS
 Terrasat, Inc.
 Date: 9/21//2016



<p>Figure 13 Proposed Locations of Three Wells and Current Site Lot Plan for Lewis and Clark</p>	<p>For: Big Country Enterprises, LLC.</p>	<p>By: SCS Terrasat, Inc. Date: 10/11/16</p>
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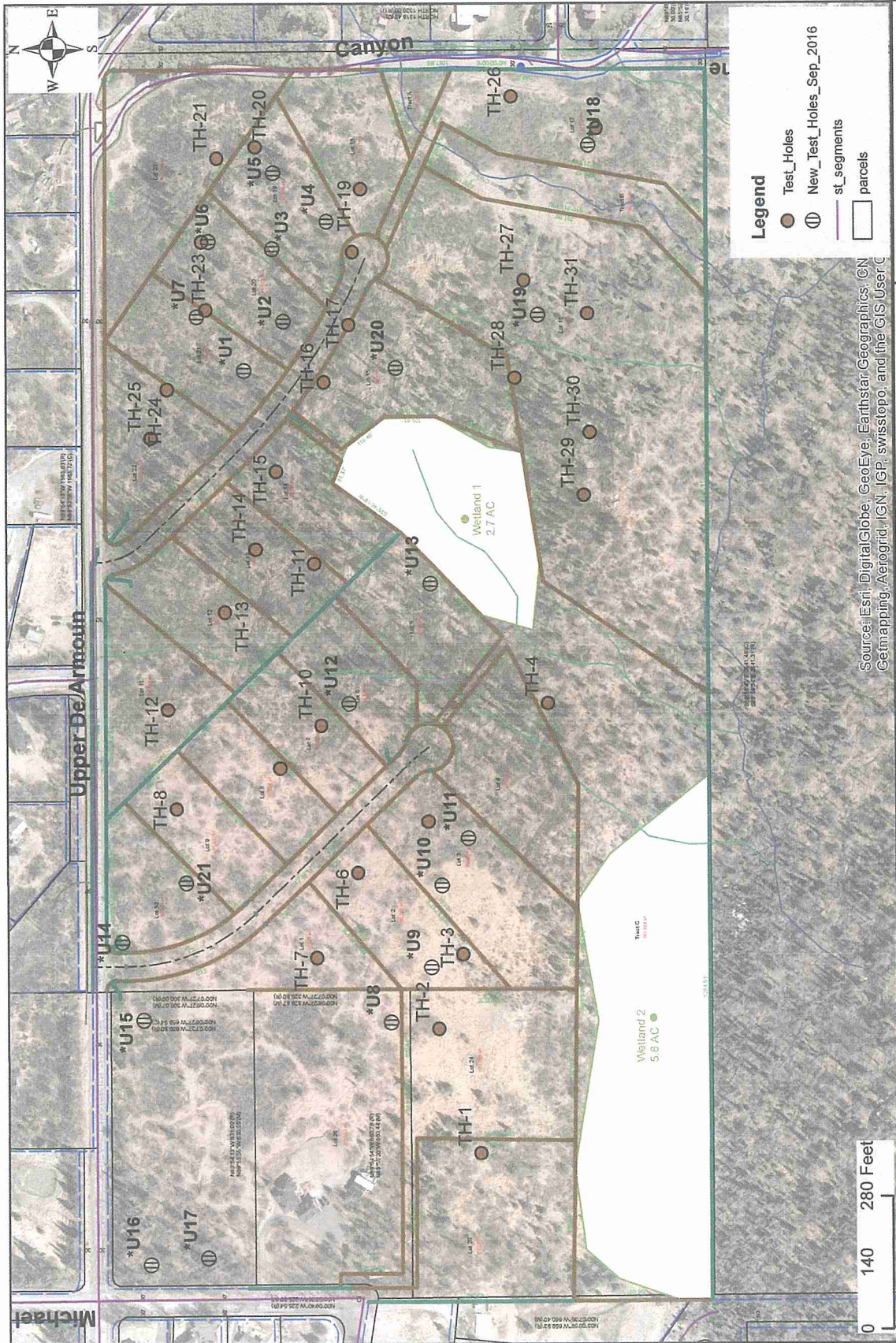


Figure 14
Locations of Percolation Test Holes Used
to Determine Ground Water Levels

For: Big Country
Enterprises, LLC.

By: TERRSAT, Inc.
Date: 9/23/16

APPENDIX A
Residential Well Data

GIS File ID	Well ID/Parcel	Alt ID	Total Depth (bgs)	Static Water Level (ftOC)	Surface Elev	Stickup	Static Water Elev	Well Aquifer	Yield (gpm)	Subdivision - block lot	nitrate *results (mg/L)	Date of results	nitrate *results (mg/L)	Date of results	Indiv well Average	1980	1990	2000	2010	Subd. Average			
107	797	021-011-22	225	32	1130	2	1037	gravel	10	8401 Alpine Acres L3	n/a	8/29/2012	1.79	8/29/2012									
37	31599	017-013-20	195	172	960	2	1680	bedrock and/gravel	9	Alpine Acres L3	1.3	11/14/1998	1.4	8/12/1991	4.8	4/11/2003	2.50	2.3	2.6	3.4	2.6		
17	1012	017-013-20	195	172	960	2	790	bedrock	5.9	Aspen Highlands 1 B119	1.3	10/29/1997	7	1/9/1992	1.2		5.80						
18	2364	017-013-96	120	70	1050	2	982	bedrock	5	Aspen Highlands 1 B216	1.3	11/13/1992	1	8/15/1997	2.67		1.07						
109	1392	017-013-75	150	120	1000	2	882	gravel	5	Aspen Highlands 1 B311	1.3	11/13/1992	1	8/15/1997	2.67		3.42						
115	017-013-21		215	180	970	2	772	and/gravel	3.4	Aspen Highlands B110	1.3	10/10/2012	0.65	10/10/2012									
116	017-013-22		278	201	970	2	771	gravel	3.4	Aspen Highlands B111	1.4	2/4/1992											
117	017-013-18		175	140	960	2	822	gravel	6	Aspen Highlands B117	1.4	7/4/1992											
114	017-013-19		150	124	960	2	838	and/gravel	5.5	Aspen Highlands B118	1.1	12/20/1988	2.35	5/26/1999	2.7	9/26/2000	2.36						
34	24994	021-011-27	245	39	1960	2	1923	bedrock	4	Blue Skies 1 L3	0.975	7/21/2000	0.179	8/13/2011			0.28				0.3		
36	24993		247	37	1890	2	1855	bedrock	3.5	Blue Skies 3 L18-1	0.375	7/14/2010					1.9	3.4	2.1	2.5			
48	25830		507	18	1220	2	1204	bedrock	0.75	Bonnie View L12	n/a												
50	25831		527	18	1230	2	1214	bedrock	1	Bonnie View L13	n/a												
83	017-022-10		415	24	1240	2	1218	bedrock	5	Bonnie View L1	2.99	7/1/1996	1.08	12/8/2002			2.04						
89	017-022-10		342	24	1240	2	1242	bedrock	0.75	Bonnie View L4	0.81	3/30/1992	5.31	4/3/2000	1.56	5/5/2000	2.56						
90	017-022-24		250	28	1240	2	1242	bedrock	1.35	Bonnie View L5	1.9	2/21/1990	2	5/23/1990	0.578	1/27/2010	1.7	7/9/2013	1.54				
94	017-022-11		180	20	1240	2	1242	bedrock	1	Bonnie View L2	n/a												
95	017-022-14		425	38	1230	2	1222	bedrock	0.46	Bonnie View L5	2	1/0/1980	1.83	11/29/2012	2.41	1/22/2015	2.08						
85	017-022-15		440	35	1220	2	1212	bedrock	0.57	Bonnie View L6	5.76	7/4/2000	4.59	6/22/2011			5.18						
3	2489	017-022-15	227	30	1220	2	1197	bedrock	0.5	Bonnie View L7	0.56	4/12/1988											
87	017-022-16		377	14	1210	2	1198	bedrock	0.88	Bonnie View L7	n/a												
88	017-022-39		525	6	1210	2	1206	bedrock	3	Bonnie View L8A	1.4	5/23/2012											
111	14923	015-231-77	70	40	930	2	892	bedrock	9	Breitman L1	n/a												
21	31649		146	64	1110	1112	2	1048	bedrock	12	Canyon Road	n/a											
91	017-013-50		140	39	1090	1062.5	3.5	1054.5	bedrock	3	Engle L1	6	4/21/1994										
92	017-013-48-1		281	173	1060	1062	2	889	bedrock	3	Engle L2	2.41	11/13/2015										
93	017-013-48-2		216	169	1060	1062	2	893	bedrock	2.93	Engle L2	4.43	8/1/2012										
94	017-013-49		204	160	1070	1072	2	912	bedrock	1	Engle L3	n/a											
30	11282	017-401-44	378	19	1140	1142	2	1123	bedrock	4	Fordland View B112	n/a											
28	6884	017-401-44	344	45	1160	1162	2	1117	bedrock	5	Fordland View B114	n/a											
29	7486	017-401-46	172	77	1190	1192	2	1115	bedrock	0.75	Fordland View B115	2.5	7/28/1994	2.46	8/5/2002	2.52							
32	4290	017-401-25	247	14.65	1240	1242	2	1227.35	?	3	Fordland View B116	4.4	9/1/1992										
31	10937	017-401-24	240	52	1250	1252	2	1200	bedrock	3	Gombart L1	3.3	6/17/1987										
73	017-074-28		197	137	1000	1002	2	965	bedrock	6.5	Gredan Hills B110	0.225	4/12/2010										
67	017-074-61		197	128	1030	1032	2	904	bedrock	5.5	Gredan Hills B112	2.2	6/19/2000										
68	017-074-31		326	138	1030	1032	2	894	bedrock	10	Gredan Hills B113	n/a											
69	017-074-32		315	136	1050	1052	2	916	bedrock	10	Gredan Hills B114	0.05	10/16/07	0.05	5/5/2000	0.05							
70	017-074-58		180	127	1030	1032	2	905	gravel	8	Gredan Hills B115	0.05	11/9/2009										
71	017-074-26		62	34	1010	1012	2	978	gravel	8	Gredan Hills B118	1.93	6/9/1996										
72	017-074-64		225	163	1000	1002	2	893	bedrock	1.9	Gredan Hills B212	n/a											
77	11571812		222	80	960	962	2	959	bedrock	20	Gredan Hills B212	n/a											
76	12 B2 Gredan		146	67	970	972	2	905	and/gravel	3	Gredan Hills B2113	n/a											
74	017-073-68		120	84	1000	1002	2	918	and/gravel	20	Gredan Hills B213	n/a											
75	017-073-72		68	35	990	992	2	957	and/gravel	3.9	Gredan Hills B217	4.72	7/18/2014										
58	3671		46	30	990	992	2	962	and/gravel	3	Gredan Hills B219	n/a											
81	017-013-91		330	27	1160	1162	2	1135	bedrock	3	Kemp L1	1.44	6/30/2006	0.05	9/25/2006	0.194	9/9/2011	0.56			3.1	0.7	1.9
82	017-013-92		400	269.5	1160	1162	2	892.5	bedrock	1.85	Kemp L2	3.2	7/20/1994	3	3/19/1996	3.10							
14	1149	017-073-47	60	0	870	872	2	872	and/gravel	4.9	Kimberly Manor 2 B315	0.51	9/10/1997	0.6	8/28/1992	0.919	9/11/2013	0.68			0.7		0.7
98	18	017-073-53	304	185	990	992	2	807	bedrock	0.4	Kimberly Manor 1 B117	n/a											
106	202	017-073-53	24	2	840	842	2	840	gravel	60	Kimberly Manor 2 B31	2.3	9/26/2005										
104	84	017-073-48	61	0	860	862	2	862	gravel	6	Kimberly Manor 2 B31	0.738	11/21/1996										
63	2101E09		300	49	1810	1812	2	1763	bedrock	4	Macora Hills L3	n/a											
95	017-013-67		200	113	1090	1092	2	979	bedrock	1.7	Marin L1	0.1	6/21/1993										
96	017-013-68		260	28	1080	1082	2	1054	bedrock	1.7	Marin L2	5.52	4/1/2002										
97	017-013-70		237	n/a	1050	1052	2	n/a	bedrock	1.3	Marin L4	n/a											
122	017-022-18		246	178	950	952	2	774	and/gravel	4.8	Mountain Park Estates #1	1.7	11/13/1987										
121	017-022-03		76	67	970	972	2	905	and/gravel	6	Mountain Park Estates #1	4.45	4/21/2006	5.7	6/13/2006	5.08				2.4	4.4	3.4	
119	017-022-15		225	175	950	952	2	777	and/gravel	4.8	Mountain Park Estates #1	3.21	2/823/1998	3.56	5/19/1998	3.39							
128	017-022-19		410	68	950	952	2	884	and/gravel	1.1	Mountain Park Estates #2	0.9	10/1/1993	4.4	10/5/2002	2.65							
120	184 Pk1 B214		290	270	970	972	2	702	and/gravel	7	Mountain Park Estates #2	n/a											
119	017-022-16		300	44	950	952	2	908	and/gravel	5.5	Mountain Park Estates #2	3.45	1/12/1995	4.61	6/15/2000	3.93	10/7/2001					4.00	

GIS ID	Well ID/Parcel ID	Alt ID	Total Depth (ft)	Static Water Level (ft)	Surface Elevation (ft)	TOC Elevation (ft)	Static Water elev (ft)	Well Aquifer Type	Yield (gpm)	Subdivision - block lot	nitrate *results (mg/L)	Date of results	nitrate results (mg/L)	Date of results	nitrate *results (mg/L)	Date of results	nitrate results (mg/L)	Date of results	Intiv well	1980	1990	2000	2010	Stand. Average
133	017-022-17		305	130	950	952	2	822	0.4	Mountain Park Estates #1	1.08	12/27/1998	3.55	4/27/2004	4.13	3/16/2006	4.94	11/27/2013	3.43					
2	2688		304	25	1130	1132	2	1107	bedrock	1	0.18									8.4	3.4	5.9		5.9
1	2688		304	25	1130	1132	2	1107	bedrock	1	0.18													
0	2687		245	33	1140	1142	2	1109	bedrock	1	0.18													
57	5751		165	41	1190	1192	2	1151	bedrock	15	0.18													
58	3824		120	100	1140	1142	2	1102	bedrock	4.4	9/12/1992	5.39	6/16/1999											
56	5269		139	104	1280	1282	2	1178	bedrock	5	0.18													
55	5269		139	104	1280	1282	2	1178	bedrock	5	0.18													
6	530		125	87	1190	1192	2	1139	bedrock	5	0.18													
10	710		110	33	1170	1172	2	1139	bedrock	2.4	0.18													
8	711		200	32	1320	1322	2	1290	bedrock	12	0.18													
51	3408		185	16	1070	1072	2	1054	bedrock	3	0.18													
51	3501		67	25	1070	1072	2	1054	bedrock	3	0.18													
54	1458		310	23	1060	1062	2	1049	bedrock	1	0.18													
52	7554		475	n/a	1070	1072	2	4VALUE	bedrock	2	0.18													
4	1340		125	42	1110	1112	2	1070	bedrock	3	0.18													
110	2807	017-072-18	47	8	790	792	2	784	gravel	15	0.18													
105	140	017-072-15	113	76	880	882	2	806	gravel	5.5	0.18													
23	2870	017-072-17	260	150	840	842	2	692	bedrock	1	0.18													
22	1193	017-071-15	340	37	935	937	2	900	bedrock	1	0.18													
35	3227	017-071-23	325	72	960	962	2	890	bedrock	1.5	0.18													
11	27631	021-021-18	126	59	1380	1382	2	1323	bedrock	0.5	0.18													
10	10306	021-021-16	362	37.5	1290	1292	2	1254.5	bedrock	3	0.18													
40	021-021-24		275	3	1250	1252	2	1249	bedrock	3	0.18													
41	021-021-33		325	35	1230	1232	2	1197	bedrock	3	0.18													
47	021-021-30		40	40	1200	1202	2	1162	?	1.3	0.18													
38	31514	021-021-29	106	15	1170	1172	2	1157	bedrock	5	0.18													
24	27595		67	20	1180	1182	2	1162	bedrock	20	0.18													
44	13608		225	87	1260	1262	2	1175	bedrock	6	0.18													
30	29996		208	0	1140	1142	2	1142	bedrock	7.75	0.18													
46	021-021-19		65	n/a	1430	1432	2	4VALUE	n/a	5.84	0.18													
46	021-021-10		45	33	1160	1162	2	1129	and/gravel	5.3	0.18													
33	24164		58	4	1170	1172	2	1168	water table	30	0.18													
35	24014		168	n/a	1190	1192	2	4VALUE	bedrock	1.4	0.18													
47	24015		386	46.8	1240	1242	2	1195.2	bedrock	1	0.18													
45	021-021-15		73	22	1270	1272	2	1250	bedrock	0.8	0.18													
9	676	021-021-16-2	175	37	1330	1332	2	1295	bedrock	5.6	0.18													
63	017-401-52		165	10	1290	1292	2	1287	bedrock	1.75	0.18													
64	017-401-51		160	18	1300	1302	2	1284	bedrock	1.1	0.18													
65	017-401-54		345	36	1310	1312	2	1276	bedrock	2	0.18													
66	017-401-55		445	134	1330	1332	2	1198	bedrock	1	0.18													
39	021-021-21		40		1310	1312	2	1312	bedrock	0.33	0.18													
108	1115	017-422-30	207	42	1200	1202	2	1160	gravel	X 2 est	0.05													
7	533	017-422-09	49	17	1240	1242	2	1225	bedrock	2.5	0.18													
13	2872	017-401-35	250	11	1420	1422	2	1411	bedrock	4.5	0.18													
12	1048	017-401-37	350	86	1470	1472	2	1386	bedrock	2	0.18													
25	14435	017-401-38	455	38	1350	1352	2	1314	bedrock	1	0.18													
5	151	017-013-88	400	37	1140	1142	2	1105	bedrock	0.3	0.18													
60	10861	017-073-42	168	154	1030	1032	2	878	gravel	10	0.18													
59	75	017-073-16	150	90	990	992	2	902	gravel	7	0.18													
99	017-073-17		141	118	990	992	2	874	bedrock	5.7	0.18													
102	017-074-59		275	197	1020	1022	2	825	bedrock	6.36	0.18													
103	017-074-61		180	128	1000	1002	2	874	bedrock	1.2	0.18													
100	017-074-41	7544	106	78	990	992	2	919	bedrock	2.5	0.18													
101	017-073-11		155	129	1010	1012	2	872	bedrock	2.4	0.18													
28	3003	017-411-31	387	102	1740	1742	2	1640	bedrock	6	0.18													
78	017-411-31		128	17	1610	1612	2	1595	bedrock	16	0.18													
79	017-411-26		205	43	1650	1652	2	1609	bedrock	1.4	0.18													
79	017-411-27		204	40	1670	1672	2	1632	bedrock	3.5	0.18													
80	017-411-29		600	105	1720	1722	2	1617	bedrock	3.2	0.18													
113	017-074-060		230	160	1090	1092	2	872	and/gravel	5	0.18													
19	7587	017-421-32	730	n/a	1120	1122	2	4VALUE	bedrock	1	0.18													

* for non-detect results (ND) a value of 0.05 is used, which is 1/2 of the PQL or LOQ for most Alaska laboratories for this test.

APPENDIX B

Nitrogen and Bacteria Fate and Transport Models

Lewis and Clark Subdivision-- Nitrogen Migration in Water Table from a Sanitary Leach Field that is Designed to Serve a Single Family House

Three Dimensional Mass Solute Analytical Solution

Introduction

Mass solute can be modeled with 1-, 2-, and 3-dimensional analytical groundwater models, as well as with a mass balance equation. Numerical models are much more complex and are used when multiple sources, multiple sinks and variable site conditions exist. Numerical models are appropriate when much more information is available, such as the horizontal and vertical distribution of hydraulic conductivities and porosity. This information is seldom known across the domain of a leach field to a down gradient receptor in Alaska.

We choose a 3-dimensional analytical model because it provides a good understanding of what occurs down gradient of a leach field. Analytical models have proven to be powerful tools to evaluate solute transport and are abundant in the hydrogeological literature. The 3-D model considers longitudinal dispersion, transverse dispersion and vertical dispersion, three important transport processes that are only approximately accounted for in a mass balance model.

This 3-dimensional analytical model ignores molecular diffusion because diffusion is so small compared with mechanical dispersion in a flowing aquifer that diffusion becomes trivial. This 3-D model ignores precipitation entering the aquifer. Precipitation in South Central Alaska is small enough, over the model domain (<8% of recharge), that it will not significantly influence the final concentration at the compliance point.

This 3-D model considers aquifer thickness and appropriately restricts vertical dispersion to the maximum depth of the aquifer.

Nitrate is biodegradable as it migrates down gradient from its source. Biodegradation rates are not available so the process is eliminated from this model. The results are likely biased high at the compliance point, meaning the actual results will be lower than shown.

Assumptions

The aquifer is uniform thickness. This is a limitation of the analytical model. We therefore assume that the aquifer is uniformly 12.7 feet thick, based on the average of 19 local water well logs. The aquifer could be as thick as 24 feet in places, which means significant dilution will likely occur before water reaches the compliance point. We selected 12.7 feet thick because the mean is likely the most representative value to represent site conditions, based on available water well logs from adjacent subdivisions.

We assume that the aquifer is infinite laterally and down gradient. This is likely true, within the domain of the model. Water well logs from surrounding subdivisions support this assumption.

We assume that mechanical dispersion is much greater than molecular diffusion. We assume molecular diffusion is trivial in this model and is therefore omitted. This is a safe assumption when hydraulic conductivities are moderate or higher. If molecular diffusion was significant, the final concentration at the compliance point would be decreased.

We assume that nitrogen, as it migrates, does not react with minerals or elements in the aquifer. This assumption is likely valid for nitrogen, as most models with nitrogen assume nitrogen travels at the same rate of groundwater flow.

We assume sorption does not occur for nitrogen. Nitrogen is generally known as a conservative solute, traveling at the same velocity as groundwater. If conditions exist where nitrogen does adsorb to soil particles, these models would predict higher concentrations at the compliance point than are actually likely to occur.

We assume that we have a continuous flow of both groundwater and nitrogen input from the source. Even though nitrogen is episodically discharged throughout a day, an average value is sufficient to evaluate the hydrogeologic model.

Lastly, for the Lewis and Clark Subdivision, we assume nitrates and septic effluent will likely not reach the water table, because most of the 30 plus test pits show an aquitard exists above the water table, causing effluent to remain perched.

Inputs

Source conditions	
$C_0 := 15.6 \cdot \frac{mg}{L}$	Nitrogen concentration beneath septic adsorption bed, effluent. This is a weighted average from 117 advantex sites independently tested and reported in the Advantex literature.
$R := 1.$	Retardation, 1 for no retardation
$Y := 30 \cdot ft$	Width of leach field above aquifer
$Z := 1 \cdot ft$	Depth of leachate penetration into top of aquifer, likely <1 foot
Receptor	
$x := 430 \cdot ft$	Distance to receptor, lot closest to creek
$t := 1.1 \cdot yr$	Time since source began leaching into aquifer
Aquifer conditions	
$i := 0.13$	hydraulic gradient (measured from MOA 10-foot contour data of land surface, the average slope of 23 lots)
$k := 0.003 \cdot \frac{cm}{s} = 8.5 \cdot \frac{ft}{day}$	hydraulic conductivity (based on percolation tests results)

$$\eta_e := 0.3$$

Effective porosity (assumed, text book range for sand)

$$b := 12.7 \cdot ft$$

aquifer thickness (minimum, based on existing water well logs)

$$v := \frac{k \cdot i}{\eta_e} = 3.685 \frac{ft}{day}$$

Aquifer velocity

$$\alpha_x := 0.1 \cdot x$$

Longitudinal dispersivity, parallel to x-axis, Gelhar *et al.* 1992

$$\alpha_y := .1 \cdot \alpha_x = 4.3 \cdot ft$$

Transverse dispersivity, perpendicular to x-axis, typically 10% of longitudinal dispersivity

$$\alpha_z := .025 \cdot \alpha_x = 1.08 \cdot ft$$

Vertical dispersivity, typically 10% of transverse dispersivity

Function Definitions

$$y := 1 \cdot ft$$

offset from x axis at downgradient compliance point

$$z := 1 \cdot ft$$

vertical offset from x axis at downgradient compliance point

$$x' := \frac{(b - Z)^2}{\alpha_z}$$

x' is used in the Z component to limit vertical dispersion to the thickness of the aquifer

$$y_{component} := \operatorname{erf} \left(\frac{y + \frac{Y}{2}}{4 \cdot (\alpha_y \cdot x)^{0.5}} \right) - \operatorname{erf} \left(\frac{y - \frac{Y}{2}}{4 \cdot (\alpha_y \cdot x)^{0.5}} \right)$$

$$Z_{component} := \operatorname{erf} \left(\frac{z + Z}{2 \cdot (\alpha_z \cdot x')^{0.5}} \right) - \operatorname{erf} \left(\frac{z - Z}{2 \cdot (\alpha_z \cdot x')^{0.5}} \right)$$

$$t := 10 \cdot yr$$

This is a guess value for time to reach steady state

$$\beta := -2$$

when $\beta = -2$ concentration is at steady state conditions

$$\beta = \frac{x - \frac{v \cdot t}{R}}{2 \cdot \left(\alpha_x \cdot \frac{v \cdot t}{R} \right)^{0.5}}$$

$$steady_state_time := \operatorname{find}(t) = 1.05 \cdot yr$$

Solve for time to reach steady state concentrations at distance from source $x = 430 \cdot ft$

$$\beta := \frac{x - \frac{v \cdot t}{R}}{2 \cdot \left(\alpha_x \cdot \frac{v \cdot t}{R} \right)^{0.5}} = -2.082$$

When $\beta < -2$, aquifer is at steady state conditions at $x = 430 \cdot ft$ from source

Analysis

$$x := 430 \cdot ft$$

$$y = 1 \cdot ft$$

$$z = 1 \cdot ft$$

$$t := steady_{state_time} = 1.05 \cdot yr$$

$$C_{xyzl} := \frac{C_0}{8} \cdot \operatorname{erfc} \left(\frac{x - v \cdot t}{2 \cdot (\alpha_x \cdot v \cdot t)^{0.5}} \right) \cdot y_{component} \cdot Z_{component}$$

Results

$$C_{xyzl} = 0.07 \frac{mg}{l}$$

Maximum nitrogen concentration in aquifer at $x = 430 \cdot ft$ from source and aquifer has reached steady state concentrations.

Conclusions

This three-dimensional analytical mass transport equation is an appropriate model to evaluate leachate in a septic system drainfield with essentially continuous source release. The model is widely used and accepted throughout the groundwater industry. The model assumes groundwater velocity in one direction with mechanical dispersion down gradient, transverse to the gradient, and vertical to the flow direction.

Results from these evaluations show that after the flow field reaches steady state, the highest concentration directly down gradient at $x = 430 \cdot ft$ will be $C_{xyzl} = 0.07 \frac{mg}{l}$.

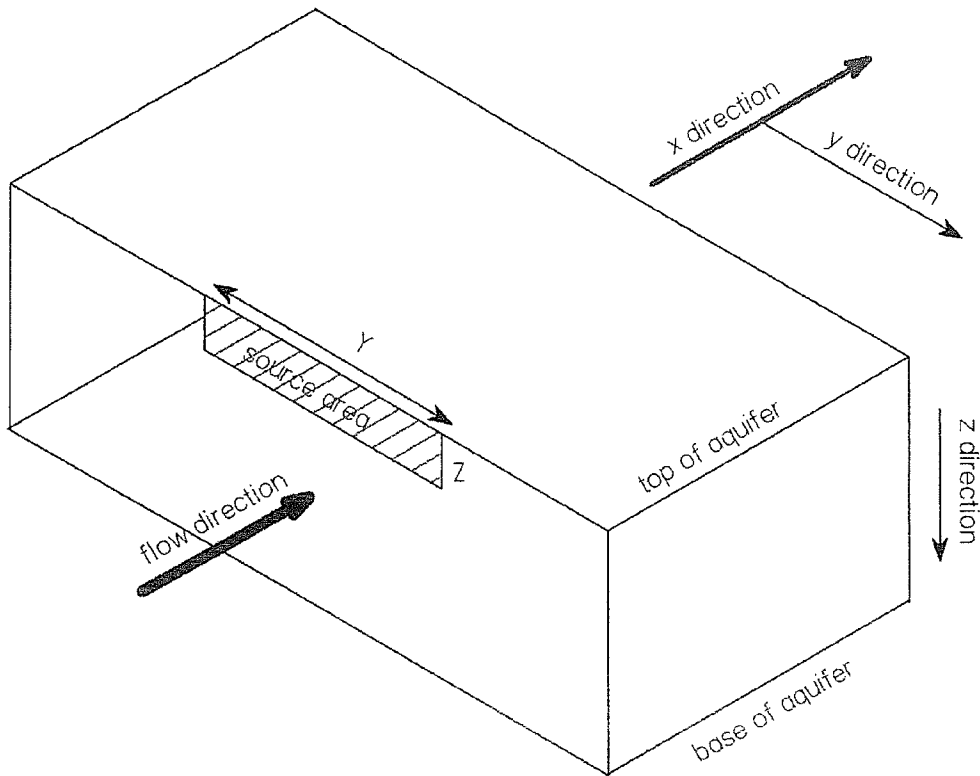
Sources:

Domenico, P., and Schwartz, F., 1990, Physical and Chemical Hydrogeology, John Wiley and Sons, Inc. 504 pps.

Domenico, P.A., and Robbins, G.A., 1985, A New Method of Contaminant Plume Analysis, Ground Water, Vol 23.

Alvarez, J.J. and Illman, W.A., 2006. Bioremediation and Natural Attenuation, John Wiley and Sons, Inc., p. 177.

Mass Transport Conceptual Model



Additional resources:

Devlin, J.F., *et al.*, 2012, Using the Domenico Solution to Teach Contaminant Transport Modeling, *Journal of Geoscience Education*, vol 690, pps 123-132. "The Domenico solution is a heuristically derived equation that closely approximates rigorous solutions to the advection dispersion equation under conditions that are representative of real world plumes" (page 132 in conclusions).

Gelhar, L.W. *et al.*, 1992, A Critical Review of Data on Field-scale Dispersion in Aquifers. *Water Resources Research* 28(7):1955-1974. Dispersivity values are calculated with Gelhar *et al.* methods.

Tong, W. and Rong, Y., 1999, Domenico Spreadsheet Analytical Model Manual, Underground Storage Tank Section California Regional Water Quality Control Board - Los Angeles Region, 17p.

Pennsylvania Department of Environmental Protection, 2014, User's Manual for the Quick Domenico Groundwater Fate-and-Transport Model. 30 p.

Deactivation of Pathogenic Organisms

$N_1 := 1$	Final number of colonies or viruses at specified distance from leach field
$N_2 := 10000$	Number of initial colonies or viruses
$\log_{reduction} := \log\left(\frac{N_2}{N_1}\right) = 4$	log reduction in bacteria or viruses
$\tau = \frac{t}{\log\left(\frac{N_2}{N_1}\right)}$	τ is the inactivation rate, t is time to deactivate with $\log_{reduction} = 4$
$t = \tau \cdot \log_{reduction}$	Rearrange and solve for t = time to deactivate
Average days to achieve 90% deactivation for groundwater less than 59 degrees F.	Time to achieve deactivation for $\log_{reduction} = 4$
$\tau_{Coliform_bacteria} := 6.6 \cdot day$	$t_{coliform} := \tau_{Coliform_bacteria} \cdot \log_{reduction} = 26.4 \cdot day$
$\tau_{Enterocci_bacteria} := 3.5 \cdot day$	$t := \tau_{Enterocci_bacteria} \cdot \log_{reduction} = 14 \cdot day$
$\tau_{Fecal_streptococci} := 3.5 \cdot day$	$t := \tau_{Fecal_streptococci} \cdot \log_{reduction} = 14 \cdot day$
$\tau_{Salmonella} := 2.0 \cdot day$	$t := \tau_{Salmonella} \cdot \log_{reduction} = 8 \cdot day$
$\tau_{Shigella} := 3.5 \cdot day$	$t := \tau_{Shigella} \cdot \log_{reduction} = 14 \cdot day$
Seepage Velocity is $V_s = k \cdot i / \phi$	k is hydraulic conductivity
$\phi := .28$	Porosity
$k := 8.3 \cdot \frac{ft}{day}$	Hydraulic conductivity
$i := 0.13$	gradient measured from source to receptor
$v_s := \frac{k \cdot i}{\phi} = 3.9 \cdot \frac{ft}{day}$	Seepage velocity
$t_{coliform} \cdot v_s = 102 \cdot ft$	Distance from leachfield to inactivation, assuming that bacteria travels as fast as the seepage velocity. Coliform bacteria form slime colonies and can only travel as fast as the colony can grow downgradient.

Pyne, David, 2005, Aquifer Storage Recovery, 2nd Ed., p 272, ASR Systems, LLC.

Maliva, R., and Missimer, T., 2010, Aquifer Storage and Recovery and managed Aquifer Recharge Using Wells: Planning, Hydrogeology, Design and Operation, Pg. 385. Published by Schlumberger Marketing Communications.

APPENDIX C
High Water Site
Measurements

Date	8/17/16	8/25/16	9/1/16	9/9/16	9/16/16	9/23/16	9/30/16	10/7/16	10/14/16	10/21/16	10/28/16	DEPTH
TH-1	8.9	8.16	D	8.25	8.32	8.23	8.65	8.98	9.40	9.40	9.43	9.80
TH-2	D	D	D	D	D	6.23	D	D	D	D	D	6.85
TH-3	D	D	D	D	D	D	D	D	D	D	D	4.80
TH-4	D	D	D	D	D	6.44	7.20	8.20	9.75	B	D	11.60
TH-5	D	D	D	17.74	16.92	13.40	13.45	13.05	13.42	17.19	D	17.80
TH-6	D	D	D	D	D	D	D	D	D	D	D	18.95
TH-7	D	D	D	D	D	D	D	D	D	D	D	13.55
TH-8	D	D	NA	D	D	D	D	D	D	D	D	12.30
TH-9	D	D	D	D	D	D	D	D	D	D	D	16.00
TH-10	D	D	D	D	D	D	D	D	D	D	D	18.05
TH-11	17.45	D	D	14.70	13.22	12.29	14.32	11.60	10.66	12.34	12.90	17.80
TH-12	D	D	D	D	D	D	D	D	D	D	D	16.85
TH-13	D	D	D	D	D	D	D	D	D	D	D	16.20
TH-14	13.62	12.51	14.55	12.80	13.17	10.52	9.92	11.00	12.45	14.02	15.70	17.35
TH-15	16.1	15.07	15.40	15.00	15.40	15.01	15.57	16.24	16.37	16.38	D	17.20
TH-16	D	D	NA	D	D	D	D	14.80	14.48	16.10	D	17.30
TH-17	D	D	D	D	D	D	D	18.16	16.75	17.86	18.91	19.25
TH-18	D	D	D	D	D	D	D	D	D	D	D	14.00
TH-19	D	D	D	D	15.73	14.94	15.29	15.60	15.81	16.28	D	15.20
TH-20	8.15	8.09	8.24	8.10	7.77	7.10	6.90	6.90	7.03	7.24	7.65	13.57
TH-21	9.85	10.05	9.92	10.00	9.47	9.02	8.50	8.62	8.52	9.00	9.46	13.85
TH-22	D	D	D	D	D	D	D	D	D	D	D	14.85
TH-23	D	D	D	D	D	D	D	D	D	D	D	17.60
TH-24	15.3	15.65	15.43	15.65	15.15	14.80	14.51	14.95	14.64	15.38	15.95	19.60
**TH-25	6.17	5.96	6.26	5.55	P	P	P	P	P	P	P	15.00
TH-26	D	D	D	D	D	D	D	18.57	D	D	18.25	18.70
TH-27	D	D	D	D	D	D	D	D	D	D	D	19.15
TH-28	D	D	D	D	10.30	7.82	7.91	10.00	D	D	D	15.10
TH-29	D	D	D	D	D	D	D	D	D	D	D	18.25 (*4.25)
TH-30	D	D	D	D	D	D	D	D	D	D	D	14.50
TH-31	D	D	D	D	D	10.37	10.77	11.11	D	11.50	11.78	11.75
TH-32	D	D	D	D	D	D	D	D	D	D	14.50	18.25
TH-UNK-1	D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.70

Date	8/17/16	8/25/16	9/1/16	9/9/16	9/16/16	9/23/16	9/30/16	10/7/16	10/14/16	10/21/16	10/28/16	DEPTH
TH-UNK-2	D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	18.25
TH-UNK-3	D	NA	D	D	D	D	D	D	D	D	D	17.55
TH-UNK-4	12.5	NA	12.55	12.75	12.15	11.80	11.27	11.13	11.08	11.50	D	14.80
TH-UNK-5	12.27	NA	12.15	12.15	10.80	8.30	9.28	9.70	B	B	B	15.70
U-1					NA	NA	D	D	D	D	D	16.66
U-2					NA	NA	D	D	13.40	13.30	D	14.77
U-3					D	D	D	D	D	D	D	20.10
U-4					D	D	D	D	D	D	D	20.20
U-5					NI	NI	NI	NI	NI	NI	NI	NA
U-6					NI	NI	NI	NI	NI	NI	NI	NA
U-7					NI	NI	NI	NI	NI	NI	NI	NA
U-8					NA	D	***13.63	13.36	13.15	13.14	13.30	4(13.77 ON 9/30)
U-9					NA	D	15.05	D	D	D	D	15.50
U-10					NA	D	13.16	12.42	11.95	11.70	11.93	14.90
U-11					NA	D	D	10.33	9.37	9.70	9.75	10.07
U-12					NA	5.45	6.55	8.55	D	D	D	10.20
U-13					NA	NA	P	P	P	7.30	7.34	14.70
U-14					NA	NA	D	D	D	D	D	15.00
U-15					NA	NA	D	D	D	D	D	14.87
U-16					NA	D	D	D	D	D	D	15.05
U-17					NA	D	D	D	D	D	D	15.10
U-18					D	D	D	D	D	D	D	15.10
U-19					D	NA	14.83	D	14.67	D	D	14.96
U-20					NA	D	6.05	5.75	5.71	6.00	6.17	14.70
U-21					NA	D	D	D	D	D	D	10.30
U New-1									D	D	D	10.85
U New-2									D	D	D	15.05
U New-3									D	D	D	14.00

APPENDIX D

Well Logs

TERRASAT, INC. 4203 Iowa Drive Anchorage, AK			PROJECT:		BORING ID:	
			21607		LCW-1	
			LOCATION:		WELL ID:	
			Anchorage, Alaska		LCW-1	
			DRILLING CONTRACTOR:		NORTHING:	EASTING:
			M-W Drilling for TERRASAT, Inc.		2594227	1690709
DRILLING EQUIPMENT:			GROUND SURFACE ELEV.:		TOC ELEVATION:	
Acker			1172		1174	
DRILLING METHOD:			TOTAL DEPTH:		DEPTH TO WATER:	
Air Rotary			375		21	
LOGGED BY:			SAMPLING METHOD:		DATE STARTED:	
SCS			semi-continuous via bluey tube		12/16/16	
					1/10/17	

Depth (feet)	USCS	Graphic Log	Description	% REC	Well Construction
0	PT		Peat, organics, wood		
20	SW		Gravelly sand, silty, brown - dry		
40	SW-GW		Inorganic clay lens, grey		
			Water - likely water table - thin 1-2 foot - < 1 gal/min		
			Higher percentage gravel		
60	GW		Gravelly sand, silty, brown; some organics		
			silty, sandy gravel		
			BEDROCK 43 FT BGS- Weathered - greywackee		
			BEDROCK CONSOLIDATED - greywacke		
80			CASING ENDS AT 65 FT BGS		
			BEDROCK - greywacke		
100			BEDROCK - shale		
			BEDROCK - greywacke		
120					
140					
160					
180					
200					
220			Water - very thin fracture zone - 0.5 gal/minute water		
			BEDROCK - greywacke		
			Water - several very thin fractures - total water production 1-1.5 gal/minute		
240			BEDROCK - greywacke with quartz and other hydrothermal mineralization		
260					
280					
300					
320					
340					
360			Water - additional 0.5 gal/minute water - total 2 gal/minute		
			BEDROCK with small fracture zones - total water 3 gal/minute		
380					
400			TD at 393 FT BGS - Producing 3 gal/minutes		

NOTES: Notes here
 More notes here

TERRASAT, INC. 4203 Iowa Drive Anchorage, AK	PROJECT: 21607		BORING ID: LCW-2	
	LOCATION: Anchorage, Alaska		WELL ID: LCW-2	
	DRILLING CONTRACTOR: M-W Drilling for TERRASAT, Inc.		NORTHING: 2594343	EASTING: 1690507
	DRILLING EQUIPMENT: Acker		GROUND SURFACE ELEV.: 1164	TOC ELEVATION: 1166
	DRILLING METHOD: Air Rotary		TOTAL DEPTH: 256	DEPTH TO WATER: 51
	LOGGED BY: SCS		SAMPLING METHOD: 5-foot continuous sampler	DATE STARTED: 12/13/16

Depth (feet)	USCS	Graphic Log	Description	% REC	Well Construction
0	PT		Peat, organics, wood		
	SW		Gravelly sand, silty, greenish brown		
20	SW-SM		very silty sand, some coarse gravel		
			Gravelly, silty sand - well graded sand - dry		
40	SW				
	SW-SM		Gravelly, silty sand, more gravel		
60			WATER - very thin layer < 1 gal/min		
			BEDROCK - Not completely consolidated - greywacke matrix-		
			CASING ENDS		
			BEDROCK - Alternating between brown and grey -		
			Consolidated - moist at 92 ft.		
80					
100			BEDROCK - dry after 95 ft.		
			BEDROCK - SHALE		
			BEDROCK - Alternating between shale and greywacke		
120			WATER - 3-5 gal/min - Fracture zone likely 3-4 ft thick		
			BEDROCK - greywacke		
140					
160			Water - additional 1-2 gal/minute - thin fracture zone		
			BEDROCK - greywacke with quartz hydrothermal veining		
180					
			Water - additional 1-2 gal/minute - total of 6 gal/minute		
			Additional water in several very small fractures - total 8-10 gal/minute		
200					
220					
240			BEDROCK - greywacke with green and white mineralization		
260			TD - 256 - Producing 10 gal/minute		

NOTES: Notes here
 More notes here

TERRASAT, INC. 4203 Iowa Drive Anchorage, AK			PROJECT: 21607		BORING ID: LCW-3	
			LOCATION: Anchorage, Alaska		WELL ID: LCW-3	
			DRILLING CONTRACTOR: M-W Drilling for TERRASAT, Inc.		NORTHING: 2594335	EASTING: 1690362
			DRILLING EQUIPMENT: Acker		GROUND SURFACE ELEV.: 1155.5	TOC ELEVATION: 1166
			DRILLING METHOD: Air Rotary		TOTAL DEPTH: 236	DEPTH TO WATER: 30 to Water Table
			LOGGED BY: SCS		SAMPLING METHOD: 5-foot continuous sampler	
Depth (feet)	USCS	Graphic Log	Description	% REC	Well Construction	
0	PT SW		Peat, organics, wood			
			Gravelly sand, silty, brown - dry			
	SW-GW		Gravel content 45%, silty sand			
20	SW		Gravelly sand, silty, brown; some organics			
	SW		Inorganic clay lens, grey			
	SM		Silty sand, little gravel, fine sand			
	SC-SM		WATER TABLE - 1 foot thick - little water			
40	SC		CLAYEY sand - likely confining layer			
	SW		Clayey-Silty Sand, fine gravel			
	SW		Clayey Sand - Sand-Clay Mixture, some fine gravel			
	SW		Gravelly, silty sands			
60	SW-SC		Clayey, gravelly, Silty Sand			
	SW-SC		Clayey, gravelly, silty sand - WATER, very little, either thin 1-2 ft layer or from snow in drill pipe			
	SW		Gravelly sand, fine gravel, silt			
80	SW-SM		Silty, gravelly, sand - brown			
	SM		Silty sand, little or no gravel			
100			BEDROCK - Weathered/fractured; red iron colored- mixed with silt and fine sand			
			becomes more consolidated			
120			Fully Consolidated Bedrock - greywacke			
140			shale			
160			WATER - Small fracture zone < 1 gal/min			
			shale consolidated			
180			WATER - Large fracture zone - 4-6 gal/min			
200			BEDROCK			
220						
240			TD at 236 FT BGS - Producing 6 gal/minutes			
NOTES: Notes here More notes here						

APPENDIX E

AqteSolv Aquifer Test Results

Data Set: P:\2016 Projects\21607 - Lewis & Clark Subd Hydrogeology - Big Country Ent\REPORTS\MAIN REPORT
Date: 02/07/17
Time: 13:06:42

PROJECT INFORMATION

Company: TERRASAT
Client: Big Country EnterprisesLC
Project: 21607
Location: Anchorage, Alaska
Test Date: 1/31/17
Test Well: LCW-1

AQUIFER DATA

Saturated Thickness: 70. ft
Anisotropy Ratio (Kz/Kr): 0.93
Slab Block Thickness: 1. ft
Spherical Block Diameter: 1. ft
Fracture Length: 1. ft
Fracture Radius: 1.658 ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: LCW-1

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.25 ft
Well Radius: 0.25 ft

Fully Penetrating Well

No. of pumping periods: 4

Pumping Period Data			
Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	2.	361.	0.
360.	2.	1440.	0.

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: LCW-1

X Location: 0. ft
Y Location: 0. ft

Radial distance from LCW-1: 0. ft

Fully Penetrating Well

No. of Observations: 963

Observation Data			
Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.5	0.052	241.5	3.728
1.	0.052	242.	3.728
1.5	0.218	242.5	3.68
2.	0.29	372.	3.993
2.5	0.409	372.5	3.731
3.	0.552	373.	3.468
3.5	0.648	373.5	3.206
4.	1.006	374.	2.971
4.5	1.363	374.5	2.732
5.	1.626	375.	2.494
5.5	1.769	375.5	2.279

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
6.	1.84	376.	2.064
6.5	1.936	376.5	1.826
7.	1.983	377.	1.635
7.5	2.055	377.5	1.444
8.	2.127	378.	1.25
8.5	2.198	378.5	1.063
9.	2.222	379.	0.869
9.5	2.508	379.5	0.702
10.	2.866	380.	0.538
10.5	3.295	380.5	0.371
11.	3.629	381.	0.204
11.5	3.939	381.5	0.034
12.	4.13	382.	-0.106
12.5	4.225	382.5	-0.249
13.	4.392	383.	-0.395
13.5	4.488	383.5	-0.538
14.	4.607	384.	-0.657
14.5	4.753	384.5	-0.801
15.	4.893	385.	-0.92
15.5	4.989	385.5	-1.063
16.	5.06	386.	-1.182
16.5	5.182	386.5	-1.301
17.	5.278	387.	-1.421
17.5	5.349	387.5	-1.516
18.	5.466	388.	-1.635
18.5	5.54	388.5	-1.731
19.	5.564	389.	-1.826
19.5	5.588	389.5	-1.945
20.	5.683	390.	-2.017
20.5	5.731	390.5	-2.112
21.	5.779	391.	-2.208
21.5	5.826	391.5	-2.303
22.	5.871	392.	-2.375
22.5	5.922	392.5	-2.47
23.	5.946	393.	-2.545
23.5	5.993	393.5	-2.616
24.	6.041	394.	-2.712
24.5	6.065	394.5	-2.783
25.	6.136	395.	-2.828
25.5	6.184	395.5	-2.926
26.	6.232	396.	-2.998
26.5	6.256	396.5	-3.069
27.	6.327	397.	-3.117
27.5	6.351	397.5	-3.189
28.	6.399	398.	-3.26
28.5	6.399	398.5	-3.308
29.	6.446	399.	-3.379
29.5	6.47	399.5	-3.427
30.	6.59	400.	-3.475
30.5	6.542	400.5	-3.546
31.	6.613	401.	-3.594
31.5	6.613	401.5	-3.642
32.	6.613	402.	-3.689
32.5	6.685	402.5	-3.764
33.	6.685	403.	-3.812
33.5	6.709	403.5	-3.859
34.	6.709	404.	-3.907
34.5	6.733	404.5	-3.931
35.	6.78	405.	-3.979
35.5	6.78	405.5	-4.026
36.	6.78	406.	-4.074
36.5	6.804	406.5	-4.122
37.	6.831	407.	-4.146
37.5	6.828	407.5	-4.193
38.	6.876	408.	-4.241
38.5	6.876	408.5	-4.268
39.	6.923	409.	-4.312
39.5	6.923	409.5	-4.363
40.	6.971	410.	-4.387
40.5	6.947	410.5	-4.435

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
41.	6.995	411.	-4.459
41.5	7.019	411.5	-4.482
42.	7.022	412.	-4.53
42.5	7.022	412.5	-4.554
43.	7.09	413.	-4.578
43.5	7.093	413.5	-4.629
44.	7.141	414.	-4.649
44.5	7.141	414.5	-4.673
45.	7.117	415.	-4.7
45.5	7.165	415.5	-4.724
46.	7.189	416.	-4.772
46.5	7.165	416.5	-4.796
47.	7.213	417.	-4.796
47.5	7.237	417.5	-4.843
48.	7.237	418.	-4.867
48.5	7.284	418.5	-4.891
49.	7.284	419.	-4.915
49.5	7.284	419.5	-4.939
50.	7.308	420.	-4.962
50.5	7.332	420.5	-4.986
51.	7.383	421.	-5.01
51.5	7.359	421.5	-5.01
52.	7.359	422.	-5.058
52.5	7.407	422.5	-5.058
53.	7.43	423.	-5.106
53.5	7.43	423.5	-5.106
54.	7.454	424.	-5.129
54.5	7.454	424.5	-5.153
55.	7.454	425.	-5.177
55.5	7.454	425.5	-5.177
56.	7.478	426.	-5.201
56.5	7.502	426.5	-5.225
57.	7.502	427.	-5.249
57.5	7.526	427.5	-5.273
58.	7.502	428.	-5.296
58.5	7.526	428.5	-5.32
59.	7.55	429.	-5.32
59.5	7.55	429.5	-5.344
60.	7.573	430.	-5.344
60.5	7.597	430.5	-5.368
61.	7.597	431.	-5.392
61.5	7.624	431.5	-5.416
62.	7.597	432.	-5.416
62.5	7.645	432.5	-5.439
63.	7.645	433.	-5.463
63.5	7.648	433.5	-5.463
64.	7.672	434.	-5.487
64.5	7.696	434.5	-5.508
65.	7.693	435.	-5.511
65.5	7.696	435.5	-5.535
66.	7.72	436.	-5.535
66.5	7.72	436.5	-5.559
67.	7.72	437.	-5.559
67.5	7.696	437.5	-5.583
68.	7.624	438.	-5.583
68.5	7.624	438.5	-5.606
69.	7.672	439.	-5.606
69.5	7.648	439.5	-5.63
70.	7.696	440.	-5.654
70.5	7.743	440.5	-5.654
71.	7.746	441.	-5.678
71.5	7.72	441.5	-5.678
72.	7.743	442.	-5.702
72.5	7.743	442.5	-5.702
73.	7.746	443.	-5.702
73.5	7.743	443.5	-5.726
74.	7.77	444.	-5.726
74.5	7.77	444.5	-5.75
75.	7.746	445.	-5.75
75.5	7.77	445.5	-5.773

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
76.	7.746	446.	-5.773
76.5	7.77	446.5	-5.773
77.	7.77	447.	-5.797
77.5	7.77	447.5	-5.797
78.	7.77	448.	-5.797
78.5	7.77	448.5	-5.821
79.	7.746	449.	-5.845
79.5	7.77	449.5	-5.845
80.	7.77	450.	-5.845
80.5	7.77	450.5	-5.869
81.	7.77	451.	-5.893
81.5	7.723	451.5	-5.893
82.	7.651	452.	-5.893
82.5	7.603	452.5	-5.916
83.	7.606	453.	-5.916
83.5	7.532	453.5	-5.916
84.	7.508	454.	-5.94
84.5	7.484	454.5	-5.94
85.	7.46	455.	-5.94
85.5	7.389	455.5	-5.964
86.	7.365	456.	-5.964
86.5	7.317	456.5	-5.988
87.	7.341	457.	-5.988
87.5	7.293	457.5	-6.012
88.	7.246	458.	-6.012
88.5	7.246	458.5	-6.012
89.	7.198	459.	-6.036
89.5	7.174	459.5	-6.036
90.	7.15	460.	-6.036
90.5	7.126	460.5	-6.06
91.	7.126	461.	-6.06
91.5	7.079	461.5	-6.06
92.	7.031	462.	-6.083
92.5	6.959	462.5	-6.083
93.	6.888	463.	-6.083
93.5	6.792	463.5	-6.107
94.	6.745	464.	-6.107
94.5	6.673	464.5	-6.11
95.	6.625	465.	-6.107
95.5	6.578	465.5	-6.131
96.	6.53	466.	-6.131
96.5	6.458	466.5	-6.131
97.	6.411	467.	-6.155
97.5	6.339	467.5	-6.158
98.	6.268	468.	-6.158
98.5	6.22	468.5	-6.158
99.	6.172	469.	-6.182
99.5	6.148	469.5	-6.182
100.	6.101	470.	-6.182
100.5	6.029	470.5	-6.182
101.	5.958	471.	-6.206
101.5	5.958	471.5	-6.206
102.	5.886	472.	-6.206
102.5	5.862	472.5	-6.206
103.	5.838	473.	-6.206
103.5	5.767	473.5	-6.23
104.	5.743	474.	-6.23
104.5	5.698	474.5	-6.23
105.	5.651	475.	-6.23
105.5	5.6	475.5	-6.253
106.	5.6	476.	-6.253
106.5	5.552	476.5	-6.253
107.	5.528	477.	-6.253
107.5	5.531	477.5	-6.253
108.	5.457	478.	-6.277
108.5	5.433	478.5	-6.277
109.	5.409	479.	-6.277
109.5	5.385	479.5	-6.277
110.	5.341	480.	-6.301
110.5	5.341	480.5	-6.301

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
111.	5.341	481.	-6.301
111.5	5.293	481.5	-6.301
112.	5.242	482.	-6.301
112.5	5.242	482.5	-6.325
113.	5.221	483.	-6.325
113.5	5.197	483.5	-6.325
114.	5.197	484.	-6.325
114.5	5.197	484.5	-6.325
115.	5.15	485.	-6.349
115.5	5.126	485.5	-6.349
116.	5.102	486.	-6.349
116.5	5.102	486.5	-6.349
117.	5.031	487.	-6.349
117.5	5.031	487.5	-6.373
118.	5.031	488.	-6.349
118.5	5.031	488.5	-6.373
119.	5.007	489.	-6.373
119.5	5.007	489.5	-6.397
120.	5.007	490.	-6.397
120.5	4.983	490.5	-6.397
121.	4.935	491.	-6.397
121.5	4.959	491.5	-6.397
122.	4.959	492.	-6.397
122.5	4.959	492.5	-6.42
123.	4.959	493.	-6.42
123.5	4.959	493.5	-6.42
124.	4.959	494.	-6.42
124.5	4.959	494.5	-6.42
125.	4.983	495.	-6.444
125.5	4.983	495.5	-6.444
126.	4.959	496.	-6.444
126.5	4.959	496.5	-6.444
127.	4.935	497.	-6.444
127.5	4.959	497.5	-6.444
128.	4.935	498.	-6.444
128.5	4.935	498.5	-6.468
129.	4.911	499.	-6.468
129.5	4.887	499.5	-6.468
130.	4.911	500.	-6.468
130.5	4.911	500.5	-6.468
131.	4.911	501.	-6.492
131.5	4.911	501.5	-6.492
132.	4.887	502.	-6.492
132.5	4.887	502.5	-6.492
133.	4.887	503.	-6.492
133.5	4.887	503.5	-6.492
134.	4.864	504.	-6.495
134.5	4.864	504.5	-6.495
135.	4.84	505.	-6.516
135.5	4.84	505.5	-6.516
136.	4.84	506.	-6.516
136.5	4.84	506.5	-6.516
137.	4.816	507.	-6.516
137.5	4.816	507.5	-6.516
138.	4.816	508.	-6.54
138.5	4.792	508.5	-6.543
139.	4.792	509.	-6.543
139.5	4.816	509.5	-6.543
140.	4.816	510.	-6.543
140.5	4.792	510.5	-6.543
141.	4.768	511.	-6.543
141.5	4.768	511.5	-6.543
142.	4.771	512.	-6.567
142.5	4.747	512.5	-6.567
143.	4.792	513.	-6.567
143.5	4.744	513.5	-6.567
144.	4.72	514.	-6.567
144.5	4.771	514.5	-6.563
145.	4.747	515.	-6.567
145.5	4.744	515.5	-6.59

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
146.	4.744	516.	-6.59
146.5	4.768	516.5	-6.59
147.	4.747	517.	-6.587
147.5	4.768	517.5	-6.59
148.	4.744	518.	-6.59
148.5	4.744	518.5	-6.59
149.	4.747	519.	-6.611
149.5	4.747	519.5	-6.614
150.	4.723	520.	-6.614
150.5	4.771	520.5	-6.614
151.	4.747	521.	-6.614
151.5	4.723	521.5	-6.614
152.	4.747	522.	-6.614
152.5	4.723	522.5	-6.614
153.	4.771	523.	-6.614
153.5	4.747	523.5	-6.614
154.	4.747	524.	-6.614
154.5	4.747	524.5	-6.638
155.	4.747	525.	-6.614
155.5	4.747	525.5	-6.638
156.	4.747	526.	-6.638
156.5	4.723	526.5	-6.638
157.	4.723	527.	-6.638
157.5	4.747	527.5	-6.638
158.	4.747	528.	-6.638
158.5	4.747	528.5	-6.662
159.	4.747	529.	-6.662
159.5	4.723	529.5	-6.662
160.	4.747	530.	-6.662
160.5	4.723	530.5	-6.662
161.	4.723	531.	-6.662
161.5	4.747	531.5	-6.662
162.	4.723	532.	-6.662
162.5	4.723	532.5	-6.662
163.	4.726	533.	-6.662
163.5	4.723	533.5	-6.686
164.	4.75	534.	-6.686
164.5	4.747	534.5	-6.686
165.	4.7	535.	-6.662
165.5	4.723	535.5	-6.686
166.	4.726	536.	-6.686
166.5	4.723	536.5	-6.686
167.	4.723	537.	-6.686
167.5	4.703	537.5	-6.686
168.	4.723	538.	-6.686
168.5	4.703	538.5	-6.686
169.	4.703	539.	-6.71
169.5	4.723	539.5	-6.71
170.	4.726	540.	-6.71
170.5	4.726	540.5	-6.71
171.	4.726	541.	-6.71
171.5	4.723	541.5	-6.71
172.	4.7	542.	-6.71
172.5	4.703	542.5	-6.71
173.	4.7	543.	-6.734
173.5	4.7	543.5	-6.71
174.	4.723	544.	-6.71
174.5	4.703	544.5	-6.734
175.	4.726	545.	-6.734
175.5	4.703	545.5	-6.734
176.	4.726	546.	-6.734
176.5	4.703	546.5	-6.734
177.	4.679	547.	-6.734
177.5	4.703	547.5	-6.734
178.	4.75	548.	-6.734
178.5	4.703	548.5	-6.734
179.	4.703	549.	-6.734
179.5	4.679	549.5	-6.757
180.	4.703	550.	-6.734
180.5	4.703	550.5	-6.737

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
181.	4.703	551.	-6.757
181.5	4.726	551.5	-6.757
182.	4.679	552.	-6.757
182.5	4.679	552.5	-6.757
183.	4.679	553.	-6.757
183.5	4.679	553.5	-6.757
184.	4.679	554.	-6.757
184.5	4.679	554.5	-6.757
185.	4.679	555.	-6.757
185.5	4.679	555.5	-6.784
186.	4.726	556.	-6.757
186.5	4.726	556.5	-6.781
187.	4.703	557.	-6.781
187.5	4.703	557.5	-6.781
188.	4.726	558.	-6.781
188.5	4.703	558.5	-6.781
189.	4.679	559.	-6.781
189.5	4.703	559.5	-6.781
190.	4.726	560.	-6.781
190.5	4.703	560.5	-6.781
191.	4.703	561.	-6.805
191.5	4.679	561.5	-6.805
192.	4.679	562.	-6.805
192.5	4.679	562.5	-6.808
193.	4.679	563.	-6.805
193.5	4.703	563.5	-6.805
194.	4.679	564.	-6.805
194.5	4.726	564.5	-6.805
195.	4.703	565.	-6.805
195.5	4.703	565.5	-6.829
196.	4.679	566.	-6.805
196.5	4.655	566.5	-6.805
197.	4.703	567.	-6.805
197.5	4.703	567.5	-6.808
198.	4.703	568.	-6.805
198.5	4.726	568.5	-6.829
199.	4.706	569.	-6.829
199.5	4.706	569.5	-6.829
200.	4.703	570.	-6.829
200.5	4.703	570.5	-6.829
201.	4.703	571.	-6.829
201.5	4.703	571.5	-6.829
202.	4.729	572.	-6.829
202.5	4.75	572.5	-6.829
203.	4.703	573.	-6.829
203.5	4.726	573.5	-6.829
204.	4.726	574.	-6.829
204.5	4.703	574.5	-6.829
205.	4.729	575.	-6.853
205.5	4.703	575.5	-6.853
206.	4.753	576.	-6.829
206.5	4.679	576.5	-6.853
207.	4.682	577.	-6.853
207.5	4.726	577.5	-6.829
208.	4.703	578.	-6.853
208.5	4.703	578.5	-6.829
209.	4.706	579.	-6.853
209.5	4.703	579.5	-6.853
210.	4.729	580.	-6.853
210.5	4.726	580.5	-6.853
211.	4.706	581.	-6.856
211.5	4.703	581.5	-6.853
212.	4.726	582.	-6.856
212.5	4.726	582.5	-6.856
213.	4.706	583.	-6.856
213.5	4.706	583.5	-6.856
214.	4.729	584.	-6.853
214.5	4.729	584.5	-6.877
215.	4.729	585.	-6.877
215.5	4.706	585.5	-6.877

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
216.	4.706	586.	-6.88
216.5	4.706	586.5	-6.877
217.	4.726	587.	-6.88
217.5	4.706	587.5	-6.877
218.	4.682	588.	-6.88
218.5	4.682	588.5	-6.877
219.	4.634	589.	-6.88
219.5	4.634	589.5	-6.877
220.	4.634	590.	-6.88
220.5	4.61	590.5	-6.877
221.	4.562	591.	-6.877
221.5	4.539	591.5	-6.88
222.	4.515	592.	-6.9
222.5	4.467	592.5	-6.877
223.	4.491	593.	-6.9
223.5	4.443	593.5	-6.9
224.	4.467	594.	-6.877
224.5	4.443	594.5	-6.9
225.	4.419	595.	-6.904
225.5	4.419	595.5	-6.9
226.	4.396	596.	-6.9
226.5	4.348	596.5	-6.9
227.	4.345	597.	-6.9
227.5	4.348	597.5	-6.9
228.	4.345	598.	-6.9
228.5	4.324	598.5	-6.9
229.	4.276	599.	-6.924
229.5	4.252	599.5	-6.9
230.	4.276	600.	-6.924
230.5	4.226	600.5	-6.9
231.	4.226	601.	-6.904
231.5	4.181	601.5	-6.9
232.	4.157	602.	-6.9
232.5	4.106	602.5	-6.9
233.	4.083	603.	-6.9
233.5	4.059	603.5	-6.9
234.	4.035	604.	-6.904
234.5	4.014	604.5	-6.904
235.	3.987	605.	-6.9
235.5	3.963	605.5	-6.904
236.	3.916	606.	-6.9
236.5	3.916	606.5	-6.904
237.	3.844	607.	-6.88
237.5	3.871	607.5	-6.9
238.	3.847	608.	-6.9
238.5	3.799	608.5	-6.9
239.	3.799	609.	-6.9
239.5	3.796	609.5	-6.904
240.	3.775	610.	-6.9
240.5	3.728	610.5	-6.904
241.	3.752		

SOLUTION

Pumping Test
 Aquifer Model: Fractured
 Solution Method: Gringarten-Ramey w/horizontal fracture

VISUAL ESTIMATION RESULTSEstimated Parameters

Parameter	Estimate	
Kr	0.009723	ft/min
Ss	0.0006773	ft ⁻¹
Kz/Kr	0.93	
Rf	1.658	ft

K = 0.004939 cm/sec
 T = K*b = 0.6806 ft²/min (10.54 sq. cm/sec)

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
Kr	0.009723	0.05437	+/- 0.1067	0.1788	ft/min
Ss	0.0006773	0.01279	+/- 0.02509	0.05297	ft ⁻¹
Kz/Kr	0.93	not estimated			
Rf	1.658	9.308	+/- 18.26	0.1781	ft

C.I. is approximate 95% confidence interval for parameter

t-ratio = estimate/std. error

No estimation window

K = 0.004939 cm/sec

T = K*b = 0.6806 ft²/min (10.54 sq. cm/sec)

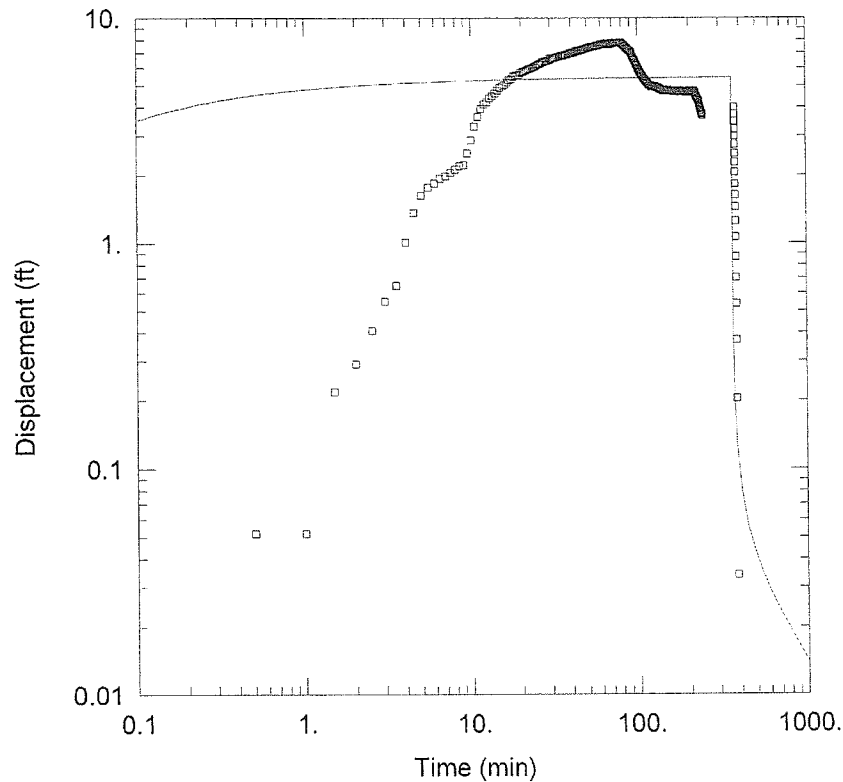
Parameter Correlations

	Kr	Ss	Rf
Kr	1.00	0.96	-1.00
Ss	0.96	1.00	-0.96
Rf	-1.00	-0.96	1.00

Residual Statistics

for weighted residuals

Sum of Squares 1.803E+4 ft²
 Variance 18.78 ft²
 Std. Deviation 4.334 ft
 Mean -2.782 ft
 No. of Residuals 963
 No. of Estimates 3



WELL TEST ANALYSIS

Data Set: P:\...wELL 1 oNLY 2GPMM.agt

Date: 02/07/17

Time: 13:06:06

PROJECT INFORMATION

Company: TERRASAT

Client: Big Country EnterprisesLC

Project: 21607

Location: Anchorage, Alaska

Test Well: LCW-1

Test Date: 1/31/17

AQUIFER DATA

Saturated Thickness: 70. ft

Fracture Radius: 1.658 ft

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
LCW-1	0	0	□ LCW-1	0	0

SOLUTION

Aquifer Model: Fractured

Solution Method: Gringarten (Horizontal)

Kr = 0.009723 ft/min

Ss = 0.0006773 ft⁻¹

Kz/Kr = 0.93

Rf = 1.658 ft

AQTESOLV for Windows

Data Set: P:\2016 Projects\21607 - Lewis & Clark Subd Hydrogeology - Big Country Ent\REPORTS\MAIN REPORT
Date: 02/06/17
Time: 13:48:06

PROJECT INFORMATION

Company: TERRASAT
Client: Big Country EnterprisesLC
Project: 21607
Location: Anchorage, Alaska
Test Date: 1/24/17
Test Well: LCW-2

AQUIFER DATA

Saturated Thickness: 60. ft
Anisotropy Ratio (Kz/Kr): 0.93
Slab Block Thickness: 1. ft
Spherical Block Diameter: 1. ft
Fracture Length: 1. ft
Fracture Radius: 7.003 ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: LCW-2

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.25 ft
Well Radius: 0.25 ft

Fully Penetrating Well

No. of pumping periods: 4

Pumping Period Data			
Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	10.	1441.	0.
1440.	10.	2880.	0.

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: LCW-2

X Location: 0. ft
Y Location: 0. ft

Radial distance from LCW-2: 0. ft

Fully Penetrating Well

No. of Observations: 4077

Observation Data			
Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.5	1.574	1872.5	6.275
1.	5.486	1873.	6.275
1.5	5.987	1873.5	6.251
2.	6.678	1874.	6.251
2.5	7.752	1874.5	6.251
3.	9.014	1875.	6.227
3.5	10.04	1875.5	6.227
4.	10.97	1876.	6.227
4.5	11.78	1876.5	6.203
5.	12.47	1877.	6.203
5.5	13.14	1877.5	6.203

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
6.	13.69	1878.	6.179
6.5	14.19	1878.5	6.179
7.	14.67	1879.	6.179
7.5	15.07	1879.5	6.156
8.	15.5	1880.	6.156
8.5	15.89	1880.5	6.156
9.	16.24	1881.	6.156
9.5	16.58	1881.5	6.156
10.	16.89	1882.	6.156
10.5	17.17	1882.5	6.132
11.	17.46	1883.	6.132
11.5	17.75	1883.5	6.108
12.	17.98	1884.	6.108
12.5	18.22	1884.5	6.108
13.	18.46	1885.	6.108
13.5	18.65	1885.5	6.084
14.	18.86	1886.	6.084
14.5	19.06	1886.5	6.084
15.	19.25	1887.	6.06
15.5	19.46	1887.5	6.06
16.	19.65	1888.	6.036
16.5	19.84	1888.5	6.036
17.	20.01	1889.	6.034
17.5	20.18	1889.5	6.036
18.	20.37	1890.	6.034
18.5	20.54	1890.5	6.012
19.	20.73	1891.	6.012
19.5	20.89	1891.5	6.012
20.	21.08	1892.	6.012
20.5	21.23	1892.5	5.989
21.	21.39	1893.	5.989
21.5	21.56	1893.5	5.989
22.	21.73	1894.	5.965
22.5	21.9	1894.5	5.965
23.	22.04	1895.	5.965
23.5	22.2	1895.5	5.941
24.	22.35	1896.	5.941
24.5	22.49	1896.5	5.941
25.	22.64	1897.	5.941
25.5	22.78	1897.5	5.915
26.	22.95	1898.	5.917
26.5	23.09	1898.5	5.915
27.	23.21	1899.	5.893
27.5	23.35	1899.5	5.893
28.	23.47	1900.	5.893
28.5	23.61	1900.5	5.893
29.	23.73	1901.	5.867
29.5	23.85	1901.5	5.867
30.	23.97	1902.	5.869
30.5	24.07	1902.5	5.843
31.	24.18	1903.	5.845
31.5	24.3	1903.5	5.843
32.	24.4	1904.	5.82
32.5	24.54	1904.5	5.82
33.	24.66	1905.	5.82
33.5	24.78	1905.5	5.82
34.	24.88	1906.	5.822
34.5	25.	1906.5	5.798
35.	25.11	1907.	5.798
35.5	25.21	1907.5	5.798
36.	25.31	1908.	5.772
36.5	25.43	1908.5	5.774
37.	25.52	1909.	5.774
37.5	25.64	1909.5	5.772
38.	25.76	1910.	5.774
38.5	25.86	1910.5	5.75
39.	25.95	1911.	5.75
39.5	26.07	1911.5	5.75
40.	26.16	1912.	5.748
40.5	26.26	1912.5	5.726

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
41.	26.38	1913.	5.726
41.5	26.45	1913.5	5.7
42.	26.55	1914.	5.726
42.5	26.67	1914.5	5.702
43.	26.76	1915.	5.702
43.5	26.86	1915.5	5.678
44.	26.95	1916.	5.678
44.5	27.05	1916.5	5.678
45.	27.14	1917.	5.678
45.5	27.24	1917.5	5.678
46.	27.33	1918.	5.655
46.5	27.43	1918.5	5.655
47.	27.52	1919.	5.653
47.5	27.62	1919.5	5.653
48.	27.69	1920.	5.653
48.5	27.79	1920.5	5.655
49.	27.88	1921.	5.631
49.5	27.98	1921.5	5.629
50.	28.05	1922.	5.607
50.5	28.12	1922.5	5.605
51.	28.22	1923.	5.607
51.5	28.31	1923.5	5.607
52.	28.41	1924.	5.583
52.5	28.53	1924.5	5.583
53.	28.6	1925.	5.581
53.5	28.69	1925.5	5.583
54.	28.79	1926.	5.583
54.5	28.86	1926.5	5.557
55.	28.95	1927.	5.557
55.5	29.05	1927.5	5.559
56.	29.12	1928.	5.559
56.5	29.22	1928.5	5.535
57.	29.29	1929.	5.535
57.5	29.39	1929.5	5.535
58.	29.46	1930.	5.533
58.5	29.55	1930.5	5.512
59.	29.62	1931.	5.51
59.5	29.72	1931.5	5.512
60.	29.79	1932.	5.488
60.5	29.86	1932.5	5.488
61.	29.93	1933.	5.486
61.5	30.	1933.5	5.486
62.	30.1	1934.	5.488
62.5	30.17	1934.5	5.464
63.	30.24	1935.	5.464
63.5	30.32	1935.5	5.464
64.	30.39	1936.	5.44
64.5	30.48	1936.5	5.438
65.	30.55	1937.	5.44
65.5	30.6	1937.5	5.44
66.	30.7	1938.	5.438
66.5	30.74	1938.5	5.438
67.	30.82	1939.	5.416
67.5	30.86	1939.5	5.44
68.	30.93	1940.	5.416
68.5	30.98	1940.5	5.416
69.	31.05	1941.	5.416
69.5	31.1	1941.5	5.392
70.	31.17	1942.	5.392
70.5	31.22	1942.5	5.392
71.	31.29	1943.	5.368
71.5	31.34	1943.5	5.368
72.	31.41	1944.	5.366
72.5	31.46	1944.5	5.368
73.	31.53	1945.	5.345
73.5	31.58	1945.5	5.345
74.	31.63	1946.	5.345
74.5	31.7	1946.5	5.345
75.	31.77	1947.	5.343
75.5	31.82	1947.5	5.321

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
76.	31.86	1948.	5.321
76.5	31.94	1948.5	5.321
77.	31.98	1949.	5.321
77.5	32.03	1949.5	5.297
78.	32.1	1950.	5.295
78.5	32.15	1950.5	5.295
79.	32.2	1951.	5.297
79.5	32.25	1951.5	5.297
80.	32.32	1952.	5.273
80.5	32.39	1952.5	5.297
81.	32.46	1953.	5.271
81.5	32.51	1953.5	5.273
82.	32.56	1954.	5.247
82.5	32.6	1954.5	5.249
83.	32.65	1955.	5.249
83.5	32.72	1955.5	5.247
84.	32.77	1956.	5.225
84.5	32.84	1956.5	5.225
85.	32.89	1957.	5.225
85.5	32.94	1957.5	5.223
86.	32.99	1958.	5.225
86.5	33.06	1958.5	5.225
87.	33.1	1959.	5.199
87.5	33.18	1959.5	5.199
88.	33.23	1960.	5.201
88.5	33.27	1960.5	5.201
89.	33.34	1961.	5.178
89.5	33.41	1961.5	5.176
90.	33.46	1962.	5.178
90.5	33.51	1962.5	5.176
91.	33.58	1963.	5.154
91.5	33.63	1963.5	5.154
92.	33.68	1964.	5.154
92.5	33.75	1964.5	5.154
93.	33.8	1965.	5.154
93.5	33.84	1965.5	5.154
94.	33.89	1966.	5.154
94.5	33.94	1966.5	5.13
95.	34.01	1967.	5.128
95.5	34.06	1967.5	5.128
96.	34.11	1968.	5.128
96.5	34.16	1968.5	5.104
97.	34.18	1969.	5.104
97.5	34.2	1969.5	5.104
98.	34.25	1970.	5.106
98.5	34.35	1970.5	5.08
99.	34.39	1971.	5.082
99.5	34.49	1971.5	5.08
100.	34.54	1972.	5.082
100.5	34.61	1972.5	5.082
101.	34.66	1973.	5.082
101.5	34.7	1973.5	5.058
102.	34.8	1974.	5.056
102.5	34.85	1974.5	5.058
103.	34.92	1975.	5.056
103.5	34.97	1975.5	5.032
104.	35.01	1976.	5.034
104.5	35.06	1976.5	5.034
105.	35.11	1977.	5.034
105.5	35.18	1977.5	5.032
106.	35.59	1978.	5.034
106.5	35.94	1978.5	5.034
107.	36.25	1979.	5.011
107.5	36.49	1979.5	5.009
108.	36.71	1980.	5.009
108.5	36.92	1980.5	4.987
109.	37.11	1981.	4.987
109.5	37.28	1981.5	4.987
110.	37.4	1982.	4.987
110.5	37.54	1982.5	4.987

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
111.	37.64	1983.	4.961
111.5	37.73	1983.5	4.961
112.	37.85	1984.	4.963
112.5	37.92	1984.5	4.963
113.	37.99	1985.	4.963
113.5	38.04	1985.5	4.937
114.	38.14	1986.	4.961
114.5	38.19	1986.5	4.937
115.	38.28	1987.	4.937
115.5	38.33	1987.5	4.939
116.	38.4	1988.	4.939
116.5	38.47	1988.5	4.937
117.	38.52	1989.	4.915
117.5	38.57	1989.5	4.913
118.	38.59	1990.	4.913
118.5	38.64	1990.5	4.889
119.	38.66	1991.	4.891
119.5	38.71	1991.5	4.891
120.	38.76	1992.	4.889
120.5	38.78	1992.5	4.889
121.	38.85	1993.	4.891
121.5	38.9	1993.5	4.868
122.	38.95	1994.	4.889
122.5	39.	1994.5	4.866
123.	39.02	1995.	4.868
123.5	39.09	1995.5	4.868
124.	39.14	1996.	4.866
124.5	39.16	1996.5	4.844
125.	39.23	1997.	4.844
125.5	39.28	1997.5	4.82
126.	39.31	1998.	4.844
126.5	39.38	1998.5	4.82
127.	39.4	1999.	4.818
127.5	39.47	1999.5	4.82
128.	39.5	2000.	4.82
128.5	39.57	2000.5	4.818
129.	39.62	2001.	4.796
129.5	39.66	2001.5	4.794
130.	39.71	2002.	4.794
130.5	39.76	2002.5	4.794
131.	39.81	2003.	4.794
131.5	39.85	2003.5	4.796
132.	39.93	2004.	4.772
132.5	39.95	2004.5	4.77
133.	40.	2005.	4.77
133.5	40.05	2005.5	4.77
134.	40.12	2006.	4.772
134.5	40.19	2006.5	4.748
135.	40.24	2007.	4.746
135.5	40.28	2007.5	4.748
136.	40.31	2008.	4.748
136.5	40.36	2008.5	4.748
137.	40.43	2009.	4.746
137.5	40.45	2009.5	4.724
138.	40.52	2010.	4.722
138.5	40.59	2010.5	4.724
139.	40.62	2011.	4.724
139.5	40.64	2011.5	4.722
140.	40.71	2012.	4.724
140.5	40.74	2012.5	4.724
141.	40.79	2013.	4.701
141.5	40.86	2013.5	4.701
142.	40.91	2014.	4.699
142.5	40.93	2014.5	4.701
143.	40.98	2015.	4.675
143.5	41.02	2015.5	4.675
144.	41.1	2016.	4.675
144.5	41.12	2016.5	4.677
145.	41.14	2017.	4.675
145.5	41.22	2017.5	4.675

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
146.	41.24	2018.	4.675
146.5	41.29	2018.5	4.651
147.	41.33	2019.	4.653
147.5	41.38	2019.5	4.651
148.	41.43	2020.	4.651
148.5	41.48	2020.5	4.651
149.	41.5	2021.	4.653
149.5	41.55	2021.5	4.629
150.	41.57	2022.	4.627
150.5	41.64	2022.5	4.629
151.	41.67	2023.	4.627
151.5	41.72	2023.5	4.603
152.	41.74	2024.	4.603
152.5	41.79	2024.5	4.605
153.	41.84	2025.	4.605
153.5	41.88	2025.5	4.605
154.	41.91	2026.	4.605
154.5	41.95	2026.5	4.605
155.	42.	2027.	4.579
155.5	42.03	2027.5	4.581
156.	42.07	2028.	4.579
156.5	42.1	2028.5	4.579
157.	42.15	2029.	4.579
157.5	42.19	2029.5	4.579
158.	42.17	2030.	4.557
158.5	42.19	2030.5	4.557
159.	42.22	2031.	4.555
159.5	42.24	2031.5	4.555
160.	42.26	2032.	4.555
160.5	42.29	2032.5	4.532
161.	42.31	2033.	4.532
161.5	42.36	2033.5	4.534
162.	42.38	2034.	4.532
162.5	42.43	2034.5	4.534
163.	42.45	2035.	4.508
163.5	42.48	2035.5	4.51
164.	42.53	2036.	4.51
164.5	42.53	2036.5	4.508
165.	42.6	2037.	4.508
165.5	42.62	2037.5	4.508
166.	42.62	2038.	4.508
166.5	42.69	2038.5	4.51
167.	42.72	2039.	4.484
167.5	42.74	2039.5	4.484
168.	42.77	2040.	4.484
168.5	42.81	2040.5	4.484
169.	42.84	2041.	4.46
169.5	42.86	2041.5	4.46
170.	42.91	2042.	4.46
170.5	42.93	2042.5	4.46
171.	42.93	2043.	4.46
171.5	42.98	2043.5	4.438
172.	43.05	2044.	4.438
172.5	43.05	2044.5	4.438
173.	43.08	2045.	4.438
173.5	43.1	2045.5	4.46
174.	43.15	2046.	4.436
174.5	43.17	2046.5	4.436
175.	43.22	2047.	4.412
175.5	43.27	2047.5	4.412
176.	43.27	2048.	4.412
176.5	43.29	2048.5	4.414
177.	43.29	2049.	4.412
177.5	43.29	2049.5	4.414
178.	43.29	2050.	4.412
178.5	43.31	2050.5	4.414
179.	43.34	2051.	4.412
179.5	43.34	2051.5	4.389
180.	43.34	2052.	4.389
180.5	43.38	2052.5	4.389

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
181.	43.38	2053.	4.365
181.5	43.41	2053.5	4.367
182.	43.46	2054.	4.365
182.5	43.48	2054.5	4.365
183.	43.48	2055.	4.365
183.5	43.53	2055.5	4.367
184.	43.53	2056.	4.365
184.5	43.6	2056.5	4.343
185.	43.65	2057.	4.341
185.5	43.7	2057.5	4.341
186.	43.72	2058.	4.341
186.5	43.77	2058.5	4.317
187.	43.79	2059.	4.317
187.5	43.84	2059.5	4.319
188.	43.89	2060.	4.317
188.5	43.91	2060.5	4.317
189.	43.93	2061.	4.341
189.5	43.98	2061.5	4.317
190.	44.01	2062.	4.319
190.5	44.03	2062.5	4.317
191.	44.08	2063.	4.293
191.5	44.08	2063.5	4.319
192.	44.1	2064.	4.293
192.5	44.13	2064.5	4.295
193.	44.17	2065.	4.293
193.5	44.2	2065.5	4.293
194.	44.22	2066.	4.295
194.5	44.27	2066.5	4.293
195.	44.27	2067.	4.293
195.5	44.29	2067.5	4.271
196.	44.34	2068.	4.271
196.5	44.36	2068.5	4.271
197.	44.41	2069.	4.269
197.5	44.44	2069.5	4.247
198.	44.44	2070.	4.271
198.5	44.51	2070.5	4.245
199.	44.48	2071.	4.247
199.5	44.53	2071.5	4.245
200.	44.55	2072.	4.245
200.5	44.58	2072.5	4.247
201.	44.63	2073.	4.245
201.5	44.65	2073.5	4.224
202.	44.67	2074.	4.222
202.5	44.7	2074.5	4.224
203.	44.72	2075.	4.222
203.5	44.74	2075.5	4.222
204.	44.74	2076.	4.222
204.5	44.77	2076.5	4.222
205.	44.82	2077.	4.2
205.5	44.84	2077.5	4.222
206.	44.86	2078.	4.198
206.5	44.89	2078.5	4.198
207.	44.89	2079.	4.198
207.5	44.94	2079.5	4.198
208.	44.96	2080.	4.174
208.5	44.96	2080.5	4.174
209.	44.96	2081.	4.176
209.5	44.96	2081.5	4.176
210.	44.96	2082.	4.174
210.5	45.01	2082.5	4.15
211.	45.06	2083.	4.15
211.5	45.08	2083.5	4.15
212.	45.1	2084.	4.152
212.5	45.1	2084.5	4.15
213.	45.1	2085.	4.15
213.5	45.1	2085.5	4.152
214.	45.15	2086.	4.15
214.5	45.13	2086.5	4.15
215.	45.13	2087.	4.15
215.5	45.15	2087.5	4.128

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
216.	45.15	2088.	4.126
216.5	45.2	2088.5	4.126
217.	45.2	2089.	4.128
217.5	45.22	2089.5	4.126
218.	45.25	2090.	4.128
218.5	45.25	2090.5	4.102
219.	45.29	2091.	4.102
219.5	45.29	2091.5	4.102
220.	45.32	2092.	4.102
220.5	45.34	2092.5	4.104
221.	45.32	2093.	4.102
221.5	45.37	2093.5	4.102
222.	45.37	2094.	4.078
222.5	45.39	2094.5	4.078
223.	45.39	2095.	4.078
223.5	45.39	2095.5	4.078
224.	45.41	2096.	4.08
224.5	45.44	2096.5	4.078
225.	45.46	2097.	4.078
225.5	45.48	2097.5	4.078
226.	45.46	2098.	4.078
226.5	45.51	2098.5	4.055
227.	45.51	2099.	4.08
227.5	45.48	2099.5	4.055
228.	45.48	2100.	4.055
228.5	45.51	2100.5	4.055
229.	45.51	2101.	4.055
229.5	45.56	2101.5	4.055
230.	45.56	2102.	4.031
230.5	45.58	2102.5	4.031
231.	45.56	2103.	4.031
231.5	45.63	2103.5	4.031
232.	45.6	2104.	4.007
232.5	45.6	2104.5	4.031
233.	45.65	2105.	4.031
233.5	45.67	2105.5	4.007
234.	45.67	2106.	4.031
234.5	45.67	2106.5	4.007
235.	45.7	2107.	4.007
235.5	45.7	2107.5	4.007
236.	45.72	2108.	3.983
236.5	45.72	2108.5	3.983
1089.5	59.32	2109.	4.007
1090.	59.46	2109.5	3.983
1090.5	59.58	2110.	3.985
1091.	59.68	2110.5	3.983
1091.5	59.77	2111.	3.985
1092.	59.89	2111.5	3.983
1092.5	59.96	2112.	3.959
1093.	60.08	2112.5	3.983
1093.5	60.18	2113.	3.959
1094.	60.27	2113.5	3.961
1094.5	60.37	2114.	3.961
1095.	60.44	2114.5	3.959
1095.5	60.51	2115.	3.959
1096.	60.63	2115.5	3.959
1096.5	60.68	2116.	3.937
1097.	60.75	2116.5	3.961
1097.5	60.84	2117.	3.937
1098.	60.89	2117.5	3.935
1098.5	60.94	2118.	3.935
1099.	61.01	2118.5	3.935
1099.5	61.08	2119.	3.935
1100.	61.13	2119.5	3.935
1100.5	61.2	2120.	3.913
1101.	61.25	2120.5	3.911
1101.5	61.32	2121.	3.911
1102.	61.37	2121.5	3.911
1102.5	61.42	2122.	3.911
1103.	61.47	2122.5	3.911

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1103.5	61.47	2123.	3.913
1104.	61.49	2123.5	3.911
1104.5	61.51	2124.	3.913
1105.	61.54	2124.5	3.888
1105.5	61.61	2125.	3.888
1106.	61.68	2125.5	3.888
1106.5	61.75	2126.	3.89
1107.	61.8	2126.5	3.89
1107.5	61.82	2127.	3.888
1108.	61.87	2127.5	3.866
1108.5	61.89	2128.	3.888
1109.	61.94	2128.5	3.864
1109.5	61.99	2129.	3.864
1110.	62.01	2129.5	3.864
1110.5	62.06	2130.	3.864
1111.	62.09	2130.5	3.864
1111.5	62.11	2131.	3.864
1112.	62.16	2131.5	3.842
1112.5	62.18	2132.	3.84
1113.	62.18	2132.5	3.84
1113.5	62.18	2133.	3.84
1114.	62.13	2133.5	3.864
1114.5	62.16	2134.	3.84
1115.	62.16	2134.5	3.84
1115.5	62.16	2135.	3.84
1116.	62.18	2135.5	3.84
1116.5	62.18	2136.	3.816
1117.	62.2	2136.5	3.816
1117.5	62.2	2137.	3.816
1118.	62.23	2137.5	3.818
1118.5	62.27	2138.	3.816
1119.	62.27	2138.5	3.816
1119.5	62.3	2139.	3.792
1120.	62.32	2139.5	3.816
1120.5	62.35	2140.	3.792
1121.	62.4	2140.5	3.792
1121.5	62.42	2141.	3.816
1122.	62.44	2141.5	3.792
1122.5	62.47	2142.	3.792
1123.	62.49	2142.5	3.792
1123.5	62.49	2143.	3.792
1124.	62.52	2143.5	3.792
1124.5	62.54	2144.	3.792
1125.	62.51	2144.5	3.792
1125.5	62.56	2145.	3.792
1126.	62.56	2145.5	3.768
1126.5	62.56	2146.	3.768
1127.	62.63	2146.5	3.768
1127.5	62.61	2147.	3.768
1128.	62.66	2147.5	3.77
1128.5	62.68	2148.	3.745
1129.	62.7	2148.5	3.745
1129.5	62.71	2149.	3.745
1130.	62.75	2149.5	3.745
1130.5	62.75	2150.	3.747
1131.	62.78	2150.5	3.747
1131.5	62.8	2151.	3.747
1132.	62.85	2151.5	3.745
1132.5	62.85	2152.	3.721
1133.	62.87	2152.5	3.721
1133.5	62.9	2153.	3.721
1134.	62.92	2153.5	3.721
1134.5	62.97	2154.	3.721
1135.	62.99	2154.5	3.721
1135.5	62.99	2155.	3.721
1136.	62.99	2155.5	3.721
1136.5	63.02	2156.	3.721
1137.	63.04	2156.5	3.721
1137.5	63.11	2157.	3.697
1138.	63.13	2157.5	3.721

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1138.5	63.18	2158.	3.699
1139.	63.21	2158.5	3.697
1139.5	63.28	2159.	3.697
1140.	63.33	2159.5	3.697
1140.5	63.35	2160.	3.697
1141.	63.4	2160.5	3.697
1141.5	63.42	2161.	3.673
1142.	63.47	2161.5	3.673
1142.5	63.49	2162.	3.673
1143.	63.52	2162.5	3.673
1143.5	63.56	2163.	3.673
1144.	63.59	2163.5	3.673
1144.5	63.61	2164.	3.673
1145.	63.63	2164.5	3.673
1145.5	63.66	2165.	3.675
1146.	63.68	2165.5	3.649
1146.5	63.71	2166.	3.649
1147.	63.75	2166.5	3.649
1147.5	63.8	2167.	3.649
1148.	63.8	2167.5	3.649
1148.5	63.75	2168.	3.649
1149.	63.68	2168.5	3.649
1149.5	63.54	2169.	3.649
1150.	63.33	2169.5	3.625
1150.5	63.16	2170.	3.649
1151.	62.94	2170.5	3.625
1151.5	62.82	2171.	3.625
1152.	62.66	2171.5	3.625
1152.5	62.54	2172.	3.625
1153.	62.47	2172.5	3.625
1153.5	62.4	2173.	3.625
1154.	62.27	2173.5	3.625
1154.5	62.09	2174.	3.601
1155.	61.92	2174.5	3.601
1155.5	61.94	2175.	3.601
1156.	62.04	2175.5	3.601
1156.5	62.11	2176.	3.601
1157.	62.09	2176.5	3.603
1157.5	62.06	2177.	3.601
1158.	62.01	2177.5	3.601
1158.5	61.99	2178.	3.578
1159.	61.99	2178.5	3.578
1159.5	61.94	2179.	3.578
1160.	61.94	2179.5	3.578
1160.5	61.97	2180.	3.578
1161.	61.99	2180.5	3.578
1161.5	62.01	2181.	3.58
1162.	62.04	2181.5	3.58
1162.5	62.04	2182.	3.554
1163.	62.06	2182.5	3.554
1163.5	62.06	2183.	3.554
1164.	62.06	2183.5	3.578
1164.5	62.06	2184.	3.554
1165.	62.06	2184.5	3.556
1165.5	62.09	2185.	3.554
1166.	62.09	2185.5	3.554
1166.5	62.11	2186.	3.554
1167.	62.11	2186.5	3.554
1167.5	62.13	2187.	3.53
1168.	62.16	2187.5	3.532
1168.5	62.18	2188.	3.53
1169.	62.2	2188.5	3.53
1169.5	62.2	2189.	3.556
1170.	62.2	2189.5	3.53
1170.5	62.23	2190.	3.53
1171.	62.23	2190.5	3.53
1171.5	62.23	2191.	3.53
1172.	62.23	2191.5	3.53
1172.5	62.23	2192.	3.53
1173.	62.23	2192.5	3.53

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1173.5	62.23	2193.	3.53
1174.	62.2	2193.5	3.53
1174.5	62.2	2194.	3.506
1175.	62.18	2194.5	3.506
1175.5	62.16	2195.	3.506
1176.	62.16	2195.5	3.506
1176.5	62.13	2196.	3.506
1177.	62.11	2196.5	3.506
1177.5	62.11	2197.	3.506
1178.	62.11	2197.5	3.506
1178.5	62.11	2198.	3.482
1179.	62.11	2198.5	3.482
1179.5	62.09	2199.	3.506
1180.	62.11	2199.5	3.482
1180.5	62.11	2200.	3.482
1181.	62.09	2200.5	3.484
1181.5	62.09	2201.	3.482
1182.	62.09	2201.5	3.482
1182.5	62.09	2202.	3.458
1183.	62.09	2202.5	3.458
1183.5	62.09	2203.	3.458
1184.	62.09	2203.5	3.458
1184.5	62.09	2204.	3.458
1185.	62.09	2204.5	3.458
1185.5	62.11	2205.	3.458
1186.	62.09	2205.5	3.458
1186.5	62.11	2206.	3.458
1187.	62.11	2206.5	3.458
1187.5	62.11	2207.	3.458
1188.	62.09	2207.5	3.434
1188.5	62.09	2208.	3.434
1189.	62.09	2208.5	3.434
1189.5	62.09	2209.	3.434
1190.	62.06	2209.5	3.434
1190.5	62.06	2210.	3.434
1191.	62.06	2210.5	3.434
1191.5	62.06	2211.	3.411
1192.	62.06	2211.5	3.411
1192.5	62.06	2212.	3.411
1193.	62.06	2212.5	3.411
1193.5	62.06	2213.	3.411
1194.	62.06	2213.5	3.411
1194.5	62.06	2214.	3.411
1195.	62.06	2214.5	3.411
1195.5	62.06	2215.	3.411
1196.	62.06	2215.5	3.411
1196.5	62.04	2216.	3.411
1197.	62.04	2216.5	3.411
1197.5	62.04	2217.	3.387
1198.	62.04	2217.5	3.387
1198.5	62.04	2218.	3.387
1199.	62.04	2218.5	3.387
1199.5	62.04	2219.	3.387
1200.	62.04	2219.5	3.387
1200.5	62.04	2220.	3.387
1201.	62.06	2220.5	3.387
1201.5	62.04	2221.	3.387
1202.	62.04	2221.5	3.387
1202.5	62.04	2222.	3.387
1203.	62.04	2222.5	3.387
1203.5	62.01	2223.	3.363
1204.	62.01	2223.5	3.363
1204.5	62.02	2224.	3.363
1205.	62.04	2224.5	3.363
1205.5	62.04	2225.	3.363
1206.	62.04	2225.5	3.363
1206.5	62.04	2226.	3.363
1207.	62.04	2226.5	3.363
1207.5	62.06	2227.	3.363
1208.	62.06	2227.5	3.363

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1208.5	62.06	2228.	3.363
1209.	62.06	2228.5	3.341
1209.5	62.06	2229.	3.339
1210.	62.06	2229.5	3.341
1210.5	62.09	2230.	3.339
1211.	62.09	2230.5	3.339
1211.5	62.06	2231.	3.339
1212.	62.06	2231.5	3.339
1212.5	62.06	2232.	3.315
1213.	62.09	2232.5	3.315
1213.5	62.09	2233.	3.315
1214.	62.09	2233.5	3.315
1214.5	62.09	2234.	3.315
1215.	62.09	2234.5	3.315
1215.5	62.11	2235.	3.315
1216.	62.11	2235.5	3.315
1216.5	62.11	2236.	3.315
1217.	62.11	2236.5	3.315
1217.5	62.11	2237.	3.315
1218.	62.13	2237.5	3.315
1218.5	62.13	2238.	3.291
1219.	62.13	2238.5	3.315
1219.5	62.11	2239.	3.291
1220.	62.13	2239.5	3.291
1220.5	62.11	2240.	3.293
1221.	62.11	2240.5	3.291
1221.5	62.11	2241.	3.291
1222.	62.09	2241.5	3.268
1222.5	62.06	2242.	3.268
1223.	62.06	2242.5	3.268
1223.5	62.06	2243.	3.291
1224.	62.06	2243.5	3.268
1224.5	62.04	2244.	3.268
1225.	62.04	2244.5	3.268
1225.5	62.06	2245.	3.268
1226.	62.04	2245.5	3.268
1226.5	62.04	2246.	3.268
1227.	62.06	2246.5	3.268
1227.5	62.06	2247.	3.244
1228.	62.06	2247.5	3.244
1228.5	62.06	2248.	3.268
1229.	62.06	2248.5	3.244
1229.5	62.06	2249.	3.244
1230.	62.09	2249.5	3.244
1230.5	62.06	2250.	3.244
1231.	62.09	2250.5	3.244
1231.5	62.09	2251.	3.244
1232.	62.09	2251.5	3.244
1232.5	62.09	2252.	3.244
1233.	62.09	2252.5	3.22
1233.5	62.11	2253.	3.22
1234.	62.11	2253.5	3.22
1234.5	62.11	2254.	3.22
1235.	62.13	2254.5	3.22
1235.5	62.11	2255.	3.22
1236.	62.11	2255.5	3.22
1236.5	62.11	2256.	3.22
1237.	62.13	2256.5	3.22
1237.5	62.13	2257.	3.22
1238.	62.13	2257.5	3.22
1238.5	62.13	2258.	3.22
1239.	62.13	2258.5	3.22
1239.5	62.13	2259.	3.22
1240.	62.13	2259.5	3.196
1240.5	62.13	2260.	3.196
1241.	62.16	2260.5	3.196
1241.5	62.16	2261.	3.196
1242.	62.16	2261.5	3.198
1242.5	62.16	2262.	3.196
1243.	62.16	2262.5	3.196

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1243.5	62.16	2263.	3.196
1244.	62.16	2263.5	3.172
1244.5	62.18	2264.	3.172
1245.	62.18	2264.5	3.172
1245.5	62.18	2265.	3.172
1246.	62.18	2265.5	3.172
1246.5	62.18	2266.	3.172
1247.	62.21	2266.5	3.172
1247.5	62.18	2267.	3.172
1248.	62.18	2267.5	3.172
1248.5	62.18	2268.	3.174
1249.	62.18	2268.5	3.172
1249.5	62.2	2269.	3.148
1250.	62.2	2269.5	3.15
1250.5	62.23	2270.	3.172
1251.	62.2	2270.5	3.148
1251.5	62.23	2271.	3.148
1252.	62.23	2271.5	3.148
1252.5	62.23	2272.	3.172
1253.	62.25	2272.5	3.148
1253.5	62.25	2273.	3.148
1254.	62.23	2273.5	3.148
1254.5	62.25	2274.	3.148
1255.	62.25	2274.5	3.124
1255.5	62.25	2275.	3.148
1256.	62.25	2275.5	3.124
1256.5	62.25	2276.	3.124
1257.	62.27	2276.5	3.126
1257.5	62.27	2277.	3.124
1258.	62.27	2277.5	3.124
1258.5	62.27	2278.	3.124
1259.	62.27	2278.5	3.124
1259.5	62.27	2279.	3.124
1260.	62.27	2279.5	3.124
1260.5	62.27	2280.	3.124
1261.	62.27	2280.5	3.124
1261.5	62.3	2281.	3.101
1262.	62.3	2281.5	3.124
1262.5	62.3	2282.	3.124
1263.	62.3	2282.5	3.124
1263.5	62.3	2283.	3.101
1264.	62.32	2283.5	3.101
1264.5	62.3	2284.	3.101
1265.	62.32	2284.5	3.101
1265.5	62.32	2285.	3.101
1266.	62.33	2285.5	3.101
1266.5	62.32	2286.	3.101
1267.	62.35	2286.5	3.103
1267.5	62.35	2287.	3.101
1268.	62.35	2287.5	3.077
1268.5	62.35	2288.	3.077
1269.	62.35	2288.5	3.077
1269.5	62.37	2289.	3.077
1270.	62.37	2289.5	3.077
1270.5	62.37	2290.	3.079
1271.	62.37	2290.5	3.077
1271.5	62.37	2291.	3.077
1272.	62.37	2291.5	3.079
1272.5	62.35	2292.	3.077
1273.	62.35	2292.5	3.079
1273.5	62.32	2293.	3.077
1274.	62.33	2293.5	3.077
1274.5	62.32	2294.	3.077
1275.	62.3	2294.5	3.053
1275.5	62.3	2295.	3.053
1276.	62.3	2295.5	3.077
1276.5	62.32	2296.	3.053
1277.	62.32	2296.5	3.053
1277.5	62.32	2297.	3.053
1278.	62.32	2297.5	3.053

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1278.5	62.32	2298.	3.029
1279.	62.32	2298.5	3.053
1279.5	62.32	2299.	3.029
1280.	62.32	2299.5	3.029
1280.5	62.32	2300.	3.053
1281.	62.32	2300.5	3.029
1281.5	62.32	2301.	3.053
1282.	62.32	2301.5	3.053
1282.5	62.32	2302.	3.029
1283.	62.35	2302.5	3.029
1283.5	62.35	2303.	3.029
1284.	62.35	2303.5	3.031
1284.5	62.35	2304.	3.029
1285.	62.35	2304.5	3.029
1285.5	62.35	2305.	3.029
1286.	62.35	2305.5	3.005
1286.5	62.37	2306.	3.005
1287.	62.3	2306.5	3.005
1287.5	62.25	2307.	3.005
1288.	62.2	2307.5	3.005
1288.5	62.13	2308.	3.005
1289.	62.11	2308.5	3.029
1289.5	62.06	2309.	3.029
1290.	62.04	2309.5	3.005
1290.5	62.01	2310.	3.005
1291.	61.99	2310.5	3.005
1291.5	61.97	2311.	3.005
1292.	61.94	2311.5	3.005
1292.5	61.92	2312.	3.005
1293.	61.89	2312.5	2.981
1293.5	61.89	2313.	2.981
1294.	61.87	2313.5	2.981
1294.5	61.87	2314.	2.981
1295.	61.85	2314.5	2.981
1295.5	61.85	2315.	2.981
1296.	61.82	2315.5	2.981
1296.5	61.82	2316.	2.981
1297.	61.8	2316.5	3.005
1297.5	61.8	2317.	2.981
1298.	61.77	2317.5	2.981
1298.5	61.77	2318.	2.981
1299.	61.77	2318.5	2.957
1299.5	61.77	2319.	2.957
1300.	61.75	2319.5	2.957
1300.5	61.75	2320.	2.957
1301.	61.73	2320.5	2.957
1301.5	61.73	2321.	2.957
1302.	61.73	2321.5	2.957
1302.5	61.7	2322.	2.957
1303.	61.7	2322.5	2.957
1303.5	61.7	2323.	2.957
1304.	61.7	2323.5	2.957
1304.5	61.68	2324.	2.957
1305.	61.68	2324.5	2.957
1305.5	61.68	2325.	2.957
1306.	61.68	2325.5	2.934
1306.5	61.66	2326.	2.957
1307.	61.63	2326.5	2.957
1307.5	61.63	2327.	2.934
1308.	61.63	2327.5	2.934
1308.5	61.61	2328.	2.957
1309.	61.61	2328.5	2.957
1309.5	61.58	2329.	2.936
1310.	61.56	2329.5	2.934
1310.5	61.56	2330.	2.934
1311.	61.54	2330.5	2.91
1311.5	61.54	2331.	2.91
1312.	61.51	2331.5	2.934
1312.5	61.51	2332.	2.91
1313.	61.51	2332.5	2.91

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1313.5	61.51	2333.	2.91
1314.	61.49	2333.5	2.91
1314.5	61.49	2334.	2.91
1315.	61.49	2334.5	2.91
1315.5	61.47	2335.	2.91
1316.	61.49	2335.5	2.91
1316.5	61.49	2336.	2.91
1317.	61.49	2336.5	2.91
1317.5	61.49	2337.	2.91
1318.	61.49	2337.5	2.91
1318.5	61.49	2338.	2.886
1319.	61.49	2338.5	2.886
1319.5	61.47	2339.	2.886
1320.	61.47	2339.5	2.886
1320.5	61.47	2340.	2.91
1321.	61.47	2340.5	2.886
1321.5	61.47	2341.	2.886
1322.	61.47	2341.5	2.886
1322.5	61.47	2342.	2.886
1323.	61.47	2342.5	2.886
1323.5	61.47	2343.	2.886
1324.	61.47	2343.5	2.886
1324.5	61.47	2344.	2.886
1325.	61.47	2344.5	2.886
1325.5	61.47	2345.	2.886
1326.	61.44	2345.5	2.886
1326.5	61.44	2346.	2.886
1327.	61.44	2346.5	2.886
1327.5	61.44	2347.	2.886
1328.	61.44	2347.5	2.862
1328.5	61.44	2348.	2.862
1329.	61.44	2348.5	2.862
1329.5	61.42	2349.	2.862
1330.	61.44	2349.5	2.862
1330.5	61.44	2350.	2.862
1331.	61.44	2350.5	2.862
1331.5	61.42	2351.	2.862
1332.	61.42	2351.5	2.838
1332.5	61.42	2352.	2.838
1333.	61.42	2352.5	2.862
1333.5	61.42	2353.	2.838
1334.	61.42	2353.5	2.862
1334.5	61.42	2354.	2.862
1335.	61.42	2354.5	2.838
1335.5	61.42	2355.	2.838
1336.	61.42	2355.5	2.838
1336.5	61.42	2356.	2.838
1337.	61.42	2356.5	2.838
1337.5	61.39	2357.	2.838
1338.	61.42	2357.5	2.838
1338.5	61.42	2358.	2.838
1339.	61.42	2358.5	2.838
1339.5	61.42	2359.	2.838
1340.	61.42	2359.5	2.838
1340.5	61.42	2360.	2.838
1341.	61.42	2360.5	2.814
1341.5	61.44	2361.	2.814
1342.	61.44	2361.5	2.814
1342.5	61.44	2362.	2.814
1343.	61.44	2362.5	2.814
1343.5	61.44	2363.	2.814
1344.	61.44	2363.5	2.814
1344.5	61.44	2364.	2.814
1345.	61.42	2364.5	2.814
1345.5	61.42	2365.	2.814
1346.	61.42	2365.5	2.814
1346.5	61.39	2366.	2.814
1347.	61.39	2366.5	2.816
1347.5	61.39	2367.	2.814
1348.	61.39	2367.5	2.79

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1348.5	61.39	2368.	2.79
1349.	61.39	2368.5	2.79
1349.5	61.39	2369.	2.79
1350.	61.39	2369.5	2.79
1350.5	61.42	2370.	2.79
1351.	61.42	2370.5	2.79
1351.5	61.39	2371.	2.79
1352.	61.42	2371.5	2.79
1352.5	61.39	2372.	2.79
1353.	61.42	2372.5	2.79
1353.5	61.39	2373.	2.79
1354.	61.39	2373.5	2.79
1354.5	61.42	2374.	2.767
1355.	61.42	2374.5	2.767
1355.5	61.44	2375.	2.79
1356.	61.42	2375.5	2.767
1356.5	61.42	2376.	2.767
1357.	61.42	2376.5	2.767
1357.5	61.42	2377.	2.767
1358.	61.42	2377.5	2.767
1358.5	61.42	2378.	2.767
1359.	61.42	2378.5	2.767
1359.5	61.42	2379.	2.767
1360.	61.39	2379.5	2.767
1360.5	61.39	2380.	2.767
1361.	61.42	2380.5	2.767
1361.5	61.42	2381.	2.767
1362.	61.42	2381.5	2.743
1362.5	61.42	2382.	2.743
1363.	61.42	2382.5	2.743
1363.5	61.42	2383.	2.743
1364.	61.42	2383.5	2.743
1364.5	61.42	2384.	2.743
1365.	61.39	2384.5	2.743
1365.5	61.42	2385.	2.743
1366.	61.42	2385.5	2.743
1366.5	61.42	2386.	2.743
1367.	61.39	2386.5	2.743
1367.5	61.39	2387.	2.743
1368.	61.4	2387.5	2.743
1368.5	61.39	2388.	2.743
1369.	61.39	2388.5	2.743
1369.5	61.39	2389.	2.719
1370.	61.39	2389.5	2.719
1370.5	61.39	2390.	2.719
1371.	61.39	2390.5	2.719
1371.5	61.39	2391.	2.719
1372.	61.39	2391.5	2.719
1372.5	61.39	2392.	2.719
1373.	61.42	2392.5	2.719
1373.5	61.39	2393.	2.719
1374.	61.42	2393.5	2.695
1374.5	61.39	2394.	2.719
1375.	61.39	2394.5	2.719
1375.5	61.39	2395.	2.719
1376.	61.42	2395.5	2.719
1376.5	61.42	2396.	2.719
1377.	61.42	2396.5	2.695
1377.5	61.42	2397.	2.695
1378.	61.44	2397.5	2.695
1378.5	61.44	2398.	2.695
1379.	61.47	2398.5	2.695
1379.5	61.44	2399.	2.695
1380.	61.47	2399.5	2.695
1380.5	61.49	2400.	2.695
1381.	61.49	2400.5	2.695
1381.5	61.49	2401.	2.671
1382.	61.49	2401.5	2.695
1382.5	61.49	2402.	2.695
1383.	61.49	2402.5	2.695

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1383.5	61.51	2403.	2.695
1384.	61.51	2403.5	2.695
1384.5	61.51	2404.	2.695
1385.	61.49	2404.5	2.695
1385.5	61.51	2405.	2.671
1386.	61.51	2405.5	2.671
1386.5	61.49	2406.	2.671
1387.	61.51	2406.5	2.671
1387.5	61.51	2407.	2.671
1388.	61.51	2407.5	2.671
1388.5	61.49	2408.	2.671
1389.	61.51	2408.5	2.671
1389.5	61.49	2409.	2.647
1390.	61.49	2409.5	2.671
1390.5	61.49	2410.	2.671
1391.	61.49	2410.5	2.671
1391.5	61.49	2411.	2.671
1392.	61.49	2411.5	2.647
1392.5	61.49	2412.	2.647
1393.	61.49	2412.5	2.649
1393.5	61.49	2413.	2.647
1394.	61.47	2413.5	2.647
1394.5	61.49	2414.	2.647
1395.	61.49	2414.5	2.647
1395.5	61.49	2415.	2.647
1396.	61.49	2415.5	2.647
1396.5	61.49	2416.	2.647
1397.	61.49	2416.5	2.647
1397.5	61.49	2417.	2.624
1398.	61.49	2417.5	2.647
1398.5	61.49	2418.	2.624
1399.	61.47	2418.5	2.624
1399.5	61.49	2419.	2.624
1400.	61.49	2419.5	2.624
1400.5	61.47	2420.	2.624
1401.	61.47	2420.5	2.624
1401.5	61.47	2421.	2.624
1402.	61.47	2421.5	2.624
1402.5	61.47	2422.	2.624
1403.	61.49	2422.5	2.624
1403.5	61.47	2423.	2.624
1404.	61.47	2423.5	2.624
1404.5	61.47	2424.	2.624
1405.	61.47	2424.5	2.624
1405.5	61.47	2425.	2.624
1406.	61.47	2425.5	2.624
1406.5	61.47	2426.	2.624
1407.	61.47	2426.5	2.624
1407.5	61.49	2427.	2.624
1408.	61.47	2427.5	2.624
1408.5	61.47	2428.	2.6
1409.	61.44	2428.5	2.6
1409.5	61.47	2429.	2.6
1410.	61.49	2429.5	2.6
1410.5	61.51	2430.	2.624
1411.	61.54	2430.5	2.6
1411.5	61.56	2431.	2.6
1412.	61.56	2431.5	2.6
1412.5	61.56	2432.	2.6
1413.	61.54	2432.5	2.6
1413.5	61.54	2433.	2.6
1414.	61.54	2433.5	2.576
1414.5	61.51	2434.	2.576
1415.	61.51	2434.5	2.6
1415.5	61.49	2435.	2.6
1416.	61.49	2435.5	2.576
1416.5	61.47	2436.	2.6
1417.	61.47	2436.5	2.576
1417.5	61.44	2437.	2.576
1418.	61.44	2437.5	2.576

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1418.5	61.44	2438.	2.576
1419.	61.44	2438.5	2.576
1419.5	61.44	2439.	2.576
1420.	61.44	2439.5	2.576
1420.5	61.42	2440.	2.576
1421.	61.42	2440.5	2.576
1421.5	61.39	2441.	2.576
1422.	61.39	2441.5	2.576
1422.5	61.4	2442.	2.552
1423.	61.37	2442.5	2.576
1423.5	61.34	2443.	2.552
1424.	61.32	2443.5	2.552
1424.5	61.32	2444.	2.552
1425.	61.3	2444.5	2.552
1425.5	61.27	2445.	2.552
1426.	61.25	2445.5	2.576
1426.5	61.23	2446.	2.552
1427.	61.2	2446.5	2.552
1427.5	61.18	2447.	2.552
1428.	61.15	2447.5	2.552
1428.5	61.16	2448.	2.552
1429.	61.13	2448.5	2.552
1429.5	61.11	2449.	2.552
1430.	61.08	2449.5	2.552
1430.5	61.09	2450.	2.528
1431.	61.08	2450.5	2.528
1431.5	61.06	2451.	2.528
1432.	61.06	2451.5	2.528
1432.5	61.03	2452.	2.552
1433.	61.03	2452.5	2.528
1433.5	61.03	2453.	2.528
1434.	61.01	2453.5	2.528
1434.5	61.01	2454.	2.528
1435.	60.99	2454.5	2.528
1435.5	60.99	2455.	2.528
1436.	60.99	2455.5	2.528
1436.5	60.96	2456.	2.528
1437.	60.96	2456.5	2.528
1437.5	60.94	2457.	2.528
1438.	60.94	2457.5	2.504
1438.5	60.94	2458.	2.504
1439.	60.92	2458.5	2.528
1439.5	60.92	2459.	2.528
1440.	60.92	2459.5	2.528
1440.5	60.92	2460.	2.504
1441.	60.89	2460.5	2.504
1441.5	60.92	2461.	2.504
1442.	60.89	2461.5	2.528
1442.5	60.89	2462.	2.504
1443.	60.87	2462.5	2.504
1443.5	60.87	2463.	2.504
1444.	60.84	2463.5	2.504
1444.5	60.84	2464.	2.504
1445.	60.84	2464.5	2.504
1445.5	60.84	2465.	2.504
1446.	60.84	2465.5	2.504
1446.5	60.82	2466.	2.504
1447.	60.84	2466.5	2.504
1447.5	60.84	2467.	2.48
1448.	60.84	2467.5	2.504
1448.5	60.84	2468.	2.504
1449.	60.84	2468.5	2.504
1449.5	60.85	2469.	2.504
1450.	60.84	2469.5	2.48
1450.5	60.87	2470.	2.48
1451.	60.87	2470.5	2.48
1451.5	60.84	2471.	2.48
1452.	60.06	2471.5	2.48
1452.5	56.31	2472.	2.48
1453.	54.41	2472.5	2.48

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1453.5	52.74	2473.	2.48
1454.	51.38	2473.5	2.48
1454.5	50.14	2474.	2.48
1455.	48.99	2474.5	2.48
1455.5	47.99	2475.	2.48
1456.	47.11	2475.5	2.48
1456.5	46.3	2476.	2.48
1457.	45.59	2476.5	2.48
1457.5	44.92	2477.	2.457
1458.	44.32	2477.5	2.457
1458.5	43.78	2478.	2.457
1459.	43.25	2478.5	2.457
1459.5	42.75	2479.	2.457
1460.	42.3	2479.5	2.48
1460.5	41.85	2480.	2.457
1461.	41.44	2480.5	2.457
1461.5	41.06	2481.	2.457
1462.	40.68	2481.5	2.457
1462.5	40.34	2482.	2.457
1463.	39.98	2482.5	2.457
1463.5	39.67	2483.	2.457
1464.	39.39	2483.5	2.457
1464.5	39.1	2484.	2.457
1465.	38.82	2484.5	2.457
1465.5	38.58	2485.	2.457
1466.	38.32	2485.5	2.457
1466.5	38.05	2486.	2.457
1467.	37.81	2486.5	2.457
1467.5	37.55	2487.	2.457
1468.	37.29	2487.5	2.433
1468.5	37.05	2488.	2.433
1469.	36.84	2488.5	2.433
1469.5	36.6	2489.	2.433
1470.	36.38	2489.5	2.433
1470.5	36.17	2490.	2.433
1471.	35.95	2490.5	2.433
1471.5	35.74	2491.	2.433
1472.	35.55	2491.5	2.433
1472.5	35.36	2492.	2.433
1473.	35.14	2492.5	2.433
1473.5	34.95	2493.	2.433
1474.	34.76	2493.5	2.433
1474.5	34.57	2494.	2.433
1475.	34.4	2494.5	2.409
1475.5	34.24	2495.	2.433
1476.	34.05	2495.5	2.433
1476.5	33.88	2496.	2.433
1477.	33.69	2496.5	2.409
1477.5	33.52	2497.	2.433
1478.	33.35	2497.5	2.409
1478.5	33.19	2498.	2.409
1479.	33.05	2498.5	2.409
1479.5	32.88	2499.	2.409
1480.	32.73	2499.5	2.409
1480.5	32.57	2500.	2.409
1481.	32.4	2500.5	2.409
1481.5	32.26	2501.	2.409
1482.	32.11	2501.5	2.409
1482.5	31.97	2502.	2.409
1483.	31.8	2502.5	2.409
1483.5	31.66	2503.	2.409
1484.	31.52	2503.5	2.385
1484.5	31.37	2504.	2.409
1485.	31.23	2504.5	2.409
1485.5	31.11	2505.	2.409
1486.	30.97	2505.5	2.385
1486.5	30.82	2506.	2.385
1487.	30.68	2506.5	2.409
1487.5	30.56	2507.	2.409
1488.	30.44	2507.5	2.385

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1488.5	30.3	2508.	2.385
1489.	30.18	2508.5	2.385
1489.5	30.04	2509.	2.385
1490.	29.92	2509.5	2.385
1490.5	29.8	2510.	2.361
1491.	29.68	2510.5	2.385
1491.5	29.56	2511.	2.385
1492.	29.44	2511.5	2.385
1492.5	29.3	2512.	2.385
1493.	29.2	2512.5	2.385
1493.5	29.06	2513.	2.385
1494.	28.96	2513.5	2.361
1494.5	28.84	2514.	2.385
1495.	28.72	2514.5	2.361
1495.5	28.63	2515.	2.385
1496.	28.51	2515.5	2.361
1496.5	28.39	2516.	2.385
1497.	28.27	2516.5	2.361
1497.5	28.15	2517.	2.361
1498.	28.06	2517.5	2.361
1498.5	27.94	2518.	2.361
1499.	27.84	2518.5	2.385
1499.5	27.72	2519.	2.361
1500.	27.63	2519.5	2.361
1500.5	27.51	2520.	2.361
1501.	27.41	2520.5	2.361
1501.5	27.29	2521.	2.361
1502.	27.2	2521.5	2.361
1502.5	27.1	2522.	2.361
1503.	26.98	2522.5	2.361
1503.5	26.89	2523.	2.337
1504.	26.79	2523.5	2.361
1504.5	26.7	2524.	2.361
1505.	26.6	2524.5	2.361
1505.5	26.5	2525.	2.337
1506.	26.41	2525.5	2.337
1506.5	26.32	2526.	2.337
1507.	26.22	2526.5	2.361
1507.5	26.12	2527.	2.337
1508.	26.03	2527.5	2.361
1508.5	25.96	2528.	2.337
1509.	25.84	2528.5	2.337
1509.5	25.74	2529.	2.337
1510.	25.65	2529.5	2.337
1510.5	25.55	2530.	2.337
1511.	25.48	2530.5	2.337
1511.5	25.38	2531.	2.337
1512.	25.29	2531.5	2.337
1512.5	25.19	2532.	2.337
1513.	25.1	2532.5	2.337
1513.5	25.02	2533.	2.337
1514.	24.95	2533.5	2.337
1514.5	24.86	2534.	2.313
1515.	24.76	2534.5	2.313
1515.5	24.67	2535.	2.337
1516.	24.6	2535.5	2.337
1516.5	24.52	2536.	2.337
1517.	24.43	2536.5	2.337
1517.5	24.33	2537.	2.337
1518.	24.26	2537.5	2.313
1518.5	24.17	2538.	2.313
1519.	24.09	2538.5	2.313
1519.5	24.02	2539.	2.313
1520.	23.95	2539.5	2.313
1520.5	23.86	2540.	2.313
1521.	23.79	2540.5	2.313
1521.5	23.71	2541.	2.313
1522.	23.64	2541.5	2.313
1522.5	23.55	2542.	2.313
1523.	23.45	2542.5	2.313

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1523.5	23.38	2543.	2.313
1524.	23.31	2543.5	2.313
1524.5	23.24	2544.	2.313
1525.	23.16	2544.5	2.313
1525.5	23.09	2545.	2.313
1526.	23.02	2545.5	2.313
1526.5	22.95	2546.	2.313
1527.	22.88	2546.5	2.313
1527.5	22.81	2547.	2.313
1528.	22.71	2547.5	2.29
1528.5	22.66	2548.	2.29
1529.	22.57	2548.5	2.313
1529.5	22.5	2549.	2.313
1530.	22.45	2549.5	2.29
1530.5	22.38	2550.	2.29
1531.	22.28	2550.5	2.29
1531.5	22.23	2551.	2.29
1532.	22.16	2551.5	2.29
1532.5	22.09	2552.	2.29
1533.	22.02	2552.5	2.29
1533.5	21.95	2553.	2.29
1534.	21.9	2553.5	2.29
1534.5	21.83	2554.	2.29
1535.	21.76	2554.5	2.29
1535.5	21.69	2555.	2.29
1536.	21.61	2555.5	2.29
1536.5	21.57	2556.	2.29
1537.	21.47	2556.5	2.29
1537.5	21.42	2557.	2.29
1538.	21.35	2557.5	2.266
1538.5	21.28	2558.	2.29
1539.	21.23	2558.5	2.29
1539.5	21.16	2559.	2.266
1540.	21.09	2559.5	2.29
1540.5	21.04	2560.	2.266
1541.	20.97	2560.5	2.266
1541.5	20.9	2561.	2.266
1542.	20.85	2561.5	2.266
1542.5	20.78	2562.	2.266
1543.	20.71	2562.5	2.266
1543.5	20.68	2563.	2.266
1544.	20.59	2563.5	2.266
1544.5	20.52	2564.	2.266
1545.	20.47	2564.5	2.266
1545.5	20.42	2565.	2.266
1546.	20.37	2565.5	2.266
1546.5	20.3	2566.	2.266
1547.	20.23	2566.5	2.266
1547.5	20.18	2567.	2.242
1548.	20.11	2567.5	2.242
1548.5	20.06	2568.	2.266
1549.	20.02	2568.5	2.266
1549.5	19.95	2569.	2.242
1550.	19.9	2569.5	2.266
1550.5	19.85	2570.	2.242
1551.	19.78	2570.5	2.242
1551.5	19.73	2571.	2.242
1552.	19.66	2571.5	2.242
1552.5	19.61	2572.	2.242
1553.	19.56	2572.5	2.242
1553.5	19.52	2573.	2.242
1554.	19.44	2573.5	2.242
1554.5	19.4	2574.	2.242
1555.	19.35	2574.5	2.218
1555.5	19.3	2575.	2.242
1556.	19.23	2575.5	2.242
1556.5	19.18	2576.	2.242
1557.	19.13	2576.5	2.242
1557.5	19.09	2577.	2.242
1558.	19.04	2577.5	2.242

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1558.5	18.97	2578.	2.242
1559.	18.92	2578.5	2.242
1559.5	18.87	2579.	2.242
1560.	18.82	2579.5	2.218
1560.5	18.75	2580.	2.242
1561.	18.73	2580.5	2.242
1561.5	18.66	2581.	2.242
1562.	18.63	2581.5	2.242
1562.5	18.56	2582.	2.218
1563.	18.51	2582.5	2.242
1563.5	18.47	2583.	2.218
1564.	18.42	2583.5	2.218
1564.5	18.37	2584.	2.218
1565.	18.32	2584.5	2.218
1565.5	18.25	2585.	2.218
1566.	18.23	2585.5	2.218
1566.5	18.18	2586.	2.218
1567.	18.13	2586.5	2.218
1567.5	18.08	2587.	2.218
1568.	18.01	2587.5	2.218
1568.5	17.99	2588.	2.218
1569.	17.94	2588.5	2.218
1569.5	17.89	2589.	2.218
1570.	17.82	2589.5	2.218
1570.5	17.8	2590.	2.218
1571.	17.75	2590.5	2.218
1571.5	17.7	2591.	2.218
1572.	17.65	2591.5	2.218
1572.5	17.61	2592.	2.218
1573.	17.56	2592.5	2.194
1573.5	17.51	2593.	2.218
1574.	17.46	2593.5	2.194
1574.5	17.41	2594.	2.194
1575.	17.39	2594.5	2.194
1575.5	17.34	2595.	2.194
1576.	17.3	2595.5	2.194
1576.5	17.25	2596.	2.194
1577.	17.2	2596.5	2.194
1577.5	17.15	2597.	2.194
1578.	17.11	2597.5	2.194
1578.5	17.08	2598.	2.194
1579.	17.03	2598.5	2.194
1579.5	16.99	2599.	2.194
1580.	16.94	2599.5	2.194
1580.5	16.89	2600.	2.194
1581.	16.87	2600.5	2.194
1581.5	16.82	2601.	2.194
1582.	16.77	2601.5	2.194
1582.5	16.72	2602.	2.194
1583.	16.7	2602.5	2.194
1583.5	16.65	2603.	2.194
1584.	16.6	2603.5	2.194
1584.5	16.58	2604.	2.194
1585.	16.53	2604.5	2.194
1585.5	16.48	2605.	2.17
1586.	16.44	2605.5	2.17
1586.5	16.39	2606.	2.194
1587.	16.37	2606.5	2.194
1587.5	16.32	2607.	2.194
1588.	16.27	2607.5	2.17
1588.5	16.25	2608.	2.17
1589.	16.2	2608.5	2.194
1589.5	16.18	2609.	2.17
1590.	16.13	2609.5	2.17
1590.5	16.08	2610.	2.17
1591.	16.03	2610.5	2.17
1591.5	16.01	2611.	2.17
1592.	15.96	2611.5	2.17
1592.5	15.91	2612.	2.17
1593.	15.91	2612.5	2.17

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1593.5	15.84	2613.	2.17
1594.	15.82	2613.5	2.17
1594.5	15.77	2614.	2.17
1595.	15.75	2614.5	2.17
1595.5	15.7	2615.	2.17
1596.	15.67	2615.5	2.17
1596.5	15.63	2616.	2.146
1597.	15.6	2616.5	2.146
1597.5	15.56	2617.	2.146
1598.	15.53	2617.5	2.17
1598.5	15.48	2618.	2.17
1599.	15.46	2618.5	2.17
1599.5	15.41	2619.	2.146
1600.	15.36	2619.5	2.17
1600.5	15.34	2620.	2.146
1601.	15.29	2620.5	2.146
1601.5	15.27	2621.	2.146
1602.	15.24	2621.5	2.146
1602.5	15.2	2622.	2.17
1603.	15.17	2622.5	2.146
1603.5	15.12	2623.	2.146
1604.	15.08	2623.5	2.146
1604.5	15.05	2624.	2.146
1605.	15.03	2624.5	2.146
1605.5	15.	2625.	2.146
1606.	14.96	2625.5	2.146
1606.5	14.93	2626.	2.146
1607.	14.89	2626.5	2.146
1607.5	14.86	2627.	2.146
1608.	14.81	2627.5	2.146
1608.5	14.79	2628.	2.146
1609.	14.74	2628.5	2.146
1609.5	14.72	2629.	2.146
1610.	14.67	2629.5	2.146
1610.5	14.65	2630.	2.146
1611.	14.62	2630.5	2.146
1611.5	14.57	2631.	2.146
1612.	14.55	2631.5	2.146
1612.5	14.53	2632.	2.146
1613.	14.48	2632.5	2.146
1613.5	14.46	2633.	2.123
1614.	14.41	2633.5	2.123
1614.5	14.38	2634.	2.123
1615.	14.36	2634.5	2.146
1615.5	14.31	2635.	2.123
1616.	14.29	2635.5	2.123
1616.5	14.27	2636.	2.123
1617.	14.24	2636.5	2.123
1617.5	14.19	2637.	2.123
1618.	14.15	2637.5	2.123
1618.5	14.15	2638.	2.123
1619.	14.1	2638.5	2.123
1619.5	14.07	2639.	2.123
1620.	14.03	2639.5	2.123
1620.5	14.	2640.	2.123
1621.	13.98	2640.5	2.123
1621.5	13.96	2641.	2.099
1622.	13.93	2641.5	2.123
1622.5	13.88	2642.	2.123
1623.	13.86	2642.5	2.123
1623.5	13.84	2643.	2.099
1624.	13.81	2643.5	2.099
1624.5	13.76	2644.	2.123
1625.	13.74	2644.5	2.099
1625.5	13.72	2645.	2.123
1626.	13.69	2645.5	2.099
1626.5	13.65	2646.	2.123
1627.	13.62	2646.5	2.123
1627.5	13.6	2647.	2.099
1628.	13.57	2647.5	2.099

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1628.5	13.55	2648.	2.099
1629.	13.5	2648.5	2.099
1629.5	13.48	2649.	2.099
1630.	13.45	2649.5	2.099
1630.5	13.43	2650.	2.099
1631.	13.41	2650.5	2.099
1631.5	13.36	2651.	2.099
1632.	13.34	2651.5	2.099
1632.5	13.31	2652.	2.099
1633.	13.29	2652.5	2.099
1633.5	13.26	2653.	2.099
1634.	13.24	2653.5	2.099
1634.5	13.19	2654.	2.099
1635.	13.17	2654.5	2.099
1635.5	13.14	2655.	2.099
1636.	13.12	2655.5	2.075
1636.5	13.1	2656.	2.099
1637.	13.05	2656.5	2.075
1637.5	13.03	2657.	2.099
1638.	13.	2657.5	2.099
1638.5	12.98	2658.	2.099
1639.	12.95	2658.5	2.099
1639.5	12.93	2659.	2.075
1640.	12.9	2659.5	2.075
1640.5	12.88	2660.	2.075
1641.	12.86	2660.5	2.099
1641.5	12.83	2661.	2.099
1642.	12.81	2661.5	2.075
1642.5	12.79	2662.	2.075
1643.	12.76	2662.5	2.099
1643.5	12.72	2663.	2.075
1644.	12.69	2663.5	2.075
1644.5	12.67	2664.	2.075
1645.	12.64	2664.5	2.075
1645.5	12.62	2665.	2.075
1646.	12.6	2665.5	2.075
1646.5	12.57	2666.	2.075
1647.	12.55	2666.5	2.075
1647.5	12.52	2667.	2.075
1648.	12.48	2667.5	2.075
1648.5	12.48	2668.	2.075
1649.	12.43	2668.5	2.075
1649.5	12.43	2669.	2.075
1650.	12.38	2669.5	2.075
1650.5	12.36	2670.	2.075
1651.	12.33	2670.5	2.051
1651.5	12.31	2671.	2.075
1652.	12.29	2671.5	2.075
1652.5	12.26	2672.	2.051
1653.	12.26	2672.5	2.075
1653.5	12.21	2673.	2.075
1654.	12.19	2673.5	2.075
1654.5	12.17	2674.	2.051
1655.	12.14	2674.5	2.051
1655.5	12.14	2675.	2.051
1656.	12.09	2675.5	2.051
1656.5	12.07	2676.	2.051
1657.	12.05	2676.5	2.051
1657.5	12.02	2677.	2.051
1658.	12.	2677.5	2.051
1658.5	11.98	2678.	2.051
1659.	11.95	2678.5	2.051
1659.5	11.93	2679.	2.051
1660.	11.9	2679.5	2.051
1660.5	11.88	2680.	2.051
1661.	11.86	2680.5	2.051
1661.5	11.83	2681.	2.051
1662.	11.83	2681.5	2.051
1662.5	11.81	2682.	2.051
1663.	11.76	2682.5	2.051

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1663.5	11.76	2683.	2.051
1664.	11.71	2683.5	2.051
1664.5	11.71	2684.	2.051
1665.	11.69	2684.5	2.051
1665.5	11.66	2685.	2.051
1666.	11.64	2685.5	2.027
1666.5	11.62	2686.	2.051
1667.	11.59	2686.5	2.051
1667.5	11.59	2687.	2.051
1668.	11.55	2687.5	2.027
1668.5	11.52	2688.	2.027
1669.	11.5	2688.5	2.027
1669.5	11.5	2689.	2.051
1670.	11.47	2689.5	2.027
1670.5	11.45	2690.	2.027
1671.	11.43	2690.5	2.027
1671.5	11.4	2691.	2.027
1672.	11.38	2691.5	2.027
1672.5	11.36	2692.	2.027
1673.	11.33	2692.5	2.027
1673.5	11.31	2693.	2.027
1674.	11.31	2693.5	2.027
1674.5	11.28	2694.	2.027
1675.	11.26	2694.5	2.027
1675.5	11.24	2695.	2.027
1676.	11.21	2695.5	2.027
1676.5	11.19	2696.	2.027
1677.	11.16	2696.5	2.027
1677.5	11.14	2697.	2.027
1678.	11.12	2697.5	2.027
1678.5	11.12	2698.	2.027
1679.	11.09	2698.5	2.027
1679.5	11.07	2699.	2.027
1680.	11.05	2699.5	2.027
1680.5	11.02	2700.	2.027
1681.	11.	2700.5	2.027
1681.5	10.97	2701.	2.003
1682.	10.97	2701.5	2.027
1682.5	10.95	2702.	2.027
1683.	10.93	2702.5	2.027
1683.5	10.9	2703.	2.027
1684.	10.88	2703.5	2.003
1684.5	10.85	2704.	2.027
1685.	10.85	2704.5	2.027
1685.5	10.81	2705.	2.027
1686.	10.81	2705.5	2.003
1686.5	10.78	2706.	2.003
1687.	10.78	2706.5	2.003
1687.5	10.76	2707.	2.003
1688.	10.73	2707.5	2.003
1688.5	10.71	2708.	2.003
1689.	10.69	2708.5	2.003
1689.5	10.66	2709.	2.003
1690.	10.64	2709.5	2.003
1690.5	10.64	2710.	2.003
1691.	10.62	2710.5	2.003
1691.5	10.59	2711.	2.003
1692.	10.57	2711.5	2.003
1692.5	10.57	2712.	2.003
1693.	10.54	2712.5	2.003
1693.5	10.52	2713.	2.003
1694.	10.5	2713.5	2.003
1694.5	10.5	2714.	2.003
1695.	10.47	2714.5	1.98
1695.5	10.45	2715.	2.003
1696.	10.43	2715.5	1.98
1696.5	10.4	2716.	2.003
1697.	10.38	2716.5	2.003
1697.5	10.38	2717.	2.003
1698.	10.35	2717.5	2.003

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1698.5	10.33	2718.	2.003
1699.	10.31	2718.5	2.003
1699.5	10.31	2719.	2.003
1700.	10.28	2719.5	2.003
1700.5	10.26	2720.	2.003
1701.	10.26	2720.5	1.98
1701.5	10.23	2721.	2.003
1702.	10.21	2721.5	1.98
1702.5	10.19	2722.	1.98
1703.	10.19	2722.5	2.003
1703.5	10.16	2723.	1.98
1704.	10.14	2723.5	2.003
1704.5	10.12	2724.	1.98
1705.	10.09	2724.5	1.98
1705.5	10.09	2725.	1.98
1706.	10.07	2725.5	1.98
1706.5	10.07	2726.	1.98
1707.	10.04	2726.5	1.98
1707.5	10.02	2727.	1.98
1708.	9.996	2727.5	1.98
1708.5	9.972	2728.	1.98
1709.	9.948	2728.5	1.98
1709.5	9.948	2729.	1.98
1710.	9.924	2729.5	1.98
1710.5	9.924	2730.	1.98
1711.	9.9	2730.5	1.98
1711.5	9.876	2731.	1.98
1712.	9.852	2731.5	1.98
1712.5	9.852	2732.	1.98
1713.	9.829	2732.5	1.956
1713.5	9.805	2733.	1.98
1714.	9.805	2733.5	1.98
1714.5	9.781	2734.	1.98
1715.	9.757	2734.5	1.98
1715.5	9.757	2735.	1.98
1716.	9.733	2735.5	1.98
1716.5	9.709	2736.	1.98
1717.	9.709	2736.5	1.98
1717.5	9.685	2737.	1.956
1718.	9.662	2737.5	1.98
1718.5	9.662	2738.	1.98
1719.	9.638	2738.5	1.98
1719.5	9.614	2739.	1.98
1720.	9.614	2739.5	1.956
1720.5	9.59	2740.	1.956
1721.	9.566	2740.5	1.956
1721.5	9.566	2741.	1.956
1722.	9.519	2741.5	1.956
1722.5	9.519	2742.	1.956
1723.	9.495	2742.5	1.98
1723.5	9.495	2743.	1.956
1724.	9.471	2743.5	1.956
1724.5	9.447	2744.	1.956
1725.	9.423	2744.5	1.956
1725.5	9.423	2745.	1.956
1726.	9.423	2745.5	1.956
1726.5	9.399	2746.	1.956
1727.	9.375	2746.5	1.956
1727.5	9.375	2747.	1.956
1728.	9.352	2747.5	1.956
1728.5	9.328	2748.	1.956
1729.	9.304	2748.5	1.956
1729.5	9.304	2749.	1.956
1730.	9.28	2749.5	1.932
1730.5	9.28	2750.	1.956
1731.	9.256	2750.5	1.956
1731.5	9.232	2751.	1.956
1732.	9.232	2751.5	1.956
1732.5	9.208	2752.	1.932
1733.	9.185	2752.5	1.956

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1733.5	9.185	2753.	1.956
1734.	9.161	2753.5	1.956
1734.5	9.161	2754.	1.956
1735.	9.137	2754.5	1.932
1735.5	9.113	2755.	1.932
1736.	9.113	2755.5	1.932
1736.5	9.089	2756.	1.956
1737.	9.065	2756.5	1.956
1737.5	9.065	2757.	1.956
1738.	9.041	2757.5	1.956
1738.5	9.041	2758.	1.956
1739.	9.018	2758.5	1.932
1739.5	9.018	2759.	1.932
1740.	8.994	2759.5	1.956
1740.5	8.994	2760.	1.932
1741.	8.97	2760.5	1.932
1741.5	8.946	2761.	1.932
1742.	8.946	2761.5	1.932
1742.5	8.922	2762.	1.932
1743.	8.922	2762.5	1.932
1743.5	8.898	2763.	1.932
1744.	8.875	2763.5	1.932
1744.5	8.875	2764.	1.932
1745.	8.875	2764.5	1.932
1745.5	8.851	2765.	1.932
1746.	8.851	2765.5	1.932
1746.5	8.827	2766.	1.908
1747.	8.827	2766.5	1.908
1747.5	8.803	2767.	1.932
1748.	8.779	2767.5	1.932
1748.5	8.755	2768.	1.908
1749.	8.755	2768.5	1.908
1749.5	8.755	2769.	1.932
1750.	8.731	2769.5	1.932
1750.5	8.708	2770.	1.932
1751.	8.708	2770.5	1.932
1751.5	8.684	2771.	1.932
1752.	8.66	2771.5	1.908
1752.5	8.66	2772.	1.908
1753.	8.636	2772.5	1.932
1753.5	8.612	2773.	1.932
1754.	8.612	2773.5	1.932
1754.5	8.612	2774.	1.908
1755.	8.588	2774.5	1.932
1755.5	8.564	2775.	1.908
1756.	8.564	2775.5	1.932
1756.5	8.541	2776.	1.908
1757.	8.541	2776.5	1.932
1757.5	8.517	2777.	1.908
1758.	8.517	2777.5	1.908
1758.5	8.493	2778.	1.908
1759.	8.493	2778.5	1.908
1759.5	8.493	2779.	1.908
1760.	8.445	2779.5	1.908
1760.5	8.445	2780.	1.908
1761.	8.445	2780.5	1.908
1761.5	8.421	2781.	1.908
1762.	8.421	2781.5	1.932
1762.5	8.398	2782.	1.908
1763.	8.374	2782.5	1.908
1763.5	8.374	2783.	1.908
1764.	8.374	2783.5	1.908
1764.5	8.35	2784.	1.908
1765.	8.326	2784.5	1.908
1765.5	8.326	2785.	1.908
1766.	8.302	2785.5	1.908
1766.5	8.278	2786.	1.908
1767.	8.278	2786.5	1.908
1767.5	8.278	2787.	1.908
1768.	8.254	2787.5	1.908

<u>Time (min)</u>	<u>Displacement (ft)</u>	<u>Time (min)</u>	<u>Displacement (ft)</u>
1768.5	8.254	2788.	1.908
1769.	8.231	2788.5	1.908
1769.5	8.231	2789.	1.908
1770.	8.207	2789.5	1.908
1770.5	8.207	2790.	1.908
1771.	8.183	2790.5	1.884
1771.5	8.159	2791.	1.884
1772.	8.159	2791.5	1.908
1772.5	8.159	2792.	1.884
1773.	8.135	2792.5	1.908
1773.5	8.135	2793.	1.908
1774.	8.135	2793.5	1.908
1774.5	8.111	2794.	1.908
1775.	8.087	2794.5	1.908
1775.5	8.087	2795.	1.908
1776.	8.064	2795.5	1.908
1776.5	8.062	2796.	1.908
1777.	8.04	2796.5	1.884
1777.5	8.04	2797.	1.884
1778.	8.04	2797.5	1.908
1778.5	8.016	2798.	1.884
1779.	8.016	2798.5	1.908
1779.5	7.992	2799.	1.884
1780.	7.968	2799.5	1.884
1780.5	7.968	2800.	1.884
1781.	7.968	2800.5	1.884
1781.5	7.944	2801.	1.884
1782.	7.92	2801.5	1.884
1782.5	7.92	2802.	1.884
1783.	7.92	2802.5	1.884
1783.5	7.897	2803.	1.884
1784.	7.897	2803.5	1.884
1784.5	7.873	2804.	1.884
1785.	7.849	2804.5	1.884
1785.5	7.873	2805.	1.884
1786.	7.849	2805.5	1.908
1786.5	7.849	2806.	1.884
1787.	7.825	2806.5	1.884
1787.5	7.801	2807.	1.884
1788.	7.801	2807.5	1.884
1788.5	7.777	2808.	1.884
1789.	7.777	2808.5	1.884
1789.5	7.777	2809.	1.884
1790.	7.754	2809.5	1.884
1790.5	7.73	2810.	1.884
1791.	7.73	2810.5	1.884
1791.5	7.706	2811.	1.884
1792.	7.706	2811.5	1.884
1792.5	7.706	2812.	1.884
1793.	7.682	2812.5	1.884
1793.5	7.682	2813.	1.884
1794.	7.658	2813.5	1.884
1794.5	7.658	2814.	1.884
1795.	7.658	2814.5	1.884
1795.5	7.634	2815.	1.884
1796.	7.634	2815.5	1.884
1796.5	7.634	2816.	1.884
1797.	7.61	2816.5	1.884
1797.5	7.61	2817.	1.884
1798.	7.587	2817.5	1.86
1798.5	7.563	2818.	1.884
1799.	7.563	2818.5	1.884
1799.5	7.539	2819.	1.884
1800.	7.539	2819.5	1.884
1800.5	7.539	2820.	1.884
1801.	7.515	2820.5	1.86
1801.5	7.515	2821.	1.884
1802.	7.491	2821.5	1.86
1802.5	7.491	2822.	1.86
1803.	7.491	2822.5	1.884

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1803.5	7.467	2823.	1.884
1804.	7.443	2823.5	1.86
1804.5	7.443	2824.	1.884
1805.	7.443	2824.5	1.86
1805.5	7.443	2825.	1.86
1806.	7.42	2825.5	1.86
1806.5	7.396	2826.	1.884
1807.	7.396	2826.5	1.884
1807.5	7.396	2827.	1.86
1808.	7.372	2827.5	1.86
1808.5	7.372	2828.	1.86
1809.	7.372	2828.5	1.86
1809.5	7.348	2829.	1.884
1810.	7.348	2829.5	1.86
1810.5	7.348	2830.	1.86
1811.	7.324	2830.5	1.86
1811.5	7.3	2831.	1.86
1812.	7.3	2831.5	1.86
1812.5	7.3	2832.	1.86
1813.	7.277	2832.5	1.86
1813.5	7.277	2833.	1.86
1814.	7.253	2833.5	1.884
1814.5	7.253	2834.	1.86
1815.	7.253	2834.5	1.86
1815.5	7.229	2835.	1.86
1816.	7.229	2835.5	1.86
1816.5	7.205	2836.	1.86
1817.	7.205	2836.5	1.86
1817.5	7.181	2837.	1.86
1818.	7.181	2837.5	1.86
1818.5	7.181	2838.	1.86
1819.	7.157	2838.5	1.86
1819.5	7.157	2839.	1.86
1820.	7.157	2839.5	1.86
1820.5	7.133	2840.	1.86
1821.	7.133	2840.5	1.86
1821.5	7.11	2841.	1.86
1822.	7.11	2841.5	1.86
1822.5	7.11	2842.	1.86
1823.	7.11	2842.5	1.86
1823.5	7.086	2843.	1.86
1824.	7.062	2843.5	1.86
1824.5	7.062	2844.	1.86
1825.	7.062	2844.5	1.86
1825.5	7.038	2845.	1.86
1826.	7.038	2845.5	1.86
1826.5	7.014	2846.	1.86
1827.	7.038	2846.5	1.86
1827.5	7.014	2847.	1.86
1828.	6.99	2847.5	1.86
1828.5	6.99	2848.	1.836
1829.	6.99	2848.5	1.86
1829.5	6.99	2849.	1.86
1830.	6.966	2849.5	1.836
1830.5	6.966	2850.	1.86
1831.	6.943	2850.5	1.86
1831.5	6.943	2851.	1.86
1832.	6.943	2851.5	1.836
1832.5	6.919	2852.	1.836
1833.	6.919	2852.5	1.836
1833.5	6.895	2853.	1.86
1834.	6.895	2853.5	1.836
1834.5	6.893	2854.	1.836
1835.	6.871	2854.5	1.836
1835.5	6.847	2855.	1.836
1836.	6.847	2855.5	1.836
1836.5	6.847	2856.	1.836
1837.	6.847	2856.5	1.836
1837.5	6.823	2857.	1.836
1838.	6.823	2857.5	1.836

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1838.5	6.823	2858.	1.836
1839.	6.799	2858.5	1.836
1839.5	6.799	2859.	1.86
1840.	6.799	2859.5	1.836
1840.5	6.776	2860.	1.836
1841.	6.776	2860.5	1.836
1841.5	6.776	2861.	1.86
1842.	6.752	2861.5	1.836
1842.5	6.752	2862.	1.836
1843.	6.728	2862.5	1.836
1843.5	6.726	2863.	1.836
1844.	6.728	2863.5	1.836
1844.5	6.704	2864.	1.836
1845.	6.702	2864.5	1.836
1845.5	6.704	2865.	1.836
1846.	6.68	2865.5	1.836
1846.5	6.678	2866.	1.836
1847.	6.68	2866.5	1.836
1847.5	6.654	2867.	1.836
1848.	6.656	2867.5	1.836
1848.5	6.656	2868.	1.836
1849.	6.633	2868.5	1.836
1849.5	6.633	2869.	1.836
1850.	6.609	2869.5	1.836
1850.5	6.609	2870.	1.836
1851.	6.609	2870.5	1.836
1851.5	6.607	2871.	1.836
1852.	6.585	2871.5	1.836
1852.5	6.585	2872.	1.836
1853.	6.585	2872.5	1.836
1853.5	6.561	2873.	1.813
1854.	6.561	2873.5	1.813
1854.5	6.537	2874.	1.836
1855.	6.537	2874.5	1.813
1855.5	6.535	2875.	1.813
1856.	6.511	2875.5	1.813
1856.5	6.513	2876.	1.836
1857.	6.513	2876.5	1.813
1857.5	6.489	2877.	1.836
1858.	6.489	2877.5	1.836
1858.5	6.489	2878.	1.813
1859.	6.489	2878.5	1.813
1859.5	6.466	2879.	1.813
1860.	6.466	2879.5	1.813
1860.5	6.466	2880.	1.813
1861.	6.442	2880.5	1.813
1861.5	6.442	2881.	1.813
1862.	6.442	2881.5	1.813
1862.5	6.418	2882.	1.813
1863.	6.418	2882.5	1.813
1863.5	6.394	2883.	1.813
1864.	6.394	2883.5	1.813
1864.5	6.394	2884.	1.813
1865.	6.37	2884.5	1.813
1865.5	6.394	2885.	1.813
1866.	6.37	2885.5	1.813
1866.5	6.37	2886.	1.813
1867.	6.346	2886.5	1.813
1867.5	6.346	2887.	1.813
1868.	6.346	2887.5	1.813
1868.5	6.322	2888.	1.789
1869.	6.322	2888.5	1.813
1869.5	6.299	2889.	1.813
1870.	6.299	2889.5	1.793
1870.5	6.299	2890.	1.815
1871.	6.299	2890.5	1.789
1871.5	6.275	2891.	1.813
1872.	6.275		

SOLUTION

Pumping Test
 Aquifer Model: Fractured
 Solution Method: Gringarten-Ramey w/horizontal fracture

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
Kr	0.0001819	ft/min
Ss	0.0147	ft ⁻¹
Kz/Kr	0.93	
Rf	1.	ft

K = 9.242E-5 cm/sec

T = K*b = 0.01092 ft²/min (0.169 sq. cm/sec)

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	
Kr	0.0009039	0.0004893	+/- 0.000959	1.847	ft/min
Ss	0.00536	0.008619	+/- 0.01689	0.6219	ft ⁻¹
Kz/Kr	0.93	not estimated			
Rf	7.003	3.791	+/- 7.43	1.847	ft

C.I. is approximate 95% confidence interval for parameter

t-ratio = estimate/std. error

No estimation window

K = 0.0004592 cm/sec

T = K*b = 0.05423 ft²/min (0.8398 sq. cm/sec)

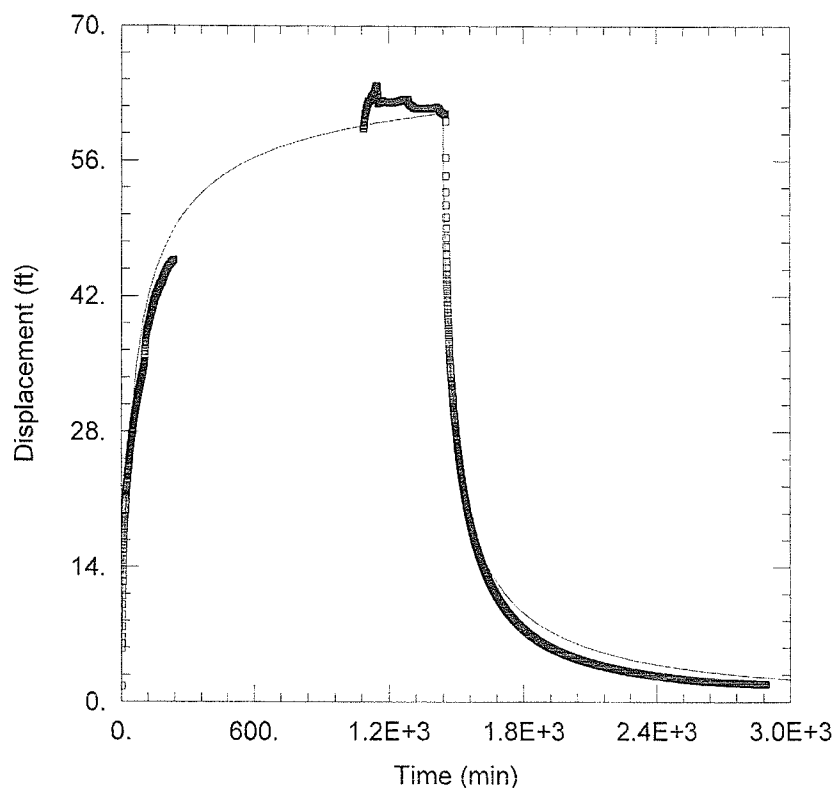
Parameter Correlations

	Kr	Ss	Rf
Kr	1.00	1.00	-1.00
Ss	1.00	1.00	-1.00
Rf	-1.00	-1.00	1.00

Residual Statistics

for weighted residuals

Sum of Squares 1.471E+4 ft²
 Variance 3.61 ft²
 Std. Deviation 1.9 ft
 Mean -0.8359 ft
 No. of Residuals 4077
 No. of Estimates 3



WELL TEST ANALYSIS

Data Set: P:\...Well2 Only 10gpm.aqt

Date: 02/06/17

Time: 13:46:39

PROJECT INFORMATION

Company: TERRASAT

Client: Big Country EnterprisesLC

Project: 21607

Location: Anchorage, Alaska

Test Well: LCW-2

Test Date: 1/24/17

AQUIFER DATA

Saturated Thickness: 60. ft

Fracture Radius: 7.003 ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
LCW-2	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ LCW-2	0	0

SOLUTION

Aquifer Model: Fractured

Solution Method: Gringarten (Horizontal)

Kr = 0.0009039 ft/min

Ss = 0.00536 ft⁻¹

Kz/Kr = 0.93

Rf = 7.003 ft

Data Set: P:\2016 Projects\21607 - Lewis & Clark Subd Hydrogeology - Big Country Ent\REPORTS\MAIN REPORT
 Title: LCW-3 Pump & Recovery Test
 Date: 02/14/17
 Time: 11:02:08

PROJECT INFORMATION

Company: TERRASAT
 Client: Big Country EnterprisesLC
 Project: 21607
 Location: Anchorage, Alaska
 Test Date: 1/28/17
 Test Well: LCW-3

AQUIFER DATA

Saturated Thickness: 25. ft
 Anisotropy Ratio (Kz/Kr): 0.93
 Slab Block Thickness: 1. ft
 Spherical Block Diameter: 1. ft
 Fracture Length: 1.743 ft
 Fracture Radius: 5.775 ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: LCW-3

X Location: 0. ft
 Y Location: 0. ft

Casing Radius: 0.25 ft
 Well Radius: 0.25 ft

Fully Penetrating Well

No. of pumping periods: 4

Pumping Period Data			
Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	5.	1441.	0.
1440.	5.	2880.	0.

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: LCW-3

X Location: 0. ft
 Y Location: 0. ft

Radial distance from LCW-3: 0. ft

Fully Penetrating Well

No. of Observations: 122

Observation Data			
Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.5	2.051	1441.5	85.86
1.5	2.982	1442.	84.96
2.	3.411	1442.5	84.17
2.5	3.743	1443.	83.41
3.	4.293	1443.5	82.72
3.5	5.39	1444.	82.03
4.	6.009	1444.5	81.33
4.5	6.511	1445.	80.69
5.	7.012	1445.5	80.09
5.5	7.678	1446.	79.52

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
6.	8.275	1446.5	78.97
6.5	9.229	1447.	78.43
7.	10.35	1447.5	77.93
7.5	11.49	1448.	77.45
8.	12.74	1448.5	76.97
8.5	13.43	1449.	76.52
9.	13.86	1449.5	76.05
9.5	14.05	1450.	75.6
10.	14.31	1450.5	75.17
11.	14.74	1451.	74.81
12.	15.62	1451.5	74.48
13.	16.36	1452.5	73.86
14.	16.96	1453.5	73.22
15.	17.5	1454.5	72.5
16.	17.96	1455.5	71.65
21.	20.06	1456.5	70.79
26.	20.89	1461.5	67.14
31.	21.42	1466.5	64.04
36.	22.02	1471.5	61.2
41.	30.12	1476.5	58.78
46.	33.75	1481.5	56.28
51.	36.68	1486.5	54.06
56.	39.02	1491.5	52.05
61.	41.1	1496.5	50.17
91.	52.28	1501.5	48.42
121.	59.29	1531.5	40.07
151.	63.4	1561.5	33.99
181.	71.27	1591.5	29.53
211.	76.75	1621.5	25.97
241.	80.19	1651.5	23.21
271.	82.	1681.5	21.04
301.	83.5	1711.5	19.25
361.	85.13	1741.5	17.7
421.	84.48	1801.5	15.5
481.	84.84	1861.5	14.07
541.	85.44	1921.5	12.66
601.	86.63	1981.5	11.71
661.	87.7	2041.5	10.97
721.	88.27	2101.5	10.3
781.	87.75	2161.5	9.706
841.	86.89	2221.5	9.157
901.	86.8	2281.5	8.68
961.	86.91	2341.5	8.275
1021.	87.11	2401.5	7.869
1081.	87.3	2461.5	7.917
1141.	87.51	2521.5	7.631
1201.	87.7	2581.5	7.344
1261.	87.84	2641.5	7.368
1321.	88.01	2701.5	7.297
1381.	88.15	2761.5	7.201
1441.	88.73	2821.5	7.082

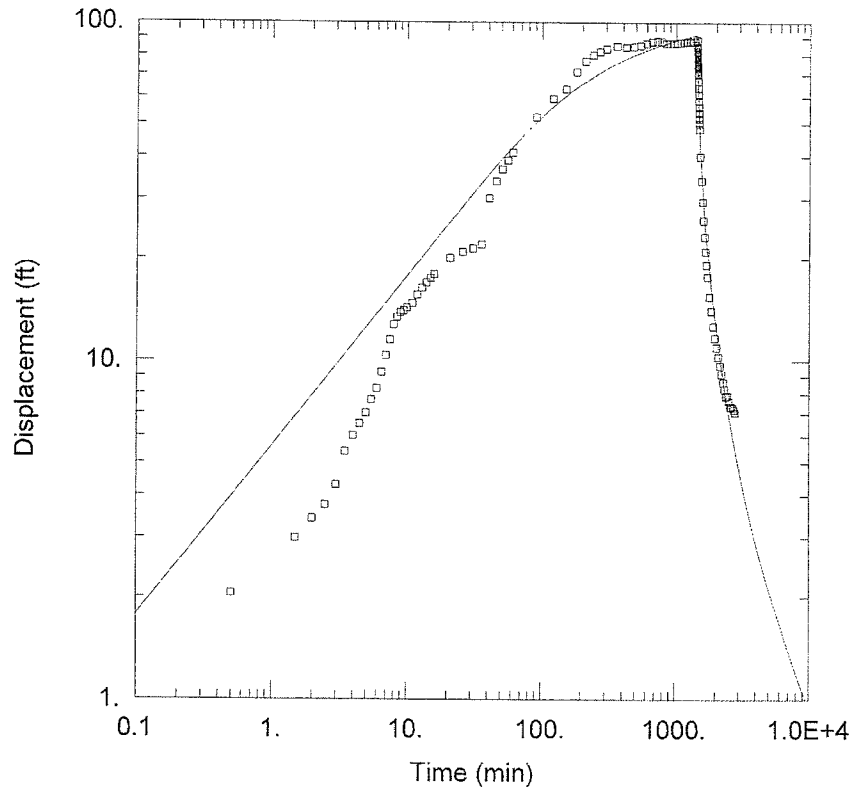
SOLUTION

Pumping Test
 Aquifer Model: Fractured
 Solution Method: Gringarten-Ramey w/horizontal fracture

VISUAL ESTIMATION RESULTSEstimated Parameters

Parameter	Estimate	
Kr	0.0003473	ft/min
Ss	0.005101	ft ⁻¹
Kz/Kr	0.93	
Rf	5.775	ft

K = 0.0001764 cm/sec
 T = K*b = 0.008683 ft²/min (0.1344 sq. cm/sec)



LCW-3 PUMP & RECOVERY TEST

Data Set: P:\...Well3 Only 5gpm.aqt

Date: 02/07/17

Time: 09:21:24

PROJECT INFORMATION

Company: TERRASAT

Client: Big Country EnterprisesLC

Project: 21607

Location: Anchorage, Alaska

Test Well: LCW-3

Test Date: 1/28/17

AQUIFER DATA

Saturated Thickness: 25. ft

Fracture Radius: 5.775 ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
LCW-3	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ LCW-3	0	0

SOLUTION

Aquifer Model: Fractured

Solution Method: Gringarten (Horizontal)

Kr = 0.0003473 ft/min

Ss = 0.005101 ft⁻¹

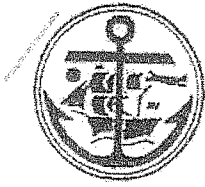
Kz/Kr = 0.93

Rf = 5.775 ft

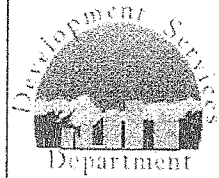
APPENDIX F

MOA On-Site Services
Well Permit Documents

On-Site Water System Permit



MUNICIPALITY OF ANCHORAGE
Development Services Department
On-Site Water & Wastewater Program
4700 Elmore Road, PO Box 196650
Anchorage, AK 99519-6650
Telephone: (907) 343-7904



Permit Number: OSP161274
Tax Code Number: 01707306000
Work Type: Well Initial
Permit Effective Dates: September 29, 2016 to September 29, 2017

Design Engineer:
Subdivision: T12N R3W SEC 25

Site Legal Address: T12N R3W SEC 25 S2W2NW4SE4 & E2NW4SE4 & NE4SE4 G:2941

Owner/Address: BIG COUNTRY ENTERPRISES LLC *Proposed Lewis & Clark L19*
4700 E 147TH AVENUE ANCHORAGE AK 995160000

Site Mailing Address:

Lot Size in Sq Ft: 2954675
Total Bedrooms: 1

This permit is for the construction of:

N Disposal Field N Septic Tank N Holding Tank N Privy Y Private Well N Water Storage

All construction must be in accordance with:

1. The attached approved design.
2. All requirements specified in Anchorage Municipal code Chapters 15.55 and 15.65 and the State of Alaska Wastewater Disposal Regulations (18AAC72) and Drinking Water Regulations (18AAC80).
3. The wastewater code requires inspections during the installation. The engineer must notify the Development Services Department at least 2 hours prior to each inspection. Provide notification by calling (907) 343-7904 (24 hours).
4. From October 15 to April 15, a subsurface soil absorption system under construction during freezing weather must either:
 - A. Open and Close on the same day.
 - B. Covered, sealed, and heated to prevent freezing.

Special Provisions: When well testing is complete, the well driller shall place an approved sanitary seal on the well head and no pitless adapter or pump shall be installed until an approved wastewater disposal system has been constructed.

Received By:

Date:

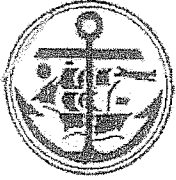
9/29/16

Issued By:

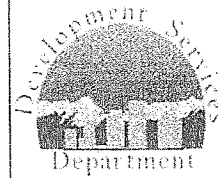
Date:

9/29/16

On-Site Water System Permit



MUNICIPALITY OF ANCHORAGE
Development Services Department
On-Site Water & Wastewater Program
4700 Elmore Road, PO Box 196650
Anchorage, AK 99519-6650
Telephone: (907) 343-7904



Permit Number: OSP161273
Tax Code Number: 01707306000
Work Type: Well Initial
Permit Effective Dates: September 29, 2016 to September 29, 2017

Design Engineer:
Subdivision: T12N R3W SEC 25

Site Legal Address: T12N R3W SEC 25 S2W2NW4SE4 & E2NW4SE4 & NE4SE4 G:2941

Owner/Address: *Proposed Lewis and Clark L20*
BIG COUNTRY ENTERPRISES LLC
4700 E 147TH AVENUE ANCHORAGE AK 995160000

Site Mailing Address: Lot Size in Sq Ft: 2954675
Total Bedrooms: 1

This permit is for the construction of:

N Disposal Field N Septic Tank N Holding Tank N Privy Y Private Well N Water Storage

All construction must be in accordance with:

1. The attached approved design.
2. All requirements specified in Anchorage Municipal code Chapters 15.55 and 15.65 and the State of Alaska Wastewater Disposal Regulations (18AAC72) and Drinking Water Regulations (18AAC80).
3. The wastewater code requires inspections during the installation. The engineer must notify the Development Services Department at least 2 hours prior to each inspection. Provide notification by calling (907) 343-7904 (24 hours).
4. From October 15 to April 15, a subsurface soil absorption system under construction during freezing weather must either:
 - A. Open and Close on the same day.
 - B. Covered, sealed, and heated to prevent freezing.

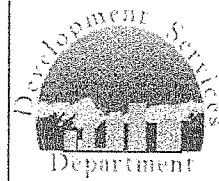
Special Provisions: When well testing is complete, the well driller shall place an approved sanitary seal on the well head and no pitless adapter or pump shall be installed until an approved wastewater disposal system has been constructed.

Received By: *[Signature]* Date: 9/29/16
Issued By: *[Signature]* Date: 9/29/16



On-Site Water System Permit

MUNICIPALITY OF ANCHORAGE
Development Services Department
On-Site Water & Wastewater Program
4700 Elmore Road, PO Box 196650
Anchorage, AK 99519-6650
Telephone: (907) 343-7904



Permit Number: OSP161272
Tax Code Number: 01707306000
Work Type: Well Initial
Permit Effective Dates: September 29, 2016 to September 29, 2017

Design Engineer:

Subdivision: T12N R3W SEC 25

Site Legal Address: T12N R3W SEC 25 S2W2NW4SE4 & E2NW4SE4 & NE4SE4 G:2941

Owner/Address: BIG COUNTRY ENTERPRISES LLC
Proposed Lewis & Clark L21
4700 E 147TH AVENUE ANCHORAGE AK 995160000

Site Mailing Address:

Lot Size in Sq Ft: 2954675
Total Bedrooms: 1

This permit is for the construction of:

N Disposal Field N Septic Tank N Holding Tank N Privy Y Private Well N Water Storage

All construction must be in accordance with:

1. The attached approved design.
2. All requirements specified in Anchorage Municipal code Chapters 15.55 and 15.65 and the State of Alaska Wastewater Disposal Regulations (18AAC72) and Drinking Water Regulations (18AAC80).
3. The wastewater code requires inspections during the installation. The engineer must notify the Development Services Department at least 2 hours prior to each inspection. Provide notification by calling (907) 343-7904 (24 hours).
4. From October 15 to April 15, a subsurface soil absorption system under construction during freezing weather must either:
 - A. Open and Close on the same day.
 - B. Covered, sealed, and heated to prevent freezing.

Special Provisions: When well testing is complete, the well driller shall place an approved sanitary seal on the well head and no pitless adapter or pump shall be installed until an approved wastewater disposal system has been constructed.

Received By:

Date:

9/29/16

Issued By:

Date:

9/29/16

APPENDIX G

ADNR Temporary Water-Use Permit Approval Documents

DIVISION OF MINING, LAND AND WATER
WATER RESOURCES SECTION
www.dnr.state.ak.us/mlw/water/index.htm



Anchorage Office 550 West 7 th Avenue, Suite 1020 Anchorage, AK 99501-3562 (907) 269-8600 Fax: (907) 269-8947	Juneau Office PO Box 111020 400 Willoughby Avenue Juneau, AK 99811-1020 (907) 465-3400 Fax: (907) 586-2954	Fairbanks Office 3700 Airport Way Fairbanks, AK 99709-4699 (907) 451-2790 Fax: (907) 451-2703	For ADNR Use Only Date/Time Stamp
For ADNR Use Only TWUP #	For ADNR Use Only CID #	For ADNR Use Only Receipt Type WR	

APPLICATION FOR TEMPORARY USE OF WATER

INSTRUCTIONS

1. Complete one application for each project including up to five water sources (incomplete applications will not be accepted).
2. Attach legible map that includes meridian, township, range, and section lines such as a USGS topographical quadrangle or subdivision plat. Indicate water withdrawal point(s), location(s) of water use, and point(s) of return flow or discharge (if applicable).
3. Attach sketch, photos, plans of water system, or project description (if applicable).
4. Attach driller's well log for drilled wells (if available).
5. Attach copy of ADNR fish habitat permit (if applicable).
6. Submit non-refundable fee (see page 4).

APPLICANT INFORMATION

Proposed Lewis and Clark Subdivision Well Installation			
Project Name			
Big Country Enterprises, LLC.		TERRASAT, Inc.	
Organization Name (if applicable)		Agent or Consultant Name (if applicable)	
Todd Brownson		Jeremy Stariwat	
Individual Name (if applicable)		Individual Co-applicant Name (if applicable)	
4203 Iowa Dr.	Anchorage	AK	99517
Mailing Address	City	State	Zip Code
907-344-3970			
Daytime Phone Number		Alternate Phone Number (optional)	
		jeremy@terrasatenvironmental.com	
Fax Number (if available)		E-Mail Address (optional)	

PROPERTY DESCRIPTIONS							
Location of Water Use							
Project Area (e.g. milepost range, place name, survey number)	Meridian	Township	Range	Section	Quarter Sections		
Corner of Upper De Armoun Rd. and Canyon Rd.	Seward	12N	3W	25	NW ¼	SE ¼	
					¼	¼	
Location of Water Source							
Geographic Name of Water Body or Well Depth	Meridian	Township	Range	Section	Quarter Sections		
Well 1 Groundwater (Well Depth Unknown)	Seward	12N	3W	25	NW ¼	SE ¼	
Well 2 Groundwater (Well Depth Unknown)	Seward	12N	3W	25	NW ¼	SE ¼	
Well 3 Groundwater (Well Depth Unknown)	Seward	12N	3W	25	NW ¼	SE ¼	
					¼	¼	
					¼	¼	
Location of Water Return Flow or Discharge (if applicable)							
Geographic Name of Water Body or Well Depth	Meridian	Township	Range	Section	Quarter Sections		
South and down gradient of wells into forested area	Seward	12N	3W	25	NW ¼	SE ¼	
					¼	¼	

METHOD OF TAKING WATER		
Pump	Pump Intake <u>Unknown</u> Inches Pump Output <u>5-15</u> GPM	Hours Working <u>24 Hours</u> Hours/Day Length of Pipe <u>Unknown</u> Feet (from pump to point of use)
Gravity	Pipe Diameter _____ Inches Head _____ Feet	Length of Pipe _____ Feet (take point to point of use)
Ditch	L _____ H _____ W _____ Feet	Diversion Rate _____ <input type="checkbox"/> GPM or <input type="checkbox"/> CFS
Reservoir	L _____ H _____ W _____ Feet	Water Storage _____ Acre-feet
Dam	L _____ H _____ W _____ Feet	Water Storage _____ Acre-feet

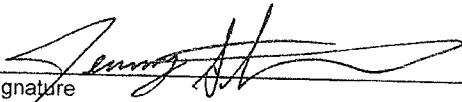
AMOUNT OF WATER					
Purpose of Water Use	Quantity of Water			Season of Use	
	Maximum Withdrawal Rate	Total Daily Amount	Total Seasonal Amount	Date Work Will Start	Date Work Will be Completed
Aquifer Pump Test Well 1	15 GPM	21,600	21,600	To Be Determined	To Be Determined
Aquifer Pump Test Well 2	15 GPM	21,600	21,600	To Be Determined	To Be Determined
Aquifer Pump Test Well 3	15 GPM	21,600	21,600		
Project Totals		64,800	64,800	Total years needed: 3 days	

PROJECT DESCRIPTION
What alternative water sources are available to your project should a portion of your requested diversion be excluded because of water shortage or public interest concerns? N/A. Three wells, currently being drilled as of 12/14/16, will be pump tested to determine if an adequate water supply exists for lots within a proposed subdivision.
Are there any surface water bodies or water wells at or near your site(s) that could be affected by the proposed activity? If yes, list any ground water monitoring programs going on at or near the sites, any water shortages or water quality problems in the area, and any information about the water table, if known. No. The most proximal stream is a tributary to Rabbit Creek approximately 1300 ft south of the three well locations. There are no down gradient water wells.
Briefly describe the type and size of equipment used to withdraw and transport water, including the amount of water the equipment uses or holds. A typical water well pump, capable of pumping at least 15 GPM, will be used. This will pump water up from the well and through a discharge hose draining down gradient (south) of the three well locations.
Briefly describe what changes at the project site and surrounding area will occur or are likely to occur because of construction or operation of your project (e.g. public access, streambed alteration, trenching, grading, excavation). Likely none. The area of discharge, south from the wells, is highly vegetated and undisturbed. No water wells are directly south and the most proximal stream is approximately 1300 ft away. Most likely the water will infiltrate into the ground as it flows south through the vegetated buffer.
Briefly describe land use around the water take, use, and return flow points (e.g. national park, recreational site, residential). The land is currently vegetated and undisturbed.
Will project be worked in phases? State reason for completion date. The project will be in three phases. As there are three water wells, each will be pumped for 24 hours and allowed to recover for 24 hours.
Briefly describe your entire project: The project is a proposed subdivision. Three water wells are to be installed on-site and tested to determine if there is adequate groundwater to supply residences.
(Attach extra page if needed.)

11 AAC 93.220 sets out the required information on the application and authorizes the department to consider any other information needed to process an application for a temporary use of water. This information is made a part of the state public water records and becomes public information under AS 40.25.110 and 40.25.120. Public information is open to inspection by you or any member of the public. A person who is the subject of the information may challenge its accuracy or completeness under AS 44.99.310, by giving a written description of the challenged information, the changes needed to correct it, and a name and address where the person can be reached. False statements made in an application for a benefit are punishable under AS 11.56.210.

SIGNATURE

The information presented in this application is true and correct to the best of my knowledge. I understand that no water right or priority is established per 11 AAC 93.210-220, that the water used remains subject to appropriation by others, and that a temporary water use authorization may be revoked if necessary to protect the water rights of other persons or the public interest.



Signature

Jeremy Stariwat

Name (please print)

12/14/16

Date

Project Geologist

Title (if applicable)

REFERENCES

Measurement Units

GPD = gallons per day

CFS = cubic feet per second

GPM = gallons per minute

AF = acre-feet

AFY = acre-feet per year (325,851 gallons/year)

AFD = acre-feet per day (325,851 gallons/day)

MGD = million gallons per day

Conversion Table

5,000 GPD=	30,000 GPD=	100,000 GPD=	500,000 GPD=	1,000,000 GPD=
0.01 CFS	0.05 CFS	0.2 CFS	0.8 CFS	1.5 CFS
3.47 GPM	20.83 GPM	69.4 GPM	347.2 GPM	694.4 GPM
5.60 AFY	33.60 AFY	112.0 AFY	560.1 AFY	1120.1 AFY
0.2 AFD	0.09 AFD	0.3 AFD	1.5 AFD	3.1 AFD
0.01 MGD	0.03 MGD	0.1 MGD	0.5 MGD	1.0 MGD

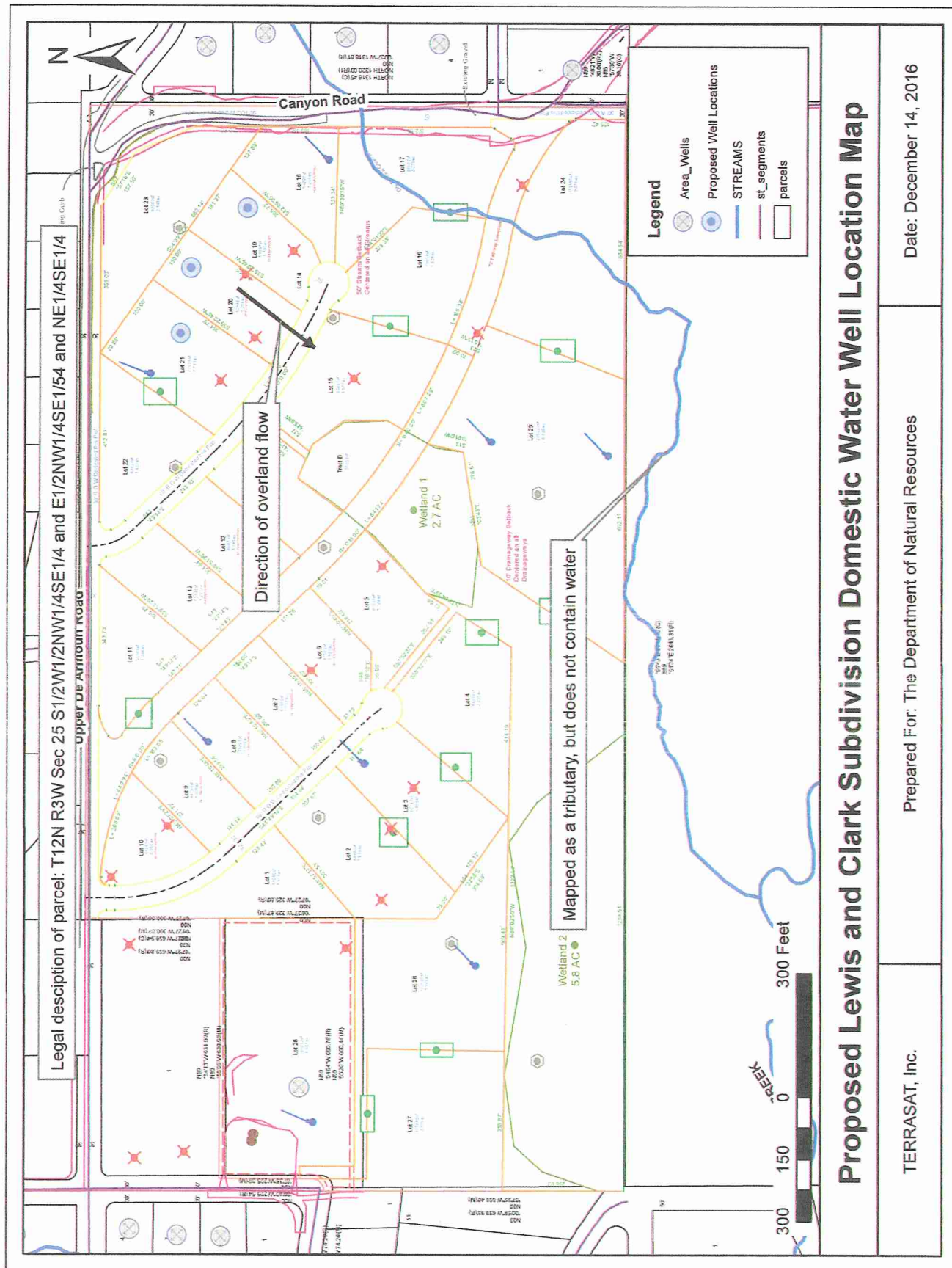
Fee required by regulation 11 AAC 05.010(a)(8)

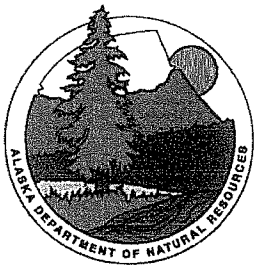
- \$350 for all uses of water from up to five water sources

Make checks payable to "Department of Natural Resources".

Coastal Zone

If this appropriation is within the Coastal Zone, and you are planning to use more than 1,000 GPD from a surface water source or 5,000 GPD from a subsurface water source, you need to submit a completed Coastal Project Questionnaire with this application. For more information on the Coastal Zone, contact the Office of Project Management and Permitting; Anchorage 269-7470, Juneau 465-3562, www.dnr.state.ak.us/acmp/.





ALASKA DEPARTMENT OF NATURAL RESOURCES

Division of Mining, Land, and Water

Water Resources Section

550 West 7th Avenue, Suite 1020, Anchorage, AK 99501-3562

TEMPORARY WATER USE AUTHORIZATION

TWUA A2016-123

Pursuant to AS 46.15, as amended and the rules and regulations promulgated thereunder, permission is hereby granted to TERRASAT, INC (authorization holder), 4203 Iowa Drive, Anchorage, AK 99517, and their contractors, to withdraw up to **64,800 gallons of water per season (with a maximum limit of 21,600 gallons of water per day)**, from the below described source of water. The water will be used for well tests at the planned Lewis & Clark Subdivision. The subdivision is in Anchorage, directly south/west of the corner of Upper De Armoun Road and Canyon Road. Water will be discharged onto the adjacent ground, which flows in a southwest direction.

SOURCES OF WATER

1. Well LCW-1, drilled 375 feet, located within SW¼, Section 25, Township 12 North, Range 3 West, Seward Meridian.
2. Well LCW-2, drilled 256 feet, located within SW¼, Section 25, Township 12 North, Range 3 West, Seward Meridian.
3. Well LCW-3, drilled 236 feet, located within SW¼, Section 25, Township 12 North, Range 3 West, Seward Meridian.

ADVISORY

The following prior appropriators (with addresses) are located within a ¼ mile of TWUA A2016-123:

1. ADL 42917/LAS 5793: 13351 View Heights Way, Anchorage, AK 99516
2. LAS 8862: 13440 View Heights Way, Anchorage, AK 99516
3. LAS 4314: 13391 Canyon Road, Anchorage, AK 99516
4. ADL 51668: 13215 Spendlove Dr, Anchorage, AK 99516
5. LAS 2225: 13481 Spendlove Dr, Anchorage, AK 99516
6. LAS 12531: 13641 Bonnielaine Rd, Anchorage, AK 99516
7. ADL 200347: 13341 Canyon Road, Anchorage, AK 99516
8. LAS 3922: 13035 Jeanne Rd, Anchorage, AK 99516
9. LAS 13449: 8601 Spendlove Dr, Anchorage, AK 99516
10. ADL 200565: 8701 Spendlove Dr, Anchorage, AK 99516
11. ADL 215139: 8740 Spendlove Dr, Anchorage, AK 99516
12. LAS 5725: 8901 Spendlove Dr, Anchorage, AK 99516
13. ADL 201716: 8731 Upper De Armoun Rd, Anchorage, AK 99516
14. LAS 30967: 8801 Upper De Armoun Rd, Anchorage, AK 99516
15. LAS 3587: 8831 Upper De Armoun Rd, Anchorage, AK 99516

Please see Condition 11 & Conditions 17, 18 and 19 regarding prior appropriators and the public interest.

STRUCTURES TO BE CONSTRUCTED AND USED

Pumps, pipes, and other water distribution equipment.

Changes in the natural state of water are to be made as stated herein and for the purposes indicated.

During the effective period of this authorization, the authorization holder shall comply with the following conditions:

CONDITIONS

1. This authorization does not authorize the authorization holder to enter upon any lands until proper rights-of-way, easements, or permission documents from the appropriate landowner have been obtained.
2. Follow acceptable engineering standards in exercising the privilege granted herein.
3. Comply with all applicable laws, and any rules and/or regulations issued thereunder.
4. Except for claims or losses arising from negligence of the State, defend and indemnify the State, the State's agents, and the State's employees against and hold each of them harmless from any and all claims, demands, suits, loss, liability and expense for injury to or death of persons and damages to or loss of property arising out of or connected with the exercise of the privileges covered by this authorization.
5. Notify the Water Resources Section upon change of address.
6. The authorization holder is responsible for obtaining and complying with other permits/approvals (state, federal, or local) that may be required prior to beginning water withdrawal pursuant to this authorization.
7. Failure to respond to a request for additional information during the term of the authorization may result in the termination of this authorization.
8. The authorization holder shall allow an authorized representative of the Water Resources Section to inspect, at reasonable times, any facilities, equipment, practices, or operations regulated or required under this authorization.
9. This authorization, or a copy thereof, shall be kept at the site of the authorized project described herein. The authorization holder is responsible for the actions of contractors, agents or other persons who perform work to accomplish the approved project, and shall ensure that workers are familiar with the requirements of this authorization. For any activity that significantly deviates from the approved project during its siting, construction, or operation, the authorization holder is required to contact the Water Resources Section and obtain approval before beginning the activity.
10. The Water Resources Section may modify this authorization to include different limitations, expand monitoring requirements, evaluate impacts, or require restoration at the site.
11. Pursuant to 11 AAC 93.220 (f), this authorization may be suspended by the Department of Natural Resources to protect the water rights of other persons or the public interest.
12. Any false statements or representations in any application, record, report, plan or other document filed or required to be maintained under this authorization may result in the termination of this authorization.
13. The authorization holder may not discharge water with petroleum, solvent, or any other contaminants into any surface or ground water. If contamination is encountered while exercising

this authorization, the authorization holder must notify Alaska Department of Environmental Conservation (ADEC) and Alaska Department of Natural Resources (DNR). Authorization holder shall cooperate with lawful prohibitions, restrictions, instructions or work plan requirements issued by ADEC Contaminated Sites/Response for authorization holder's projects.

14. Deviations from the project description submitted with the application which affect capacity, flow, operation or point of discharge must be approved by DNR in writing prior to implementation.
15. A well that is permanently decommissioned by the owner of the well must be in compliance with the requirements of 18 AAC 80.015(e). An abandonment report shall be submitted to this office and to the ADEC within 45 days of well decommissioning. As an alternative to permanent decommissioning, the authorization holder is encouraged to consider using the well to participate in the voluntary DNR, Alaska Hydrologic Survey, groundwater monitoring program. For further information on this program, contact melissa.hill@alaska.gov.
16. Monitoring and reporting of water withdrawal shall begin when the water withdrawal starts. Upon completion of the tests, raw data including: instrument calibration and/or manual verification checks, work plan (if available), baseline data, step test data, pumping data, recovery data, monitoring well identifications and coordinates, well lithologic logs and geophysical logs (if available) shall be submitted to the Alaska Department of Natural Resources, Water Resources Section within 45 days. Upon completion of the test, a final written report that includes the raw and processed data, including the analysis(es) shall be submitted to the Alaska Department of Natural Resources, Water Resources Section within 6 months. Reports may be submitted by mail to DNR-Water Resources Section or via email to: dnr.water.reports@alaska.gov
17. To insure that withdrawals do not unduly affect the rights of prior appropriators or the public interest, the authorization holder shall coordinate water withdrawals with all other authorized water users listed in the Advisory section, and with any additional immediate neighboring property owners.
18. A communication plan with prior appropriators and neighboring well owners will be submitted to DNR prior beginning pumping operations.
19. If any well owner notes interference during any pumping associated with TWUA A2016-123, work is to immediately cease and DNR-Water contacted. Pumping is not to resume until authorized by DNR-Water.
20. If rapid drawdown is noted in any pumping well or observation well, the test will immediately stop.
21. Record and report to this office all complaints relating to groundwater and surface discharge, including requests for information on groundwater data from local residents, should the situation occur.
22. Discharged water shall not create erosion, sedimentation or other hazards within adjacent or nearby properties, road rights-of-way, storm sewer systems or water bodies.
23. An application for a water right and/or authorization for these wells will be submitted to DNR at least 60 days prior to the wells being placed into production.

This Temporary Water Use Authorization is issued pursuant to 11 AAC 93.220. No water right or priority is established by a temporary water use authorization issued pursuant to 11 AAC 93.220. Water so used is subject to appropriation by others.

Pursuant to 11 AAC 93.210 (b), authorized temporary water use is subject to amendment, modification, or revocation by the Department of Natural Resources if the Department of Natural Resources determines that amendment, modification, or revocation is necessary to supply water to lawful appropriators of record or to protect the public interest.

This authorization shall expire on May 31, 2017.

Date issued: January 13, 2017

Approved: Henry C. B. [Signature]
Manager, South-Central Region, Water Management Unit
Water Resources Section, ADNR/DMLW

APPENDIX H

Water Sample
Laboratory Test Results



Laboratory Report of Analysis

To: Terrasat, Inc.
4203 Iowa Drive
Anchorage, AK 99517
(907)344-9370

Report Number: **1170452**

Client Project: **Lewis & Clark**

Dear Steve Smith,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Victoria at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Victoria Pennick
Project Manager
Victoria.Pennick@sgs.com

Date

Print Date: 02/10/2017 2:13:43PM

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Case Narrative

SGS Client: Terrasat, Inc.
SGS Project: 1170452
Project Name/Site: Lewis & Clark
Project Contact: Steve Smith

Refer to sample receipt form for information on sample condition.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Print Date: 02/10/2017 2:13:45PM

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Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) for which SGS North America Inc. is Provisionally Certified as of 2/8/2017 & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8015C, 8021B, 8082A, 8260C, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCC/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LLQC/LLIQC	Low Level Quantitation Check
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

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Sample Summary

<u>Client Sample ID</u>	<u>Lab Sample ID</u>	<u>Collected</u>	<u>Received</u>	<u>Matrix</u>
LCW-1	1170452001	01/31/2017	02/01/2017	Water (Surface, Eff., Ground)

<u>Method</u>	<u>Method Description</u>
EP200.8	Metals in Drinking Water by ICP-MS DISSO
SM21 4500NO3-F	Nitrate/Nitrite Flow injection Pres.
SM21 2540C	Total Dissolved Solids SM18 2540C

Print Date: 02/10/2017 2:13:48PM

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Detectable Results Summary

Client Sample ID: **LCW-1**

Lab Sample ID: 1170452001

Dissolved Metals by ICP/MS

Waters Department

<u>Parameter</u>	<u>Result</u>	<u>Units</u>
Calcium	27000	ug/L
Iron	1330	ug/L
Manganese	57.3	ug/L
Total Dissolved Solids	246	mg/L
Total Nitrate/Nitrite-N	1.12	mg/L

Print Date: 02/10/2017 2:13:49PM

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**Results of LCW-1**

Client Sample ID: **LCW-1**
Client Project ID: **Lewis & Clark**
Lab Sample ID: 1170452001
Lab Project ID: 1170452

Collection Date: 01/31/17 12:35
Received Date: 02/01/17 16:21
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by Dissolved Metals by ICP/MS

<u>Parameter</u>	<u>Result Qual</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>	<u>DF</u>	<u>Allowable Limits</u>	<u>Date Analyzed</u>
Calcium	27000	500	150	ug/L	1		02/10/17 10:07
Iron	1330	250	78.0	ug/L	1		02/10/17 10:07
Manganese	57.3	1.00	0.310	ug/L	1		02/10/17 10:07

Batch Information

Analytical Batch: MMS9690
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 02/10/17 10:07
Container ID: 1170452001-D

Prep Batch: MXX30478
Prep Method: E200 2
Prep Date/Time: 02/09/17 09:52
Prep Initial Wt/Vol: 20 mL
Prep Extract Vol: 50 mL

Print Date: 02/10/2017 2:13:59PM

J flagging is activated

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Results of LCW-1

Client Sample ID: **LCW-1**
Client Project ID: **Lewis & Clark**
Lab Sample ID: 1170452001
Lab Project ID: 1170452

Collection Date: 01/31/17 12:35
Received Date: 02/01/17 16:21
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by Waters Department

<u>Parameter</u>	<u>Result Qual</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>	<u>DF</u>	<u>Allowable Limits</u>	<u>Date Analyzed</u>
Total Dissolved Solids	246	10.0	3.10	mg/L	1		02/03/17 16:43

Batch Information

Analytical Batch: STS5355
Analytical Method: SM21 2540C
Analyst: AYC
Analytical Date/Time: 02/03/17 16:43
Container ID: 1170452001-B

<u>Parameter</u>	<u>Result Qual</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>	<u>DF</u>	<u>Allowable Limits</u>	<u>Date Analyzed</u>
Total Nitrate/Nitrite-N	1.12	0.100	0.0300	mg/L	2		02/06/17 17:32

Batch Information

Analytical Batch: WFI2537
Analytical Method: SM21 4500NO3-F
Analyst: AYC
Analytical Date/Time: 02/06/17 17:32
Container ID: 1170452001-A

Print Date: 02/10/2017 2:13:50PM

J flagging is activated

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Method Blank

Blank ID: MB for HBN 1753170 [MXX/30478]
Blank Lab ID: 1372557

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1170452001

Results by EP200.8

Parameter	Results	LOQ/CL	DL	Units
Calcium	250U	500	150	ug/L
Iron	125U	250	78.0	ug/L
Manganese	0.500U	1.00	0.310	ug/L

Batch Information

Analytical Batch: MMS9690
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 2/10/2017 9:49:40AM

Prep Batch: MXX30478
Prep Method: E200.2
Prep Date/Time: 2/9/2017 9:52:15AM
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Print Date: 02/10/2017 2:13:52PM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170452 [MXX30478]

Blank Spike Lab ID: 1372558

Date Analyzed: 02/10/2017 09:52

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170452001

Results by EP200.8

Blank Spike (ug/L)

Parameter	Spike	Result	Rec (%)	CL
Calcium	10000	10100	101	(85-115)
Iron	5000	5320	106	(85-115)
Manganese	500	520	104	(85-115)

Batch Information

Analytical Batch: MMS9690

Analytical Method: EP200.8

Instrument: Perkin Elmer Nexion P5

Analyst: VDL

Prep Batch: MXX30478

Prep Method: E200.2

Prep Date/Time: 02/09/2017 09:52

Spike Init Wt./Vol.: 10000 ug/L Extract Vol: 50 mL

Dupe Init Wt./Vol.: Extract Vol:

Print Date: 02/10/2017 2:13:53PM

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Matrix Spike Summary

Original Sample ID: 1372559
MS Sample ID: 1372560 MS
MSD Sample ID:

Analysis Date: 02/10/2017 10:07
Analysis Date: 02/10/2017 10:10
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1170452001

Results by EP200.8

Parameter	Sample	Matrix Spike (ug/L)			Spike Duplicate (ug/L)			CL	RPD (%)	RPD CL
		Spike	Result	Rec (%)	Spike	Result	Rec (%)			
Calcium	27000	10000	35700	86				70-130		
Iron	1330	5000	6530	104				70-130		
Manganese	57.3	500	583	105				70-130		

Batch Information

Analytical Batch: MMS9690
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexion P5
Analyst: VDL
Analytical Date/Time: 2/10/2017 10:10:37AM

Prep Batch: MXX30478
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 2/9/2017 9:52:15AM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 02/10/2017 2:13:55PM

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Method Blank

Blank ID: MB for HBN 1752894 [STS/5355]

Blank Lab ID: 1372459

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1170452001

Results by SM21 2540C

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Total Dissolved Solids	5.00U	10.0	3.10	mg/L

Batch Information

Analytical Batch: STS5355

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Analytical Date/Time: 2/3/2017 4:43:15PM

Print Date: 02/10/2017 2:13:55PM

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**Duplicate Sample Summary**

Original Sample ID: 1170417001

Duplicate Sample ID: 1372462

QC for Samples:

1170452001

Analysis Date: 02/03/2017 16:43

Matrix: Water (Surface, Eff., Ground)

Results by SM21 2540C

<u>NAME</u>	<u>Original</u>	<u>Duplicate</u>	<u>Units</u>	<u>RPD (%)</u>	<u>RPD CL</u>
Total Dissolved Solids	291	290	mg/L	0.34	(< 5)

Batch Information

Analytical Batch: STS5355

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Print Date: 02/10/2017 2:13:56PM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170452 [STS5355]

Blank Spike Lab ID: 1372460

Date Analyzed: 02/03/2017 16:43

Spike Duplicate ID: LCSD for HBN 1170452

[STS5355]

Spike Duplicate Lab ID: 1372461

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170452001

Results by SM21 2540C

Parameter	Blank Spike (mg/L)			Spike Duplicate (mg/L)			CL	RPD (%)	RPD CL
	Spike	Result	Rec (%)	Spike	Result	Rec (%)			
Total Dissolved Solids	330	319	97	330	331	100	(75-125)	3.70	(< 5)

Batch Information

Analytical Batch: STS5355

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Print Date: 02/10/2017 2:13:57PM

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**Method Blank**

Blank ID: MB for HBN 1753171 (WFI/2537)
Blank Lab ID: 1372575

Matrix: Water (Surface, Eff., Ground)

QC for Samples:
1170452001

Results by SM21 4500NO3-F

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Nitrate-N	0.0500U	0.100	0.0300	mg/L
Nitrite-N	0.0500U	0.100	0.0300	mg/L
Total Nitrate/Nitrite-N	0.0500U	0.100	0.0300	mg/L

Batch Information

Analytical Batch: WFI2537
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: AYC
Analytical Date/Time: 2/6/2017 5:19:54PM

Print Date: 02/10/2017 2:13:59PM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170452 [WFI2537]

Blank Spike Lab ID: 1372565

Date Analyzed: 02/06/2017 17:18

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170452001

Results by SM21 4500NO3-F

Parameter	Blank Spike (mg/L)			CL
	Spike	Result	Rec (%)	
Nitrate-N	2.5	2.60	104	(70-130)
Nitrite-N	2.5	2.50	100	(90-110)
Total Nitrate/Nitrite-N	5	5.10	102	(90-110)

Batch Information

Analytical Batch: WFI2537

Analytical Method: SM21 4500NO3-F

Instrument: Astoria segmented flow

Analyst: AYC

Print Date: 02/10/2017 2:14:01PM

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Matrix Spike Summary

Original Sample ID: 1170487001
MS Sample ID: 1372563 MS
MSD Sample ID: 1372564 MSD

Analysis Date: 02/06/2017 17:37
Analysis Date: 02/06/2017 17:39
Analysis Date: 02/06/2017 17:40
Matrix: Drinking Water

QC for Samples: 1170452001

Results by SM21 4500NO3-F

Parameter	Matrix Spike (mg/L)				Spike Duplicate (mg/L)					
	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Nitrate/Nitrite-N	3.52	5.00	8.33	96	5.00	8.36	97	90-110	0.40	(< 25)

Batch Information

Analytical Batch: WFI2537
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: AYC
Analytical Date/Time: 2/6/2017 5:35:09PM

Print Date: 02/10/2017 2:14:03PM

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CLIENT: Terrasat		Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.								
CONTACT: Steve Smith		Section 3								
PROJECT NAME: Lewis & Clark		Preservative								
REPORTS TO: Steve Smith		E-MAIL: steve@terrasatenvironmental.com								
INVOICE TO: Terrasat		QUOTE #: Open								
P.O. #: 21607										
RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX CODE	Pres: Type: Comp Grab Ml (Kali-Incre-mental)	Nitrate/Nitrite pres.	TDS	Diss Ca, Fe, Mn (200.8)	Lab Filter/Pres	REMARKS/LOC ID
DA	LCW-1	11/3/17	1235	W	6	X				60 ml - pres
DB	LCW-2	11/3/17	1235	W	6					500 ml
DC-D	LCW-1	11/3/17	1235	W	6					250 ml
Section 2										
Section 4										
Section 5										
Relinquished By: (1)		Date	Time	Received By:		Section 4				
Relinquished By: (2)		Date	Time	Received By:		DOD Project? Yes No				
Relinquished By: (3)		Date	Time	Received By:		Data Deliverable Requirements:				
Relinquished By: (4)		Date	Time	Received For Laboratory By:		Cooler ID: QC2/DV				
Requested Turnaround Time and/or Special Instructions: "Lab filter/pres" Diss Ca, Mn, Fe										
Temp Blank °C: 6.5 #D20 or Ambient []										
Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT										
(See attached Sample Receipt Form) (See attached Sample Receipt Form)										

200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

http://www.sgs.com/terms-and-conditions

Hand Delivered

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F083-Blank_COC_Templates_2015-03-19

☒ Client pickup Date: 1/18/2017 Time: _____

Be sure to ask if client will ship by ground (DOT) or air carrier (ATA)

☐ Deliver to client: _____

☐ Ship by/Air Carrier: _____

Airbill Number: _____

Date to ship by: _____

Notes: _____

Kit request taken by: VLJ Date: 1/16/2017

Kit prepared by: KW Date: 1-16-17

Kit (including lid tightness for pres'd bottles) checked by: FFT Date: Jan. 16, 2017

Kit packed & shipped by: KW Date: 1-16-17

Client Code: TERRAST Client Name: Terrastat		Does a Profile exist in LIMS? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Ordered By: Steve Smith Email: steve@tcrastatnowincidental.com	Phone #: 344-9370		
Project Name: Lewis & Clark	Deliverables: _____ Projects#: 21607		
Quote #: Open	Profile #: _____		
Delivery: _____	_____		

[illegible]

1. Do not rinse container before filling and be aware of any acid preservative in container.
2. Fill container to top, but do not overfill (except volatiles which should be headspace free).
3. Label the container with your sample/site ID, as well as the date & time of collection.
4. Fill in the Chain of Custody.
5. Add frozen gel packs or ice to your cooler & pack to prevent breakage.

Charges may be invoiced for bottles which are unused or improperly used.

If you have any questions concerning this sample kit, please contact your Project Manager for assistance. *Thank you.*

Other Notes/Reminders for Kit Prep:

☐ Pack for Shipping via ground (DOT)

☐ Pack for Shipping via air carrier (IATA)

☐ Temperature Blank (circle one: 120-mL OR 500-mL)

☐ Soil VOA Trip Blank - Lot#:

☐ Water VOA Trip Blank - Lot#:

☐ 524 VOA Trip Blank - Lot#:

☐ Low Level Mercury Trip Blank Lot#:

☐ Coolers

☐ Gel Ice (circle one: in each cooler OR in a separate cooler)

☐ Bubble Wrap

☐ Labels

☐ Custody Seals

☐ SGS COCs (Remember: 1 COC/10 sample) ☐ Blank COC

☐ Send additional instructions/documents (Note to PM: Be sure to include this note.)



e-Sample Receipt Form

SGS Workorder #:

1170452



Review Criteria		Condition (Yes, No, N/A)	Exceptions Noted below	
Chain of Custody / Temperature Requirements			<input checked="" type="checkbox"/> Yes	Exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location		N/A	ABSENT	
COC accompanied samples?		Yes		
<input checked="" type="checkbox"/> N/A **Exemption permitted if chilled & collected <8 hours ago, or for samples where chilling is not required				
Temperature blank compliant* (i.e., 0-6 °C after CF)?	<input checked="" type="checkbox"/> no	Cooler ID: 1	@	5.5 °C Therm. ID: D20
	<input checked="" type="checkbox"/> n/a	Cooler ID:	@	°C Therm. ID:
	<input checked="" type="checkbox"/> N/A	Cooler ID:	@	°C Therm. ID:
	<input checked="" type="checkbox"/> N/A	Cooler ID:	@	°C Therm. ID:
	<input checked="" type="checkbox"/> N/A	Cooler ID:	@	°C Therm. ID:
*If >6°C, were samples collected <8 hours ago?		<input checked="" type="checkbox"/> no	Proceed with analyses per the client.	
If <0°C, were sample containers ice free?		<input checked="" type="checkbox"/> n/a		
If samples received <u>without</u> a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "COOLER TEMP" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".				
Note: Identify containers received at non-compliant temperature. Use form FS-0029 if more space is needed.				
Holding Time / Documentation / Sample Condition Requirements			Note: Refer to form F-083 "Sample Guide" for specific holding times.	
Were samples received within holding time?		<input checked="" type="checkbox"/> Yes		
Do samples match COC** (i.e., sample IDs, dates/times collected)?		<input checked="" type="checkbox"/> Yes		
**Note: If times differ <1hr, record details & login per COC.				
Were analyses requested unambiguous? (i.e., method is specified for analyses with >1 option for analysis)		<input checked="" type="checkbox"/> Yes		
Were proper containers (type/mass/volume/preservative***) used?		<input checked="" type="checkbox"/> Yes		
		<input checked="" type="checkbox"/> n/a	***Exemption permitted for metals (e.g. 200.8/6020A).	
Volatile / LL-Hg Requirements				
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?		<input checked="" type="checkbox"/> n/a		
Were all water VOA vials free of headspace (i.e., bubbles ≤ 6mm)?		<input checked="" type="checkbox"/> n/a		
Were all soil VOAs field extracted with MeOH+BFB?		<input checked="" type="checkbox"/> n/a		
Note to Client: Any "No", answer above indicates non-compliance with standard procedures and may impact data quality.				
Additional notes (if applicable):				

F102b-15RF20m_20170131



Sample Containers and Preservatives

<u>Container Id</u>	<u>Preservative</u>	<u>Container Condition</u>	<u>Container Id</u>	<u>Preservative</u>	<u>Container Condition</u>
1170452001-A	H2SO4 to pH < 2	OK			
1170452001-B	No Preservative Required	OK			
1170452001-C	No Preservative Required	OK			
1170452001-D	HNO3 to pH < 2	PA			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.

BU - The container was received with headspace greater than 6mm.

DM- The container was received damaged.

FR- The container was received frozen and not usable for Bacteria or BOD analyses.

PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.



Laboratory Report of Analysis

To: Terrasat, Inc.
4203 Iowa Drive
Anchorage, AK 99517
(907)344-9370

Report Number: **1170368**

Client Project: **Lewis & Clark**

Dear Steve Smith,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Victoria at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Victoria Pennick
Project Manager
Victoria.Pennick@sgs.com

Date

Print Date: 02/09/2017 9:09:01AM

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Case Narrative

SGS Client: **Terrasat, Inc.**
SGS Project: **1170368**
Project Name/Site: **Lewis & Clark**
Project Contact: **Steve Smith**

Refer to sample receipt form for information on sample condition.

1170404001MS (1372050) MS

4500NO3F - Nitrate/Nitrite - MS recovery for Total NO₂/NO₃ (111%) does not meet QC criteria. Refer to LCS for accuracy requirements.

1170404001MSD (1372051) MSD

4500NO3F - Nitrate/Nitrite - MSD recovery for Total NO₂/NO₃ (112%) does not meet QC criteria. Refer to LCS for accuracy requirements.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Print Date: 02/09/2017 9:59:02AM

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Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8015C, 8021B, 8082A, 8260C, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LLQC/LLIQC	Low Level Quantitation Check
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

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Sample Summary

<u>Client Sample ID</u>	<u>Lab Sample ID</u>	<u>Collected</u>	<u>Received</u>	<u>Matrix</u>
LCW-2	1170368001	01/25/2017	01/25/2017	Water (Surface, Eff., Ground)

<u>Method</u>	<u>Method Description</u>
EP200.8	Metals in Drinking Water by ICP-MS DISSO
SM21 4500NO3-F	Nitrate/Nitrite Flow injection Pres.
SM21 2540C	Total Dissolved Solids SM18 2540C

Print Date: 02/09/2017 9:09:05AM

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Detectable Results Summary

Client Sample ID: **LCW-2**

Lab Sample ID: 1170368001

Dissolved Metals by ICP/MS

Waters Department

<u>Parameter</u>	<u>Result</u>	<u>Units</u>
Calcium	54900	ug/L
Manganese	4.67	ug/L
Total Dissolved Solids	286	mg/L
Total Nitrate/Nitrite-N	1.83	mg/L

Print Date: 02/09/2017 9:09:06AM

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Results of LCW-2

Client Sample ID: LCW-2
Client Project ID: Lewis & Clark
Lab Sample ID: 1170368001
Lab Project ID: 1170368

Collection Date: 01/25/17 11:12
Received Date: 01/25/17 16:07
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by Dissolved Metals by ICP/MS

Parameter	Result Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Calcium	54900	500	150	ug/L	1		02/06/17 14:03
Iron	125 U	250	78.0	ug/L	1		02/06/17 14:03
Manganese	4.67	1.00	0.310	ug/L	1		02/06/17 14:03

Batch Information

Analytical Batch: MMS9685
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 02/06/17 14:03
Container ID: 1170368001-D

Prep Batch: MXX30470
Prep Method: E200.2
Prep Date/Time: 02/01/17 12:30
Prep Initial Wt./Vol.: 20 mL
Prep Extract Vol: 50 mL

Print Date: 02/09/2017 9:09:07AM

J flagging is activated

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**Results of LCW-2**

Client Sample ID: **LCW-2**
Client Project ID: **Lewis & Clark**
Lab Sample ID: 1170368001
Lab Project ID: 1170368

Collection Date: 01/25/17 11:12
Received Date: 01/25/17 16:07
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by Waters Department

<u>Parameter</u>	<u>Result Qual</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>	<u>DF</u>	<u>Allowable Limits</u>	<u>Date Analyzed</u>
Total Dissolved Solids	286	10.0	3.10	mg/L	1		01/26/17 16:22

Batch Information

Analytical Batch: STS5348
Analytical Method: SM21 2540C
Analyst: AYC
Analytical Date/Time: 01/26/17 16:22
Container ID: 1170368001-B

<u>Parameter</u>	<u>Result Qual</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>	<u>DF</u>	<u>Allowable Limits</u>	<u>Date Analyzed</u>
Total Nitrate/Nitrite-N	1.83	0.100	0.0300	mg/L	2		01/30/17 16:33

Batch Information

Analytical Batch: WFI2536
Analytical Method: SM21 4500NO3-F
Analyst: AYC
Analytical Date/Time: 01/30/17 16:33
Container ID: 1170368001-A

Print Date: 02/09/2017 9:09:07AM

J flagging is activated

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Method Blank

Blank ID: MB for HBN 1752745 [MXX/30470]

Blank Lab ID: 1372160

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1170368001

Results by EP200.8

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Calcium	250U	500	150	ug/L
Iron	125U	250	78.0	ug/L
Manganese	0.500U	1.00	0.310	ug/L

Batch Information

Analytical Batch: MMS9685

Analytical Method: EP200.8

Instrument: Perkin Elmer Nexlon P5

Analyst: VDL

Analytical Date/Time: 2/6/2017 1:57:16PM

Prep Batch: MXX30470

Prep Method: E200.2

Prep Date/Time: 2/1/2017 12:30:13PM

Prep Initial Wt./Vol.: 20 mL

Prep Extract Vol: 50 mL

Print Date: 02/09/2017 9:09:06AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170368 [MXX30470]

Blank Spike Lab ID: 1372161

Date Analyzed: 02/06/2017 14:00

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170368001

Results by EP200.8

Parameter	Blank Spike (ug/L)			CL
	Spike	Result	Rec (%)	
Calcium	10000	10400	104	(85-115)
Iron	5000	5420	108	(85-115)
Manganese	500	542	108	(85-115)

Batch Information

Analytical Batch: MMS9685

Analytical Method: EP200.8

Instrument: Perkin Elmer Nexion P5

Analyst: VDL

Prep Batch: MXX30470

Prep Method: E200.2

Prep Date/Time: 02/01/2017 12:30

Spike Init Wt./Vol.: 10000 ug/L Extract Vol: 50 mL

Dupe Init Wt./Vol.: Extract Vol:

Print Date: 02/09/2017 9:09:14AM

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Matrix Spike Summary

Original Sample ID: 1372201
MS Sample ID: 1372202 MS
MSD Sample ID:

Analysis Date: 02/06/2017 14:03
Analysis Date: 02/06/2017 14:06
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1170368001

Results by EP200.8

Parameter	Sample	Matrix Spike (ug/L)			Spike Duplicate (ug/L)			CL	RPD (%)	RPD CL
		Spike	Result	Rec (%)	Spike	Result	Rec (%)			
Calcium	54900	10000	65300	104				70-130		
Iron	125U	5000	5360	107				70-130		
Manganese	4.67	500	546	108				70-130		

Batch Information

Analytical Batch: MMS9685
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexlon P5
Analyst: VDL
Analytical Date/Time: 2/6/2017 2:06:14PM

Prep Batch: MXX30470
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 2/1/2017 12:30:13PM
Prep Initial WL/Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 02/09/2017 9:09:16AM

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**Method Blank**

Blank ID: MB for HBN 1752622 [STS/5348]

Blank Lab ID: 1371676

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1170368001

Results by SM21 2540C

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Total Dissolved Solids	5.00U	10.0	3.10	mg/L

Batch Information

Analytical Batch: STS5348

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Analytical Date/Time: 1/26/2017 4:22:23PM

Print Date: 02/09/2017 9:09:16AM

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**Duplicate Sample Summary**

Original Sample ID: 1170349001

Duplicate Sample ID: 1371679

QC for Samples:

1170368001

Analysis Date: 01/26/2017 16:22

Matrix: Water (Surface, Eff., Ground)

Results by SM21 2540C

<u>NAME</u>	<u>Original</u>	<u>Duplicate</u>	<u>Units</u>	<u>RPD (%)</u>	<u>RPD CL</u>
Total Dissolved Solids	64.0	66.0	mg/L	3.10	(< 5)

Batch Information

Analytical Batch: STS5348

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Print Date: 02/09/2017 9:59:19AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170368 [STS5348]

Blank Spike Lab ID: 1371677

Date Analyzed: 01/26/2017 16:22

Spike Duplicate ID: LCSD for HBN 1170368

[STS5348]

Spike Duplicate Lab ID: 1371678

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170368001

Results by SM21 2540C

Parameter	Blank Spike (mg/L)			Spike Duplicate (mg/L)			CL	RPD (%)	RPD CL
	Spike	Result	Rec (%)	Spike	Result	Rec (%)			
Total Dissolved Solids	330	321	97	330	317	96	(75-125)	1.30	(< 5)

Batch Information

Analytical Batch: STS5348

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Print Date: 02/09/2017 9:09:20AM

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Method Blank

Blank ID: MB for HBN 1752717 (WFI/2536)

Blank Lab ID: 1372066

QC for Samples:

1170368001

Matrix: Water (Surface, Eff., Ground)

Results by SM21 4500NO3-F

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Nitrate-N	0.0500U	0.100	0.0300	mg/L
Nitrite-N	0.0500U	0.100	0.0300	mg/L
Total Nitrate/Nitrite-N	0.0500U	0.100	0.0300	mg/L

Batch Information

Analytical Batch: WFI2536

Analytical Method: SM21 4500NO3-F

Instrument: Astoria segmented flow

Analyst: AYC

Analytical Date/Time: 1/30/2017 4:05:39PM

Print Date: 02/09/2017 9:09:22AM

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Method Blank

Blank ID: MB for HBN 1752717 (WFI/2536)

Blank Lab ID: 1372068

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1170368001

Results by SM21 4500NO3-F

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Nitrate-N	0.0500U	0.100	0.0300	mg/L
Nitrite-N	0.0500U	0.100	0.0300	mg/L
Total Nitrate/Nitrite-N	0.0500U	0.100	0.0300	mg/L

Batch Information

Analytical Batch: WFI2536

Analytical Method: SM21 4500NO3-F

Instrument: Astoria segmented flow

Analyst: AYC

Analytical Date/Time: 1/30/2017 5:10:25PM

Print Date: 02/09/2017 9:09:22AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170368 [WFI2536]

Blank Spike Lab ID: 1372053

Date Analyzed: 01/30/2017 16:03

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170368001

Results by SM21 4500NO3-F

Parameter	Blank Spike (mg/L)			CL
	Spike	Result	Rec (%)	
Nitrate-N	2.5	2.45	98	(70-130)
Nitrite-N	2.5	2.58	103	(90-110)
Total Nitrate/Nitrite-N	5	5.03	101	(90-110)

Batch Information

Analytical Batch: WFI2536

Analytical Method: SM21 4500NO3-F

Instrument: Astoria segmented flow

Analyst: AYC

Print Date: 02/09/2017 9:05:23AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170368 [WFI2536]

Blank Spike Lab ID: 1372067

Date Analyzed: 01/30/2017 17:08

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170368001

Results by SM21 4500NO3-F

Parameter	Blank Spike (mg/L)			CL
	Spike	Result	Rec (%)	
Nitrate-N	2.5	2.55	102	(70-130)
Nitrite-N	2.5	2.62	105	(90-110)
Total Nitrate/Nitrite-N	5	5.17	103	(90-110)

Batch Information

Analytical Batch: WFI2536

Analytical Method: SM21 4500NO3-F

Instrument: Astoria segmented flow

Analyst: AYC

Print Date: 02/09/2017 9:09:23AM

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Matrix Spike Summary

Original Sample ID: 1170404001
MS Sample ID: 1372050 MS
MSD Sample ID: 1372051 MSD

Analysis Date: 01/30/2017 17:03
Analysis Date: 01/30/2017 17:05
Analysis Date: 01/30/2017 17:06
Matrix: Drinking Water

QC for Samples: 1170368001

Results by SM21 4500NO3-F

Parameter	Sample	Matrix Spike (mg/L)			Spike Duplicate (mg/L)			CL	RPD (%)	RPD CL
		Spike	Result	Rec (%)	Spike	Result	Rec (%)			
Total Nitrate/Nitrite-N	0.100U	5.00	5.53	111 *	5.00	5.61	112 *	90-110	1.40	(< 25)

Batch Information

Analytical Batch: WFI2536
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: AYC
Analytical Date/Time: 1/30/2017 5:05:10PM

Print Date: 02/09/2017 9:09:24AM

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CLIENT: Terrasat		Instructions: Sections 1 - 5 must be filled out. Omissions may delay the onset of analysis.								
CONTACT: Steve Smith		Section 3 Preservative								
PROJECT NAME: Lewis & Clark		Section 4								
REPORTS TO: Steve Smith		Section 5								
INVOICE TO: Terrasat		Section 6								
RESERVED for lab use	SAMPLE IDENTIFICATION	DATE mm/dd/yy	TIME HH:MM	MATRIX CODE	Pres. Type: Comp Grab M Multi-incre-mental	Nitrate/Nitrite pres.	TDS	Diss Ca, Fe, Mn (200.8)	Lab Filter/Pres	REMARKS/LOC ID
DA	LCW-2	1/23/17	11:12	W	G	X				60 ml - pres
DB	LCW-2	1/23/17	11:12	W	G		X			500 ml
DC-D	LCW-2	1/23/17	11:12	W	G			X		250 ml
Relinquished By: (1) <i>Steve Smith</i> Date 1/23/17 Time 16:07 Received By: _____										
Relinquished By: (2) _____ Date _____ Time _____ Received By: _____										
Relinquished By: (3) _____ Date _____ Time _____ Received By: _____										
Relinquished By: (4) _____ Date 1/23/17 Time 16:07 Received For Laboratory By: <i>mm</i>										
Temp Blank °C: 4.1 #238 or Ambient []										
Chain of Custody Seal: (Circle) INTACT BROKEN <u>ABSENT</u>										
(See attached Sample Receipt Form)										

[] 200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
[] 5500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557

http://www.sgs.com/terms-and-conditions

Hand Delivered

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F083-Blank_COC_Templates_2015-03-19



e-SAMPLE RECEIPT FORM

Review Criteria		Y/N (yes/no)	Exceptions Noted below
Were Custody Seals intact? Note # & location		<input type="checkbox"/>	<input checked="" type="checkbox"/> exemption permitted if sampler hand carries/delivers.
COC accompanied samples?		<input checked="" type="checkbox"/>	ABSENT
<input checked="" type="checkbox"/> **exemption permitted if chilled & collected <8hrs ago or chilling not required (i.e., waste, oil)		<input checked="" type="checkbox"/>	
Temperature blank compliant* (i.e., 0-6 °C after CF)?		<input checked="" type="checkbox"/>	Cooler ID: 1 @ 4.1 °C Therm ID: 238
		<input type="checkbox"/>	Cooler ID: @ °C Therm ID:
		<input type="checkbox"/>	Cooler ID: @ °C Therm ID:
		<input type="checkbox"/>	Cooler ID: @ °C Therm ID:
		<input type="checkbox"/>	Cooler ID: @ °C Therm ID:
*If >6°C, were samples collected <8 hours ago?		<input type="checkbox"/>	
If <0°C, were sample containers ice free?		<input type="checkbox"/>	
If samples received <u>without</u> a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "COOLER TEMP" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".			
Note: Identify containers received at non-compliant temperature. Use form FS-0029 if more space is needed.			
Were samples received within hold time?		<input checked="" type="checkbox"/>	Note: Refer to form F-083 "Sample Guide" for hold times.
Do samples match COC** (i.e., sample IDs, dates/times collected)?		<input checked="" type="checkbox"/>	The container labels were switched between the TDS and Metals containers per the client. They will be logged in and labelled correctly.
**Note: If times differ <1hr, record details & login per COC.			
Were analyses requested unambiguous?		<input checked="" type="checkbox"/>	
Were proper containers (type/mass/volume/preservative***) used?		<input checked="" type="checkbox"/>	***Exemption permitted for metals (e.g. 200.8/6020A).
IF APPLICABLE		<input type="checkbox"/>	Lab filter for dissolved metals.
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?		<input type="checkbox"/>	
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?		<input type="checkbox"/>	
Were all soil VOAs field extracted with MeOH+BFB?		<input type="checkbox"/>	
Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.			
Additional notes (if applicable):			



Sample Containers and Preservatives

<u>Container Id</u>	<u>Preservative</u>	<u>Container Condition</u>	<u>Container Id</u>	<u>Preservative</u>	<u>Container Condition</u>
1170368001-A	H2SO4 to pH < 2	OK			
1170368001-B	No Preservative Required	OK			
1170368001-C	No Preservative Required	OK			
1170368001-D	HNO3 to pH < 2	PA			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates that an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.

BU - The container was received with headspace greater than 6mm.

DM- The container was received damaged.

FR- The container was received frozen and not usable for Bacteria or BOD analyses.

PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.



Laboratory Report of Analysis

To: Terrasat, Inc.
4203 Iowa Drive
Anchorage, AK 99517
(907)344-9370

Report Number: **1170417**

Client Project: **Lewis & Clark**

Dear Steve Smith,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Victoria at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Victoria Pennick
Project Manager
Victoria.Pennick@sgs.com

Date

Print Date: 02/09/2017 9:10:08AM

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Case Narrative

SGS Client: Terrasat, Inc.
SGS Project: 1170417
Project Name/Site: Lewis & Clark
Project Contact: Steve Smith

Refer to sample receipt form for information on sample condition.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

Print Date: 02/09/2017 9:10:06AM

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Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 (DW Chemistry & Microbiology) & UST-005 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8015C, 8021B, 8082A, 8260C, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCC/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
DF	Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LLQC/LLIQC	Low Level Quantitation Check
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

Print Date: 02/09/2017 9:10:11AM

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Sample Summary

<u>Client Sample ID</u>	<u>Lab Sample ID</u>	<u>Collected</u>	<u>Received</u>	<u>Matrix</u>
LCW-3	1170417001	01/30/2017	01/30/2017	Water (Surface, Eff., Ground)

<u>Method</u>	<u>Method Description</u>
EP200.8	Metals in Drinking Water by ICP-MS DISSO
SM21 4500NO3-F	Nitrate/Nitrite Flow injection Pres.
SM21 2540C	Total Dissolved Solids SM18 2540C

Print Date: 02/09/2017 9:10:11AM

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Detectable Results Summary

Client Sample ID: **LCW-3**

Lab Sample ID: 1170417001

Dissolved Metals by ICP/MS

Waters Department

<u>Parameter</u>	<u>Result</u>	<u>Units</u>
Calcium	43300	ug/L
Manganese	59.0	ug/L
Total Dissolved Solids	291	mg/L
Total Nitrate/Nitrite-N	0.0378J	mg/L

Print Date: 02/09/2017 9:10:13AM

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**Results of LCW-3**

Client Sample ID: **LCW-3**
Client Project ID: **Lewis & Clark**
Lab Sample ID: 1170417001
Lab Project ID: 1170417

Collection Date: 01/30/17 10:17
Received Date: 01/30/17 15:55
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by Dissolved Metals by ICP/MS

<u>Parameter</u>	<u>Result Qual</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>	<u>DF</u>	<u>Allowable Limits</u>	<u>Date Analyzed</u>
Calcium	43300	500	150	ug/L	1		02/06/17 14:48
Iron	125 U	250	78.0	ug/L	1		02/06/17 14:48
Manganese	59.0	1.00	0.310	ug/L	1		02/06/17 14:48

Batch Information

Analytical Batch: MMS9685
Analytical Method: EP200.8
Analyst: VDL
Analytical Date/Time: 02/06/17 14:48
Container ID: 1170417001-D

Prep Batch: MXX30473
Prep Method: E200.2
Prep Date/Time: 02/01/17 12:30
Prep Initial Wt/Vol: 20 mL
Prep Extract Vol: 50 mL

Print Date: 02/09/2017 9:10:13AM

J flagging is activated

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Results of LCW-3

Client Sample ID: **LCW-3**
Client Project ID: **Lewis & Clark**
Lab Sample ID: 1170417001
Lab Project ID: 1170417

Collection Date: 01/30/17 10:17
Received Date: 01/30/17 15:55
Matrix: Water (Surface, Eff., Ground)
Solids (%):
Location:

Results by Waters Department

<u>Parameter</u>	<u>Result Qual</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>	<u>DF</u>	<u>Allowable Limits</u>	<u>Date Analyzed</u>
Total Dissolved Solids	291	10.0	3.10	mg/L	1		02/03/17 16:43

Batch Information

Analytical Batch: STS5355
Analytical Method: SM21 2540C
Analyst: AYC
Analytical Date/Time: 02/03/17 16:43
Container ID: 1170417001-B

<u>Parameter</u>	<u>Result Qual</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>	<u>DF</u>	<u>Allowable Limits</u>	<u>Date Analyzed</u>
Total Nitrate/Nitrite-N	0.0378 J	0.100	0.0300	mg/L	2		02/06/17 17:26

Batch Information

Analytical Batch: WFI2537
Analytical Method: SM21 4500NO3-F
Analyst: AYC
Analytical Date/Time: 02/06/17 17:26
Container ID: 1170417001-A

Print Date: 02/09/2017 9:10:13AM

J flagging is activated

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**Method Blank**

Blank ID: MB for HBN 1752753 [MXX/30473]

Blank Lab ID: 1372194

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1170417001

Results by EP200.8

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Calcium	250U	500	150	ug/L
Iron	125U	250	78.0	ug/L
Manganese	0.500U	1.00	0.310	ug/L

Batch Information

Analytical Batch: MMS9685

Analytical Method: EP200.8

Instrument: Perkin Elmer Nexlon P5

Analyst: VDL

Analytical Date/Time: 2/6/2017 2:42:06PM

Prep Batch: MXX30473

Prep Method: E200.2

Prep Date/Time: 2/1/2017 12:30:38PM

Prep Initial Wt./Vol.: 20 mL

Prep Extract Vol: 50 mL

Print Date: 02/09/2017 9:10:15AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170417 [MXX30473]

Blank Spike Lab ID: 1372195

Date Analyzed: 02/06/2017 14:45

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170417001

Results by EP200.8

Parameter	Blank Spike (ug/L)			CL
	Spike	Result	Rec (%)	
Calcium	10000	10400	104	(85-115)
Iron	5000	5290	106	(85-115)
Manganese	500	525	105	(85-115)

Batch Information

Analytical Batch: MMS9685

Analytical Method: EP200.8

Instrument: Perkin Elmer Nexlon P5

Analyst: VDL

Prep Batch: MXX30473

Prep Method: E200.2

Prep Date/Time: 02/01/2017 12:30

Spike Init Wt./Vol.: 10000 ug/L Extract Vol: 50 mL

Dupe Init Wt./Vol.: Extract Vol:

Print Date: 02/09/2017 9:10:16AM

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Matrix Spike Summary

Original Sample ID: 1372203
MS Sample ID: 1372204 MS
MSD Sample ID:

Analysis Date: 02/06/2017 14:48
Analysis Date: 02/06/2017 14:51
Analysis Date:
Matrix: Drinking Water

QC for Samples: 1170417001

Results by EP200.8

Parameter	Matrix Spike (ug/L)				Spike Duplicate (ug/L)				CL	RPD (%)	RPD CL
	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)				
Calcium	43300	10000	53900	106					70-130		
Iron	125U	5000	5510	110					70-130		
Manganese	59.0	500	590	106					70-130		

Batch Information

Analytical Batch: MMS9685
Analytical Method: EP200.8
Instrument: Perkin Elmer Nexion P5
Analyst: VDL
Analytical Date/Time: 2/6/2017 2:51:03PM

Prep Batch: MXX30473
Prep Method: DW Digest for Metals on ICP-MS
Prep Date/Time: 2/1/2017 12:30:38PM
Prep Initial Wt./Vol.: 20.00mL
Prep Extract Vol: 50.00mL

Print Date: 02/09/2017 9:10:17AM

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Method Blank

Blank ID: MB for HBN 1752894 [STS/5355]

Blank Lab ID: 1372459

Matrix: Water (Surface, Eff., Ground)

QC for Samples:

1170417001

Results by SM21 2540C

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Total Dissolved Solids	5.00U	10.0	3.10	mg/L

Batch Information

Analytical Batch: STS5355

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Analytical Date/Time: 2/3/2017 4:43:15PM

Print Date: 02/09/2017 9:10:19AM

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Duplicate Sample Summary

Original Sample ID: 1170417001

Duplicate Sample ID: 1372462

QC for Samples:

1170417001

Analysis Date: 02/03/2017 16:43

Matrix: Water (Surface, Eff., Ground)

Results by SM21 2540C

<u>NAME</u>	<u>Original</u>	<u>Duplicate</u>	<u>Units</u>	<u>RPD (%)</u>	<u>RPD CL</u>
Total Dissolved Solids	291	290	mg/L	0.34	(< 5)

Batch Information

Analytical Batch: STS5355

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Print Date: 02/09/2017 9:10:20AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170417 [STS5355]

Blank Spike Lab ID: 1372460

Date Analyzed: 02/03/2017 16:43

Spike Duplicate ID: LCSD for HBN 1170417 [STS5355]

Spike Duplicate Lab ID: 1372461

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170417001

Results by SM21 2540C

Parameter	Blank Spike (mg/L)			Spike Duplicate (mg/L)			CL	RPD (%)	RPD CL
	Spike	Result	Rec (%)	Spike	Result	Rec (%)			
Total Dissolved Solids	330	319	97	330	331	100	(75-125)	3.70	(< 5)

Batch Information

Analytical Batch: STS5355

Analytical Method: SM21 2540C

Instrument:

Analyst: AYC

Print Date: 02/09/2017 9:10:26AM

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**Method Blank**

Blank ID: MB for HBN 1753171 (WFI/2537)

Matrix: Water (Surface, Eff., Ground)

Blank Lab ID: 1372575

QC for Samples:

1170417001

Results by SM21 4500NO3-F

<u>Parameter</u>	<u>Results</u>	<u>LOQ/CL</u>	<u>DL</u>	<u>Units</u>
Nitrate-N	0.0500U	0.100	0.0300	mg/L
Nitrite-N	0.0500U	0.100	0.0300	mg/L
Total Nitrate/Nitrite-N	0.0500U	0.100	0.0300	mg/L

Batch Information

Analytical Batch: WFI2537

Analytical Method: SM21 4500NO3-F

Instrument: Astoria segmented flow

Analyst: AYC

Analytical Date/Time: 2/6/2017 5:19:54PM

Print Date: 02/09/2017 9:10 30AM

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1170417 [WFI2537]

Blank Spike Lab ID: 1372565

Date Analyzed: 02/06/2017 17:18

Matrix: Water (Surface, Eff., Ground)

QC for Samples: 1170417001

Results by SM21 4500NO3-F

Parameter	Blank Spike (mg/L)			CL
	Spike	Result	Rec (%)	
Nitrate-N	2.5	2.60	104	(70-130)
Nitrite-N	2.5	2.50	100	(90-110)
Total Nitrate/Nitrite-N	5	5.10	102	(90-110)

Batch Information

Analytical Batch: WFI2537

Analytical Method: SM21 4500NO3-F

Instrument: Astoria segmented flow

Analyst: AYC

Print Date: 02/09/2017 9:10:31AM

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Matrix Spike Summary

Original Sample ID: 1170487001
MS Sample ID: 1372563 MS
MSD Sample ID: 1372564 MSD

Analysis Date: 02/06/2017 17:37
Analysis Date: 02/06/2017 17:39
Analysis Date: 02/06/2017 17:40
Matrix: Drinking Water

QC for Samples: 1170417001

Results by SM21 4500NO3-F

Parameter	Matrix Spike (mg/L)				Spike Duplicate (mg/L)					
	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Total Nitrate/Nitrite-N	3.52	5.00	8.33	96	5.00	8.36	97	90-110	0.40	(< 25)

Batch Information

Analytical Batch: WFI2537
Analytical Method: SM21 4500NO3-F
Instrument: Astoria segmented flow
Analyst: AYC
Analytical Date/Time: 2/6/2017 5:39:09PM

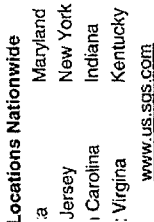
Print Date: 02/09/2017 9:10:32AM

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CHAIN OF CUSTODY RECORD

170417



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Instructions: Sections 1 - 5 must be out. Omissions may delay the onset of analysis.									
CLIENT: Terrasat		PHONE #: 344-9370		Section 3 Preservative					
CONTACT: Steve Smith		Project/ PWSID/ PERMIT#:		Lab Filtrates					
PROJECT NAME: Lewis & Clark		E-MAIL:		NSOL					
REPORTS TO: Steve Smith		steve@terrasatenvronmental.com		Dis Ca, Fe, Mn (200.8)					
INVOICE TO: Terrasat		QUOTE #: Open		Nitrate/Nitrite pres.					
P.O. #: 21607		MATRIX/ MATRIX CODE		TDS					
RESERVED for lab use		DATE mm/dd/yy		TIME HH:MM		Pres. Type:			
SAMPLE IDENTIFICATION		DATE mm/dd/yy		TIME HH:MM		Comp			
DA		1-30-17		10:17		Grab			
OB		1-30-17		10:17		M			
OC-D		1-30-17		10:17		(Multi-incre-mental)			
REMARKS/ LOC ID		60 ml - pres		500 ml -		250 ml			
Section 2		Section 4		DOD Project?		Yes		No	
Relinquished By: (1)		Date		Time		Received By:		QC2/DV	
Relinquished By: (2)		Date		Time		Received By:		Requested Turnaround Time and/or Special Instructions:	
Relinquished By: (3)		Date		Time		Received By:		Lab filter/pres "Diss Ca, Fe, Mn"	
Relinquished By: (4)		Date		Time		Received By:		Chain of Custody Seal: (Circle)	
Section 5		Section 4		DOD Project?		Yes		No	
Temp Blank °C:		10.0		#D20		or Ambient []		INTACT	
Temp Blank °C:		10.0		#D20		or Ambient []		BROKEN	
Temp Blank °C:		10.0		#D20		or Ambient []		ABSENT	
Temp Blank °C:		10.0		#D20		or Ambient []		ABSENT	

1200 W. Potter Drive Anchorage, AK 99518 Tel: (907) 562-2343 Fax: (907) 561-5301
15500 Business Drive Wilmington, NC 28405 Tel: (910) 350-1903 Fax: (910) 350-1557


<http://www.sgs.com/terms-and-conditions>

Hand Delivered

17 of 20
F083-Blank COC Templates_2015-03-19



e-SAMPLE RECEIPT FORM

1170417			
Review Criteria	Y/N (yes/no)	Exceptions Noted below	
Were Custody Seals intact? Note # & location	<input type="checkbox"/>	<input checked="" type="checkbox"/> exemption permitted if sampler hand carries/delivers.	
COC accompanied samples?	<input checked="" type="checkbox"/>	ABSENT	
<input checked="" type="checkbox"/> ** exemption permitted if chilled & collected <8hrs ago or chilling not required (i.e., waste, oil)	<input type="checkbox"/>		
Temperature blank compliant* (i.e., 0-6 °C after CF)?	<input checked="" type="checkbox"/>	Cooler ID: 1	@ 10.0 °C Therm ID: D20
	<input type="checkbox"/>	Cooler ID:	@ °C Therm ID:
	<input type="checkbox"/>	Cooler ID:	@ °C Therm ID:
	<input type="checkbox"/>	Cooler ID:	@ °C Therm ID:
	<input type="checkbox"/>	Cooler ID:	@ °C Therm ID:
*If >6°C, were samples collected <8 hours ago?	<input checked="" type="checkbox"/>		
If <0°C, were sample containers ice free?	<input type="checkbox"/>		
If samples received <u>without</u> a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "COOLER TEMP" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".			
Note: Identify containers received at non-compliant temperature. Use form FS-0029 if more space is needed.			
Note: Refer to form F-083 "Sample Guide" for hold times.			
Were samples received within hold time?	<input checked="" type="checkbox"/>		
Do samples match COC** (i.e., sample IDs, dates/times collected)?	<input checked="" type="checkbox"/>		
**Note: If times differ <1hr, record details & login per COC.			
Were analyses requested unambiguous?	<input checked="" type="checkbox"/>		
Were proper containers (type/mass/volume/preservative***) used?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> ***Exemption permitted for metals (e.g. 200.8/6020A).	
Lab Filter for Dissolved Metals.			
IF APPLICABLE			
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	<input type="checkbox"/>		
Were all VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	<input type="checkbox"/>		
Were all soil VOAs field extracted with MeOH+BFB?	<input type="checkbox"/>		
Note to Client: Any "no" answer above indicates non-compliance with standard procedures and may impact data quality.			
Additional notes (if applicable):			



Sample Containers and Preservatives

<u>Container Id</u>	<u>Preservative</u>	<u>Container Condition</u>	<u>Container Id</u>	<u>Preservative</u>	<u>Container Condition</u>
1170417001-A	H2SO4 to pH < 2	OK			
1170417001-B	No Preservative Required	OK			
1170417001-C	No Preservative Required	OK			
1170417001-D	HNO3 to pH < 2	PA			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.

BU - The container was received with headspace greater than 6mm.

DM- The container was received damaged.

FR- The container was received frozen and not usable for Bacteria or BOD analyses.

PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

TERRASAT, INC.

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Geological Consulting

Environmental Restoration

Regulatory Compliance

Evaluation of the Distribution of Nitrates in Local Water Wells Surrounding the Lewis and Clark Subdivision

Prepared for:
Big Country Enterprises, LLC.

Prepared by:
TERRASAT, Inc.
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January 12, 2017

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Appendix A	Table of Private Well Data Used in Study
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1.0 INTRODUCTION

TERRASAT evaluated the concern that nearby subdivisions have significant nitrate problems in their aquifers. Two reports about nitrates exist for this area. Both reports state that nitrate levels are low and are not concerning. TERRASAT evaluated newer data from the Municipality of Anchorage. We found low levels of nitrate exist and that the newer data is consistent with the previous reports. We found that nitrate concentrations increased in some subdivisions and decreased in others. The rates of increase are low and consistent with past information. The proposed Lewis and Clark subdivision, Figure 1, will use nitrate reducing systems. A fate and transport evaluation was completed with the results presented in the TERRASAT report “Ground Water Resource Evaluation for the Proposed Lewis and Clark Subdivision”. The results suggest nitrates will be below the detection level at the subdivision boundary.

2.0 METHODS AND DATABASES

Nitrate data was sometimes segregated into the subdivision level to create averages or trends for water quality. Figure 2 shows the approximate one-half mile distance marker outward from the Lewis and Clark site boundaries. Figure 2 shows the 124 water well locations used in the study.

TERRASAT used data from previous studies of the same area to compare nitrate trends by adding and comparing new data from the same locations to create up to date trend lines. Unfortunately, the most comprehensive study, “Status of Anchorage Hillside Well Water: Nitrates Study” (Moore *et al.*, 2011), had map locations that were different than their graphs. TERRASAT compiled MOA data to determine long-term trends. Therefore, we were able to obtain meaningful results despite the inaccurate well locations of the Moore *et al.*, 2011 report.

2.1 MOA On-Site Services (COSA)

TERRASAT compiled water quality data from the Municipality’s COSA database. The data was evaluated and interpreted with geospatial techniques and statistical procedures to determine long-term trends.

2.2 Previous Studies

Two previous nitrate studies were evaluated to determine if long term trends of nitrate concentrations remained constant or were different. Specifically, the papers¹Montgomery Watson, 2000 and Moore *et al.*, 2011 were reviewed for nitrate trends. After

¹ Local Wellhead and Aquifer Protection Study Phase II, June 2000, Montgomery Watson

review, it was found that the Moore *et al.*, 2011 study data was limited in its usability due to errors in mapping some of the data locations.

Nonetheless, TERRASAT used available data, up to the most current, to analyze trends and averages of nitrates for private and public wells in the study area, some of which were also included in the previous studies mentioned above.

2.3 ADEC Drinking Water Program

The ADEC Drinking Water Program include a database and maps of well locations, and through its Drinking Water Watch program it provides water quality information for public water wells in the State. TERRASAT used this web accessed database to review water quality for public wells within one-mile of the Lewis and Clark subdivision.

2.4 GIS

Elevations shapefiles, data conversions, proportional displays, and other mapping were all created in ESRI GIS mapping software. This software allowed interpretations and displays of pertinent data to be presented in a graphical display that portrays the pertinent information contained in tabulated spreadsheets. Nearly all of the major findings of this report are displayed in some form in GIS format. Microsoft Excel and SPSS software were used to interpret trends.

3.0 WATER QUALITY AND CONDITIONS IN THE LOCAL AREA

The water quality and aquifer conditions of neighboring properties were used to evaluate water quality trends (for nitrates) where possible in subbasins surrounding the Lewis and Clark Subdivision.

3.1 Results of Previous Studies

Montgomery Watson, 2000, investigated the occurrence of nitrates in an area across the Anchorage Hillside. They found that “fewer than 2% of the records in the database exceeded the State of Alaska Drinking Water Standard of 10 mg/liter nitrate-nitrogen” (Montgomery Watson, 2000, pg. ES-2). They also calculated nitrate trends for various areas of the Hillside.

Montgomery Watson 2000, pg. ES-3, selected an area of 118 acres near the intersection of DeArmoun and Hillside Drive to conduct a pilot study. They found a poor statistical correlation between levels of nitrates and:

- Well depth
- Casing depth
- Distance between well and septic field within a lot
- Well yield

- Lot bedroom count
- Soil absorption rating
- Sum of bedrooms within a 1,000 foot radius of a well
- Bedrock depth
- Static water level
- Terrain units

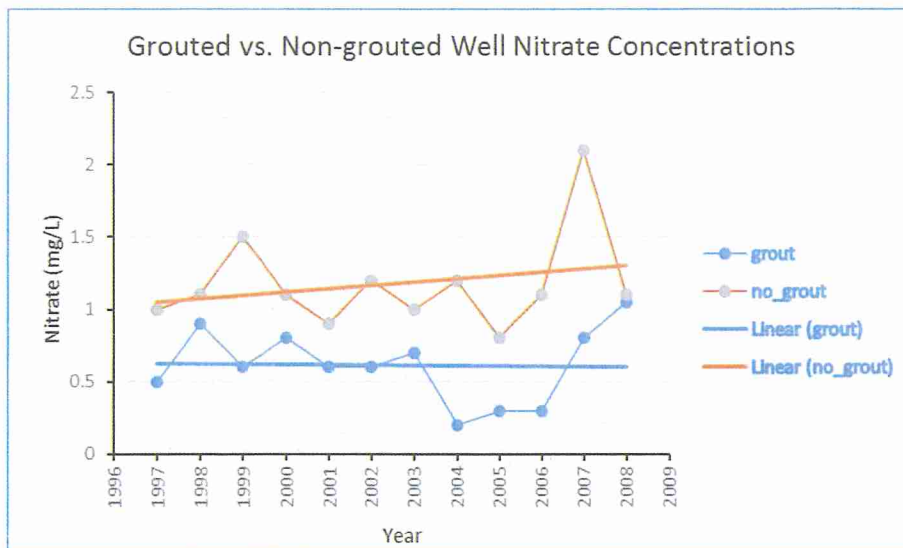
Montgomery Watson, 2000, pg. ES-3 evaluated a conceptual model of:

- Bedrock slope
- Bedrock aspect
- Water table depth
- Well depth

Their evaluation of the above criteria found no insight for the cause(s) of nitrate occurrences in the DeArmoun area.

Moore *et al.*, 2011, analyzed nitrate data “from single family and public-supply wells on the Anchorage Hillside” (pg. 1). Their report “concludes that the long-term viability of on-site wastewater systems on the Anchorage Hillside is not significantly diminished on the basis of existing nitrate trends and concentrations”. They also concluded that a simple correlation does not appear to exist between septic systems usage and the occurrence of nitrates on the Anchorage Hillside.

Moore *et al.*, 2011, pp. 23-24, compared nitrate concentrations in wells drilled before MOA grouting standards were implemented with wells constructed after grouting standards were implemented. They found the median nitrate concentration of wells pre-grouting was 1.5 mg/liter *vs.* 0.1 mg/liter for wells drilled post-grouting standard. They also plotted nitrate concentrations by year from 1997 to 2008 for wells drilled before grouting standards and wells drilled after the grouting requirements. The trend of nitrate concentrations in the wells drilled before grouting standards shows an increase since 2008. Wells constructed after grouting standards showed a neutral (flat) trend without increasing. The graph below depicts the trends of nitrate concentrations of non-grouted and grouted wells as reported in the Moore *et al.*, 2011 report.



3.2 Nitrate Trends of Private Wells

TERRASAT analyzed nitrate averages and trends for 124 private residential water wells in the area surrounding the Lewis and Clark subdivision. The data for some wells in the study area was not accessible or searchable by subdivisions or other criteria in the available web databases used in this study and therefore some wells that likely do exist within one-half mile of Lewis and Clark are not included. Thirty-eight individual wells had sufficient data to plot trends while 88 wells had at least one nitrate test result. An average was also calculated from 38 of the 88 wells, those with two or more test results. Appendix A contains spreadsheets of the data for the 124 wells used in this study.

TERRASAT found that:

- Nitrate trends showed increases for most wells that lie directly west of Lewis and Clark, while
- nitrate trends decreased or remained stable (flat) for most wells north and east of the project area.

The area directly south of Lewis and Clark is undeveloped and only a few wells southwest of Lewis and Clark were used in the study. Figure 3 shows the average or one-time nitrate test results for 88 of the 124 individual wells. Where the results were averaged, data may have been from the same decade. The average or one time only nitrate test results ranged from 0.01 mg/L (not detected above the detection limit) to 9.7 mg/L. The Alaska Department of Environmental Conservation, Drinking Water Program, considers nitrate levels of 10.0 mg/L or above to be potentially harmful to human health.

Trends or averages were more accurately calculated or plotted for subdivisions than for individual wells, as the amount of data was greater when combining all wells within a subdivision. Both nitrate trends and nitrate averages were calculated after combining the results into four decades: the 1980's, 1990's, 2000's, and 2010's, and averaging each decade if more than one test was conducted in any decade. The overall average included information from all decades where it was available. This was not possible for most of the individual wells as insufficient data were available. Trends for the ten subdivisions where the analyses were able to be conducted are shown in Figure 4, which contains ten separate graphs with trendlines.

Table 1 lists the relationship between the trend and average level of nitrates for the ten area subdivisions with data for both criteria. Of particular relevance to the Lewis and Clark development are the Grecian Hills and Terrace Hts. Subdivisions, both having an upward trend, but both with very low (1.0 mg/L – Grecian Hills) or low (2.4 mg/L Terrace Hts.) average nitrate results. Other examples are Sunshine Acres with an upward trend and a very low average of 0.6 mg/L and Mountain Shadows with a downward trend but with a relatively high nitrates average of 5.9 mg/L.

Table 1 Trend and Average Nitrate of Ten Subdivisions

Subdivision	Trend	Average (mg/L)
Aspen Highlands #1	Downward	2.6
Bonnie View	Flat	2.5
Grecian Hills	Upward	1.0
Kemp	Downward	1.9
Mountain Park Estates #2	Upward	3.4
Mountain Shadows	Downward	5.9
Spendlove View Hts. #1	Downward	2.0
Spendlove View Hts. #3	Downward	0.6
Sunshine Acres	Upward	0.6
Terrace Hts.	Upward	2.4

The Figure 4 graphs are scatter charts, with the same scale. Figure 5 shows nitrate averages for 16 of the subdivisions that had at least one decade of test results with two or more nitrate test results. As with the individual wells, not all subdivisions had sufficient data to create trends or averages.

- The average nitrate levels ranged from a low of 0.30 mg/L for the South Hills and Blue Skies #3 subdivisions to a high of 5.90 mg/L for the Mountain Shadow subdivision.

3.3 Nitrate Trends of Public Wells

TERRASAT reviewed nitrate test results of the following four public wells within one mile of Lewis and Clark: Chapel of the Cross, Greenbrook S/D, Sun Valley Hts. North, and Sun Valley Hts. South. Figure 6 shows the location of these four public wells used in this study. Figure 7 shows the plots of trend of nitrate levels with the available data that is up-to-date. Note that these results are for Nitrate only. Test for Nitrite and for Nitrate/Nitrite

were also conducted at non-specific times for each of the wells, however since test methods are not the same for all three tests, only Nitrate data was used. In particular, Nitrates data for Sun Valley Hts. North and Sun Valley Hts. South was available only up to 2009, while there were some Nitrite or Nitrate/Nitrite tests done after that.

The trends for nitrates in these wells show gentle to moderate upward trends for all except Sun Valley Hts. North. Those well results were not only lower on average, but also had a slightly upward trending but nearly flat trendline. The Sun Valley Hts. North trendline was based on only seven test results, while the other three public well trendlines contained from 20 to 30 test results. Figure 8 shows the average nitrates levels for the four public wells. The average nitrate levels ranged from a low of 1.18 mg/L for the Sun Valley Heights North locations to a high of 5.17 mg/L for the Chapel of the Cross location.

4.0 SITE TOPOGRAPHY

Figure 9 shows the topography of the Lewis and Clark site area.

- Note that the average surface gradient for the entire site is 0.13
- with a downgradient general direction of southwest.

Water table gradients generally follow surface topography. As wells are completed at the site, the water table and the potentiometric surface of the static water level from confined aquifers will likely be measured.

The main conclusions that can be made after viewing Figure 9 are:

- Much of the total area of Lewis and Clark is situated down-gradient from adjoining subdivisions in the area. This means that concerns of nitrates or contaminants migrating from Lewis and Clark onto adjoining properties is extremely unlikely regarding those up gradient properties.
- There are some properties that lie in a cross-gradient attitude in relation to Lewis and Clark. Those, as seen in Figure 5, are Foreland View, Engle, Terrace Heights, and Grecian Hills. Based solely on its topographical profile relative to the other subdivisions, and the properties of surface and ground water movement, the migration of nitrate and other contaminants from Lewis and Clark to other properties is highly unlikely.
- The only adjoining subdivisions situated down-gradient of Lewis and Clark are portions of Grecian Hills and South Hills subdivisions. Because of this, it is possible that they might receive surface or groundwater migrating from Lewis and Clark.
- Fortunately, however, no contaminants of concern have the ability to move the distances required to migrate to downgradient or cross-gradient properties before they are either stopped by attaching to soil particles or their concentration levels are far below those considered harmful to human or aquatic life.

before they are either stopped by attaching to soil particles or their concentration levels are far below those considered harmful to human or aquatic life.

5.0 CONCLUSIONS

Montgomery Watson, 2000, evaluated nitrate concentrations on the Anchorage Hillside. They found nitrate concentrations decreased in some areas and had a slight increase in other areas. They were unable to find a statistical correlation with the occurrence of nitrate and features that they evaluated.

Moore *et al.* 2011, concluded that the long-term viability of septic systems is not diminished by the occurrence of nitrate in water wells on the Anchorage Hillside. They also found that increasing trends in nitrate concentration were low rates, consistent with the Montgomery Watson 2000 investigation.

Moore *et al.* 2011, page 24, found that wells constructed in bedrock after grouting standards were implemented had one tenth the concentration of wells drilled before grouting standards (0.1 mg/L). They also found that the newer wells showed no increase in concentration over time. TERRASAT concludes that properly grouted wells in the Lewis and Clark Subdivision will protect groundwater supplies both in this subdivision and the surrounding subdivisions.

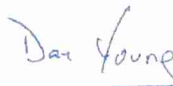
TERRASAT evaluated the concern that nearby subdivisions have a significant nitrate problem in their aquifers. Two reports about nitrates exist for this area. Both reports state that nitrate levels are generally low and are generally not concerning. TERRASAT evaluated newer data from the Municipality of Anchorage. We found low levels of nitrate exist and that the newer data is consistent with the previous reports. We found that nitrate concentrations increased in some subdivisions and decreased in others. The rates of increase are low and consistent with past reported information. The proposed Lewis and Clark subdivision is unlikely to add to existing conditions because the subdivision will use nitrate reducing systems, because groundwater recharge is from areas east and south of this subdivision, and because new water wells will be grouted according to the MOA requirements.

Prepared By:



Steven Smith
Project Environmental Scientist

Approved By:



Dan Young
Principal,
CPG, #7811

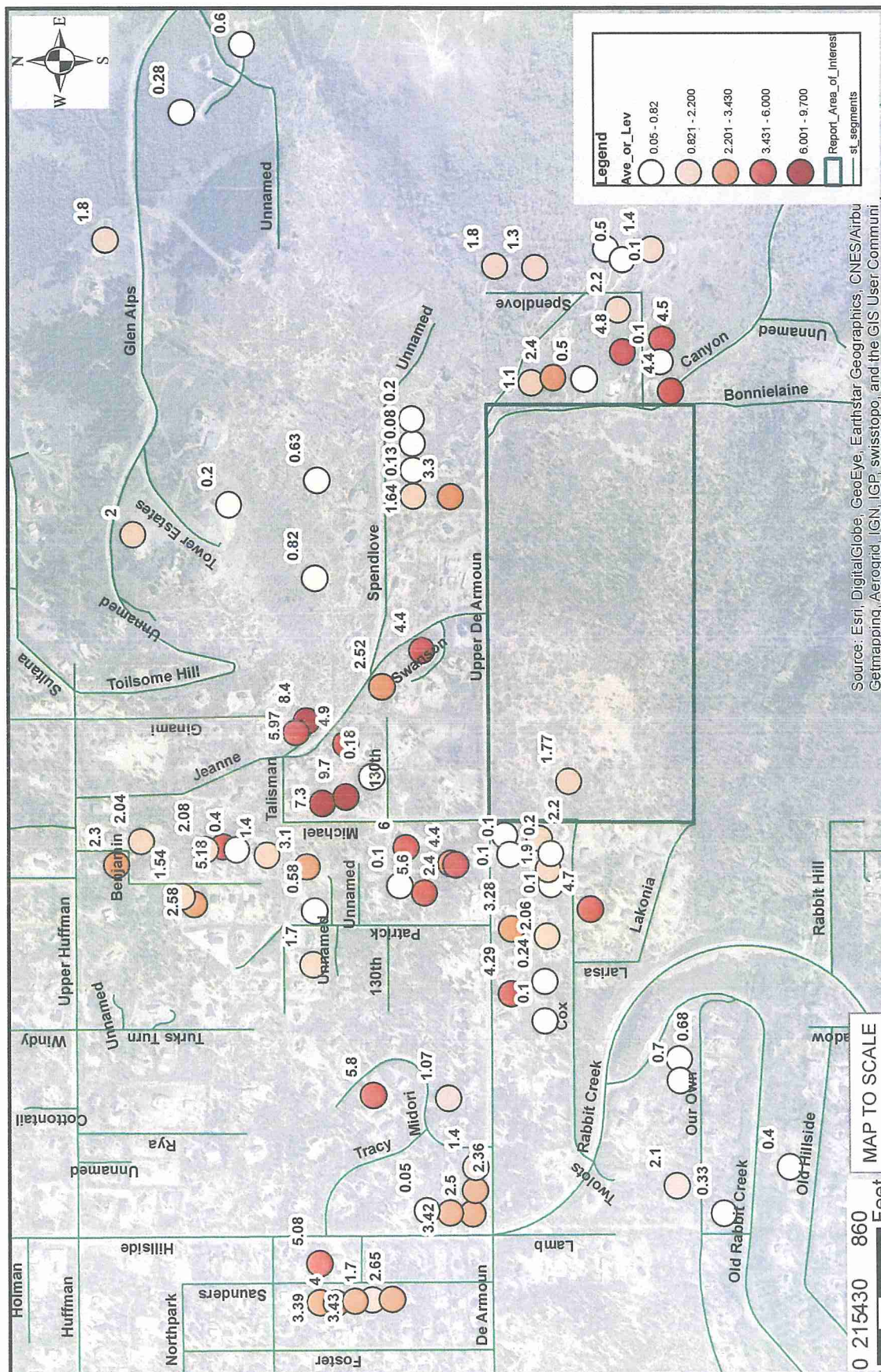


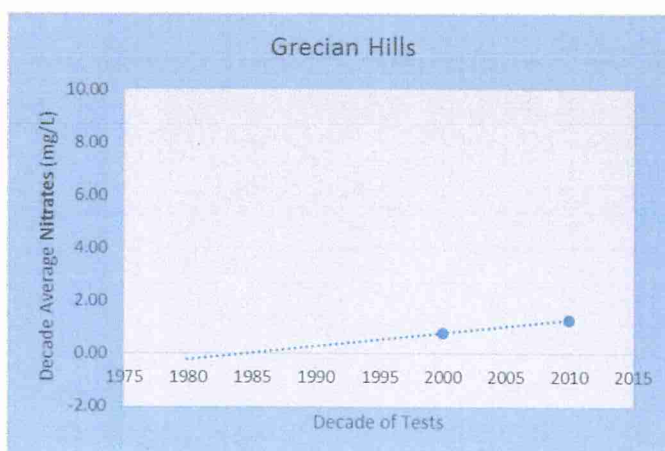
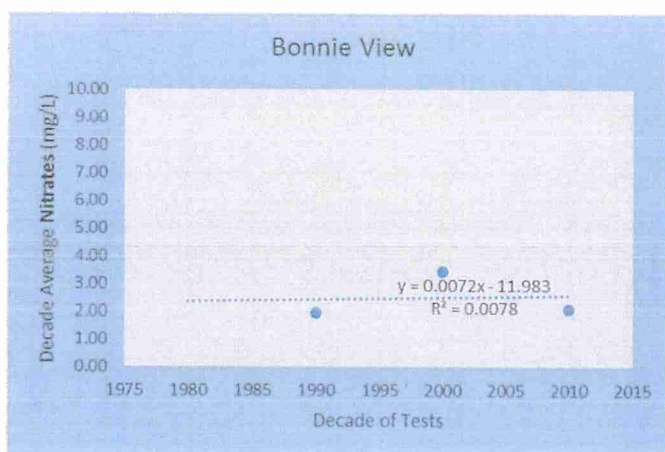
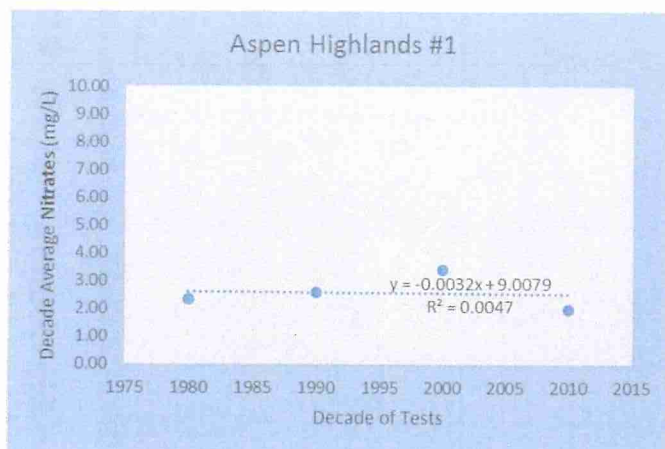
Figure 3

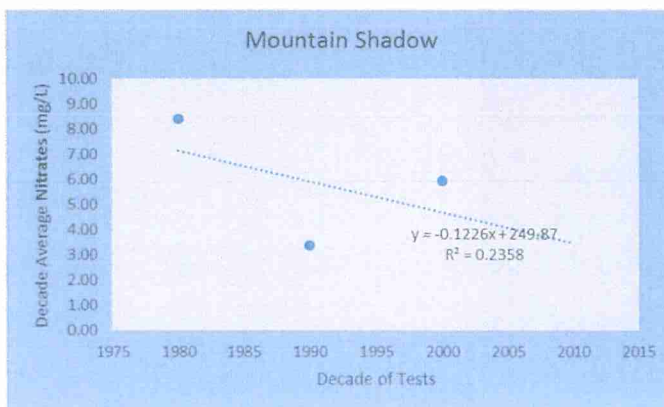
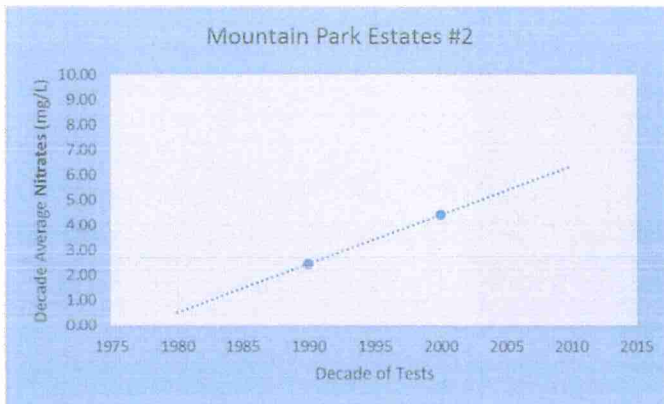
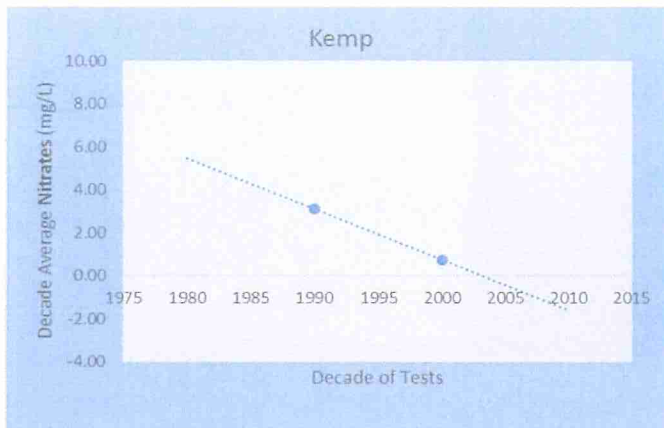
Nitrate Averages or Levels in 80 of 124 Individual Wells within One-half Mile of Lewis and Clark

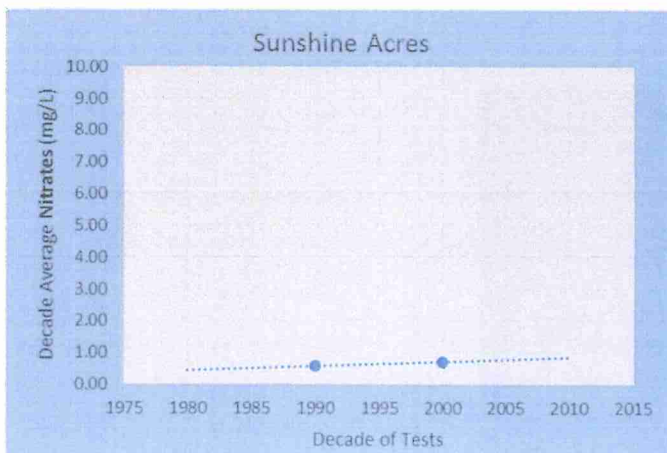
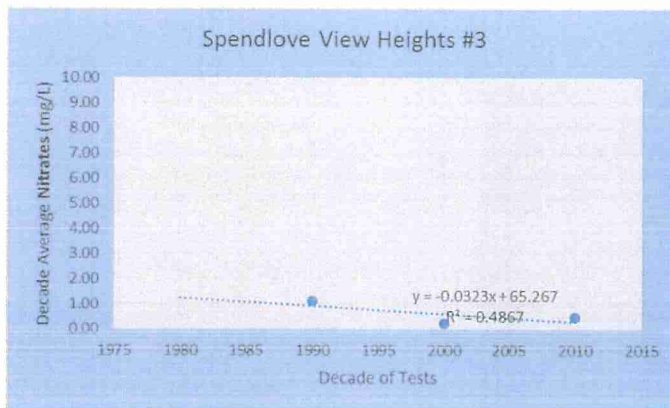
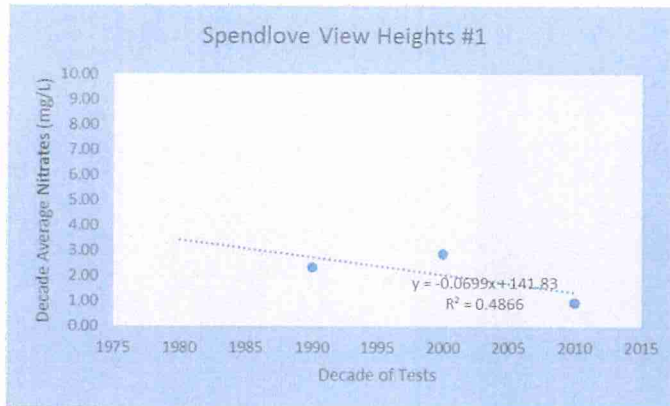
For: Big Country Enterprises LLC.

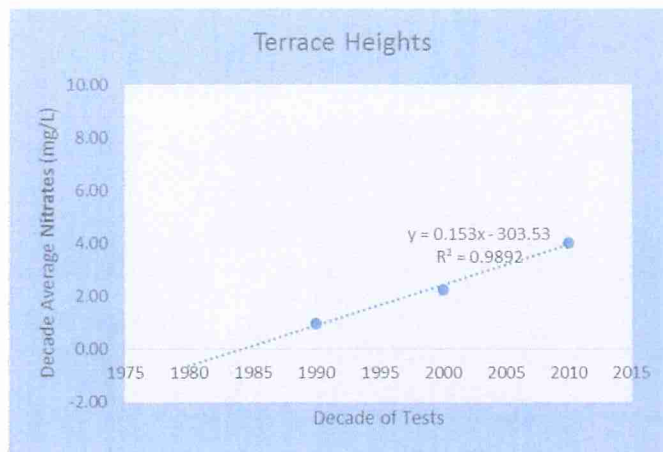
**By: SCS
Terrasat, Inc.
Date: 10/4/16**

Figure 4. Nitrate Trend Plots of Area Subdivisions









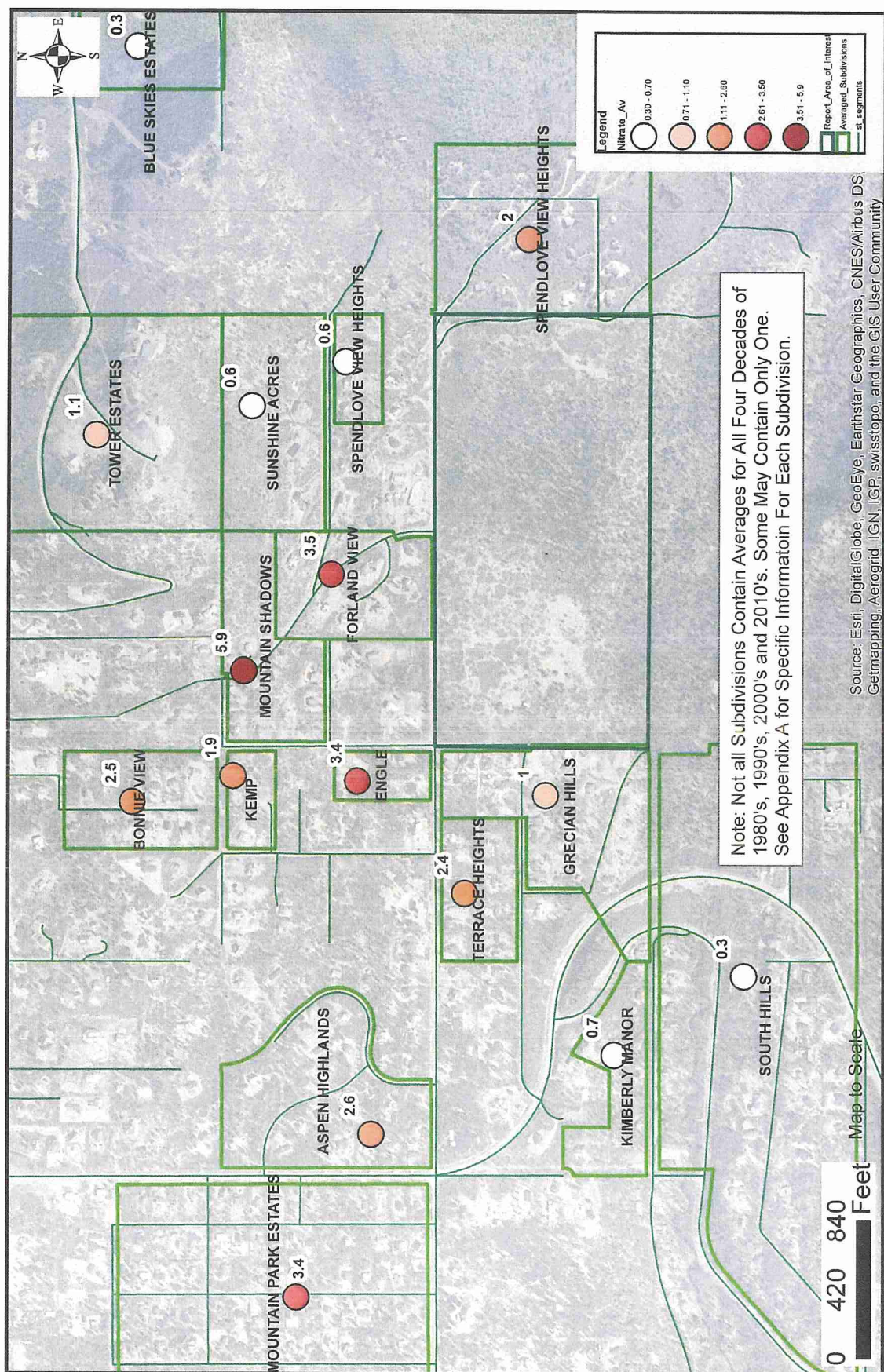


Figure 5
Nitrate Level Averages for 16 Subdivisions
in the Area of Lewis and Clark. 1980's to 2010's

By: Terrasat, Inc.
Date: 9/19/16

**For: Big Country
Enterprises, LLC**

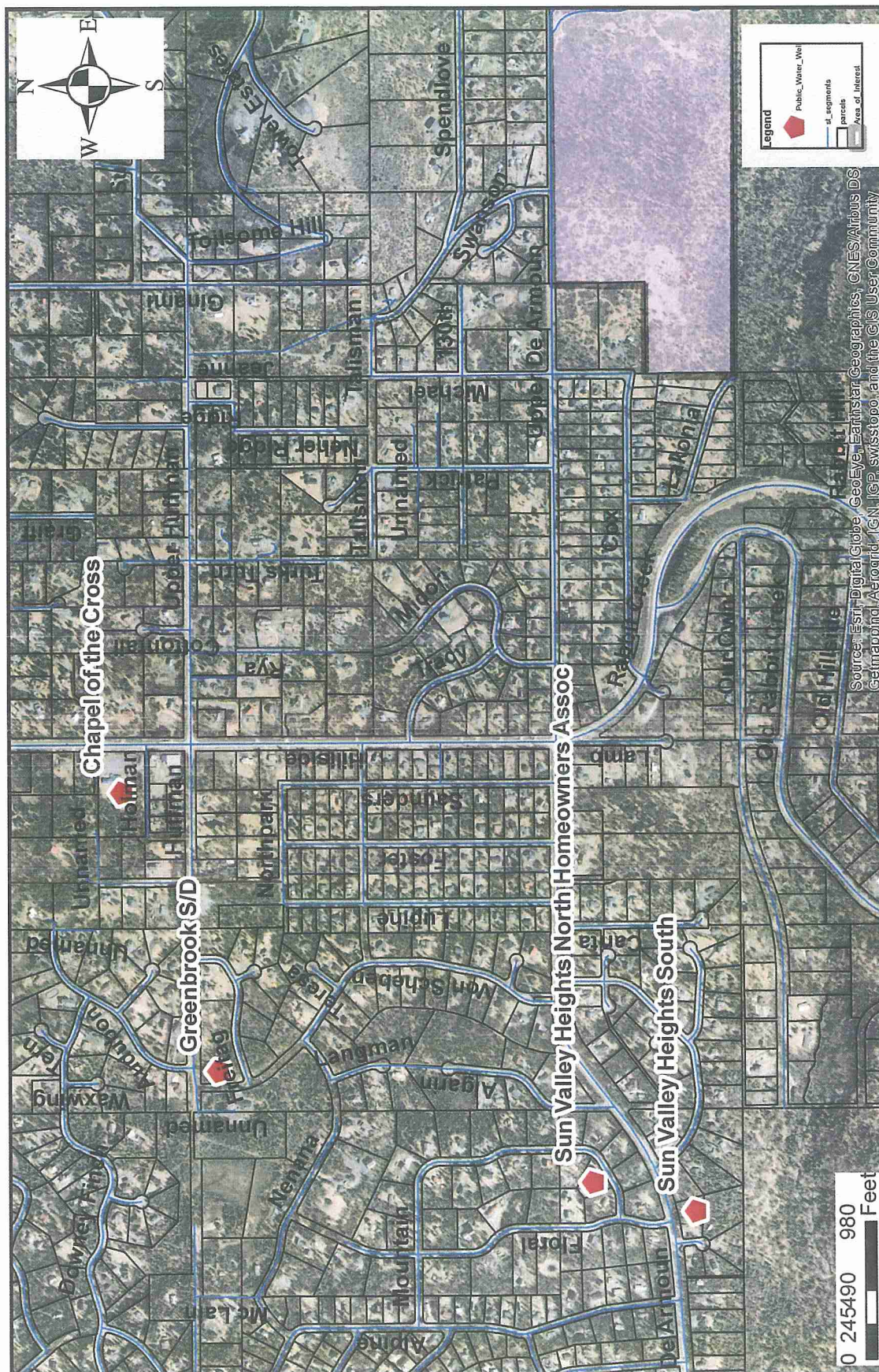
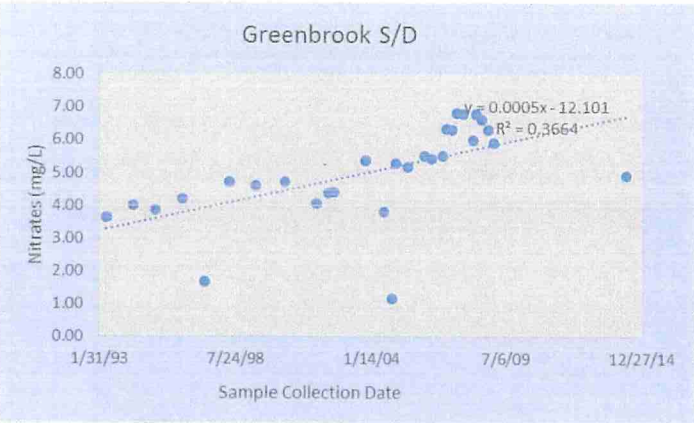
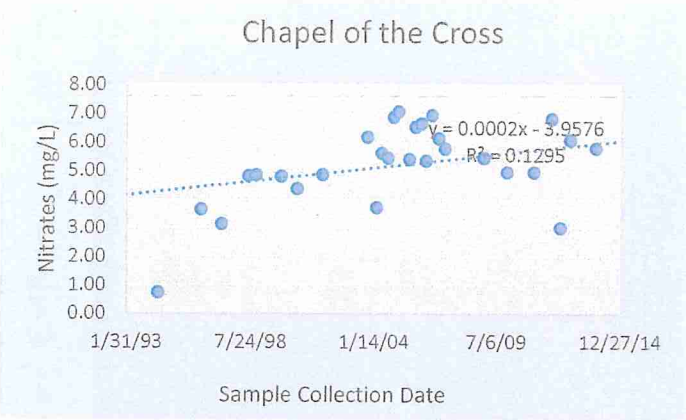


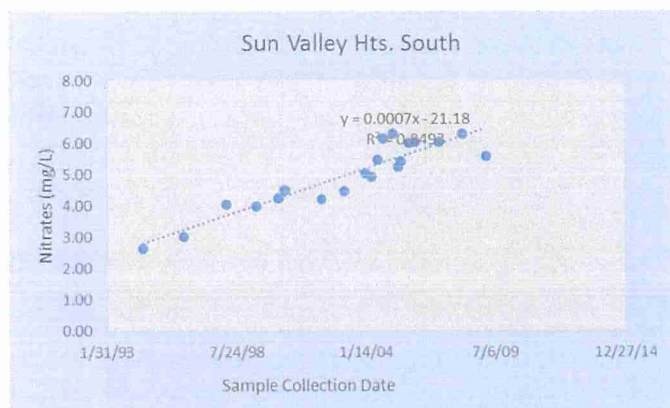
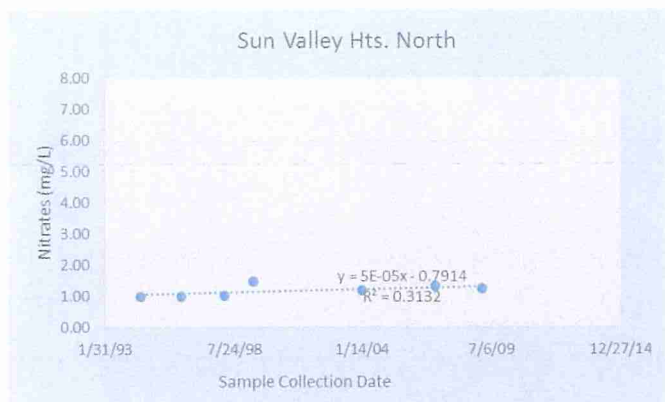
Figure 6
Public Water Systems within Approximately One
Mile of the Lewis and Clark Development Area

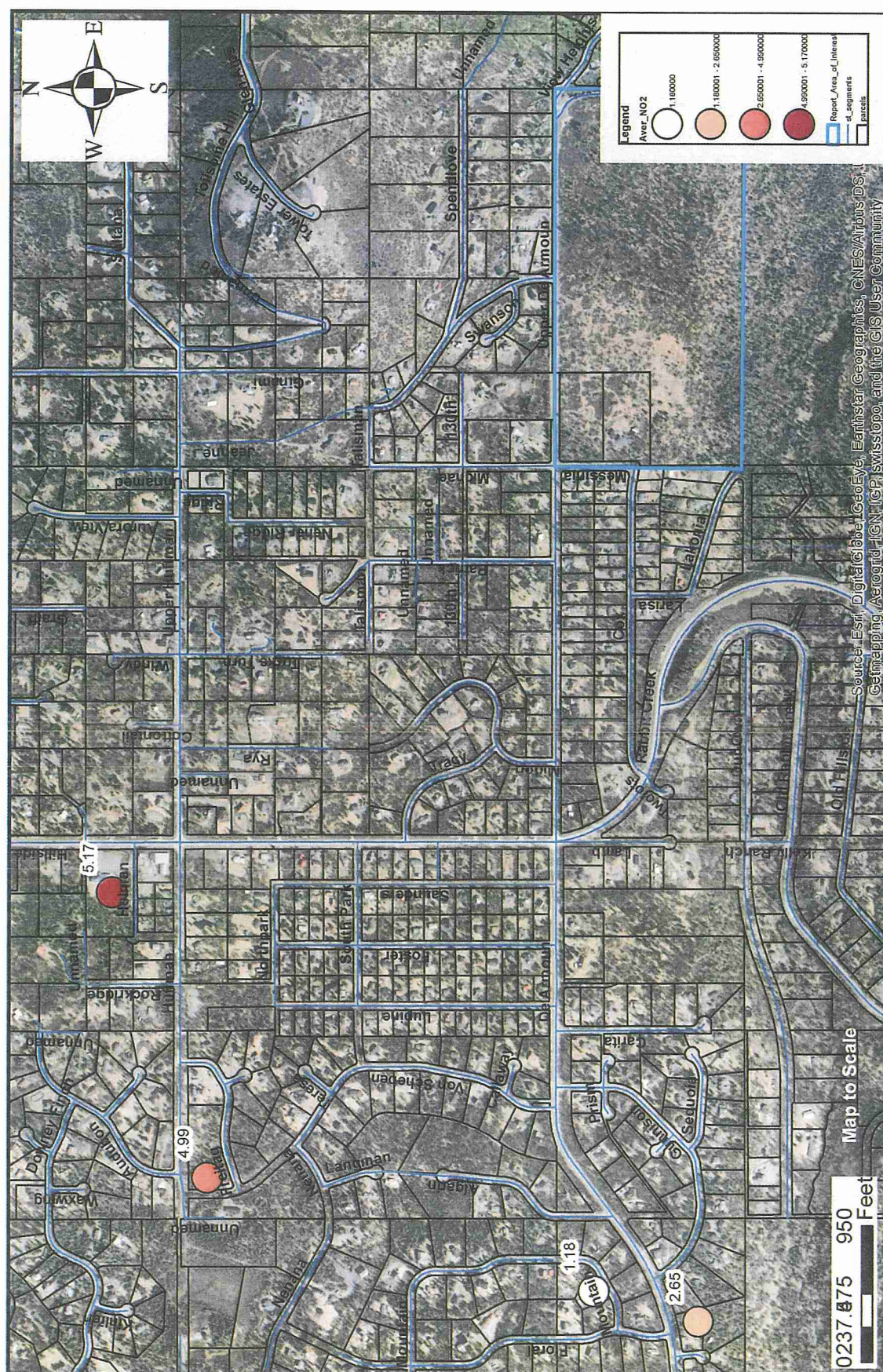
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Enterprises LLC.

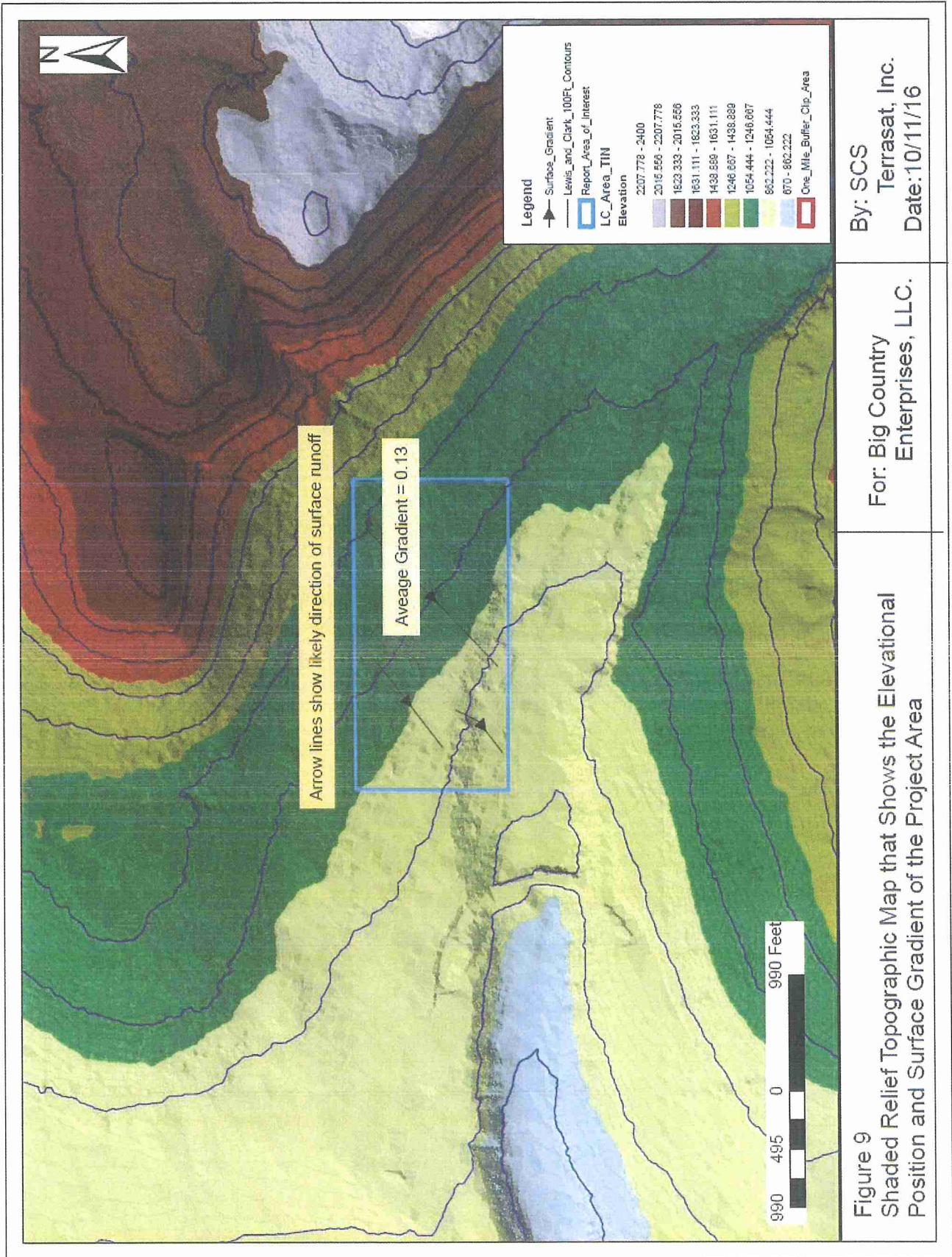
By: SCS
Terrasat, Inc.
Date: 9/26/16

Figure 7. Plots of Nitrate Trends for Four Public Wells









LEWIS & CLARK SUBDIVISION

PRELIMINARY DRAINAGE IMPACT ANALYSIS

Owner/Developer:

Big Country Enterprises, LLC

Prepared By:

TRIAD
ENGINEERING

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March 2017

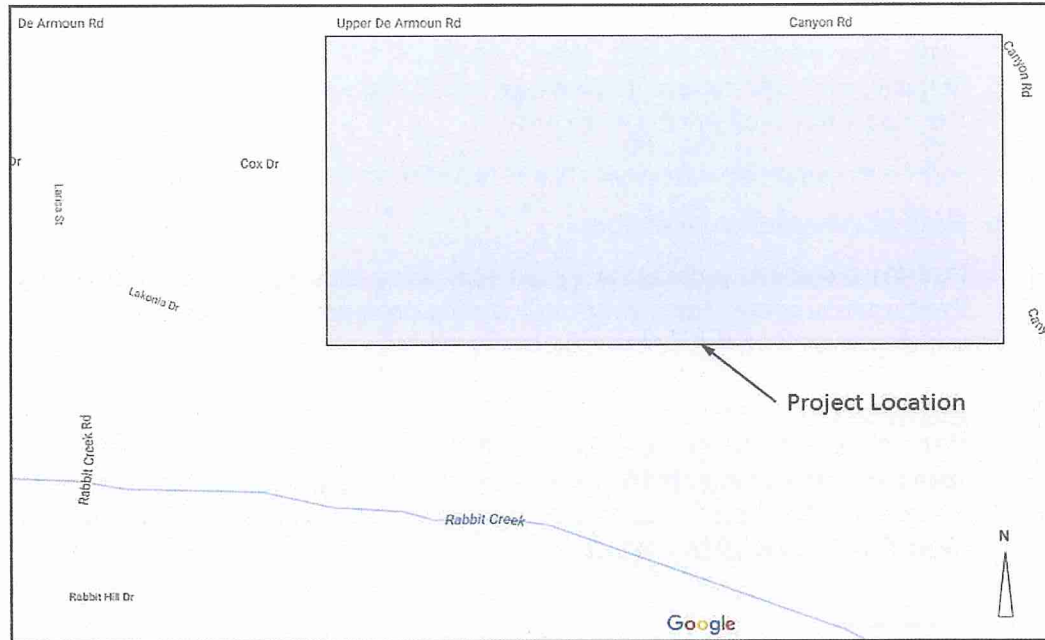
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1. Project Description

a. Location

Lewis and Clark Subdivision is located south of Upper DeArmoun Road and west of Canyon Road within the upper hillside area of Anchorage, Alaska. See the location map, below. Based on the geographic location of the site, a 2.0 orographic factor was used for this analysis (map attached in the Appendix).



Lewis and Clark Location Map

b. Project Description

This project intends to rezone the existing R-8 designation to R-6 and develop the 79-acre parcel with residential, single-family housing. The pre-development conditions will be analyzed and compared to post-development conditions with a 30-lot R-6 and a 15-lot R-8 development. The project area is currently heavily vegetated with mature trees and brush. Proposed road improvements have not been finalized but would consist of strip paved roads with roadside ditches to provide vehicular access to the residential lots.

c. Analysis Description

The primary purpose of this analysis is to quantify pre and post development flow rates and determine the additional runoff generated by increasing the parcel density from R-8 to R-6. Therefore, an analysis was completed for both the 10-year and 100-year storm events. Regardless of whether the site is developed under an R-6 or R-8 zoning designation, it must be able to safely convey the 10-year storm event as well as limit flood risk and downstream impacts to neighboring properties during the 100-year event.

2. Basin Characterization

a. Pre-development conditions

The existing parcel is primarily undeveloped and heavily vegetated. There is one single family home in the northwest corner of the property. No underground storm drain facilities exist in the immediate vicinity of the project, and runoff in the area is conveyed with constructed drainage ditches and natural drainage ways.

On site drainage generally flows in a southwesterly direction via existing drainage ways that outfall to Rabbit Creek, south of the project. The slopes across the majority of the parcel are in the range of 5-20%. See Section 2.c. for the condition of the contributing offsite drainage area.

A pre-development watershed map is included in the report Appendix.

b. Post-development conditions

Post-development conditions of the site were modeled under two scenarios: 1) development under the current R-8 zoning designation and 2) if it is re-zoned and developed with an R-6 density, limited to 30 lots.

R-8 Zoning

If the development remains zoned as R-8, the site would be developed with access roads and approximately 15 single-family lots with an average size of approximately 5 acres per lot. This is based on the maximum density of 0.2 dwelling units/acre from Table 21.08-10 in Title 21.

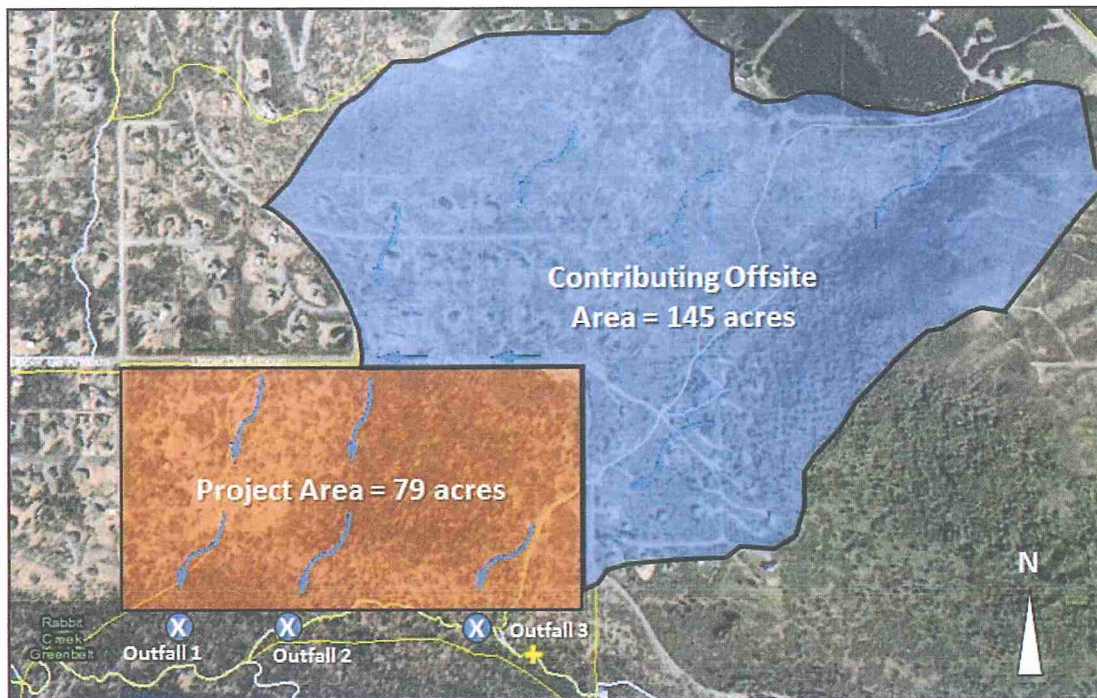
R-6 Zoning

The maximum housing density for R-6 is 0.8 dwelling units/acre as shown in Table 21.08-10 of Title 21. This would allow for 61 lots if the project was developed with no special limitations. However, if the parcel is re-zoned to R-6, the total number of single-family lots is proposed to be limited to 30, this would result in an average lot size will in excess of 2 acres per lot. Under this development concept, the access road length is assumed to be slightly longer than for the R-8 development.

Under either scenario, drainage will continue to flow in a southwesterly direction through existing, MOA-identified drainage ways and outfall to Rabbit Creek.

c. Contributing offsite drainage

Approximately 145 acres to the northwest of the site drains into the project area. This is a significant area that contributes off-site runoff upstream of the project. The offsite area is partially developed with large-lot single-family homes and access roads. A significant portion of the offsite drainage area is undeveloped with woods and steep slopes up to 20%. Flows are captured by roadside ditches and two, 24" culverts cross DeArmoun Road and discharge this offsite runoff into the project area. These flows are conveyed through the site by natural drainage ways and outfall to Rabbit Creek. A watershed map is shown on the following page.



Lewis and Clark Contributing Drainage Map

The contributing offsite area is nearly double the size of the project area and generates significant flows that will need to be addressed in the final design of the subdivision.

d. Floodways, floodplains, and wetlands

No floodways or floodplains are known to exist within the project corridor. Approximately 8.5 acres of wetlands exist on site. See the report Appendix for wetland mapping.

e. Problem areas

Glaciation concerns are present within this site as is common within hillside developments in the Anchorage area. While generally hard to predict, glaciation tends to occur at locations of shallow subsurface water flow which can vary seasonally. This shallow flow can be drawn to the surface by cold temperatures during the winter months. As the shallow subsurface water daylights it freezes and causes glaciation. To combat this issue, known locations of shallow groundwater flow discovered during the future installation of the roadway improvements will be over excavated and the excavation lined with rock. This process further insulates the subsurface water from cold weather and keeps it in a thawed state below ground.

3. Pre-development Runoff Analysis

a. Watershed area

Six total sub-basins make up the watershed area analyzed within this report, three offsite and three on site. The three offsite basins result in a total impervious area of 9.4 acres; the remaining 135.6 acres was modeled as woods in good condition.

The project area includes approximately 70.3 acres of brush and trees modeled as woods in good condition. The single family homes, roadways, and paved driveways result in an impervious area of 0.2 acre and were modeled accordingly. The 8.5 acres of wetlands were also incorporated into the model.

b. Summary of pre-development runoff.

Totals provided in Table 1, below, are for the peak inflow, in cfs, for the summation of all contributing pre-development sub-basins.

Table 1: Pre-development Peak Runoff Rates

	10-Year [cfs]	100-Year [cfs]
Outfall 1	6.8	13.7
Outfall 2	13.5	34.4
Outfall 3	14.9	37.8

Pre development analysis calculations are located within the Appendix.

4. Post-development Runoff Analysis

a. Watershed area

Total overall watershed area does not change between pre and post development conditions and the number of sub-basins does not change. On site, the impervious area increases with the development of single family homes and access roads. Under R-8 zoning, fifteen, 5-acre lots could be developed. If re-zoned to R-6, the development would be limited to 30 lots with an average lot size exceeding 2 acres.

On a per lot basis, the impervious area was estimated at 5,000 square feet, and the grassed area was estimated at 10,000 square feet. 8.5 acres of wetlands are to be left undisturbed, and the remainder of the site was modeled as woods in good condition. See Table 1, below, for surface areas and type contributing to on site runoff.

Table 2: Post-development Drainage Surface Area

Zoning Designation	Impervious Area* [Acre]	Grassed Area [Acre]	Woods [Acre]	Wetlands [Acre]
R-8	2.6	3.3	64.6	8.5
R-6	4.8	6.9	58.8	8.5

*Includes houses, paved driveways and access roads

For R-8 zoning, impervious area would make up 3.3% of the total 79 acres. The R-6 development would create an impervious area of approximately 6.1% of the total project area.

b. Summary of post-development runoff

Totals provided below are the summation of peak inflow, in cfs, for all post-development sub-basins.

Table 3: Post-development Peak Runoff Rates

	10-Year			100-Year		
	R-8 [cfs]	R-6 [cfs]	% Increase R-8 to R-6	R-8 [cfs]	R-6 [cfs]	% Increase R-8 to R-6
Outfall 1	12	12.9	7.0%	24.7	25.9	4.6%
Outfall 2	14.3	15.1	5.3%	33.6	34.7	3.2%
Outfall 3	12.9	13.7	5.8%	31.8	32.9	3.3%

Post development analysis calculations are included in the Appendix.

5. Conclusion

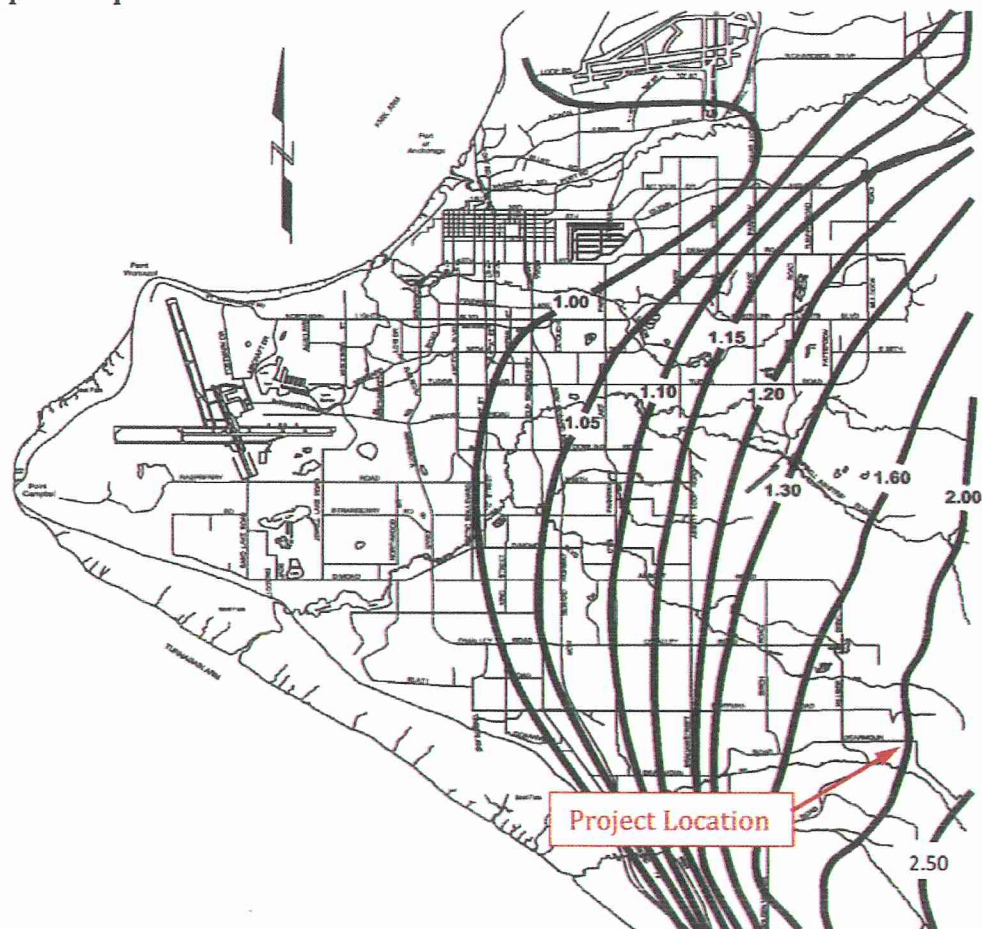
As mentioned in Section 2.c., one of the primary concerns for this development will be the contributing offsite runoff from properties to the north and east of the project. Area upstream of the project generates approximately half of the total runoff that flows through the site. This runoff will be collected and routed through vegetated drainage ways and directed to Rabbit Creek, closely matching the existing drainage path on site. No grading will be done outside of the property boundary, and MOA-identified drainage ways will remain in place downstream of the project. The overall existing drainage pattern of the surrounding area will not change or be negatively affected with the development of this parcel.

Increasing the density from R-8 to R-6 zoning (limited to 30 lots) creates a minimal change in peak runoff, with an increase in the range of 3-7%. This minor increase can be safely managed by sizing drainage ways and culverts accordingly. The increase in impervious area is also minimal, increasing from 3.3% impervious under R-8 zoning to 6.1% impervious with a 30-lot R-6 development.

As proposed, the project site will remain at a low density with an average lot size greater than 2 acres, with over 80% of the parcel predicted to remain as heavily vegetated brush and trees. Glaciation concerns will be addressed by keeping shallow ground water along the roadways below the ground surface. No adverse impacts to neighboring properties are anticipated under the proposed R-6 zoning designation and 30-lot limitation.

Appendix

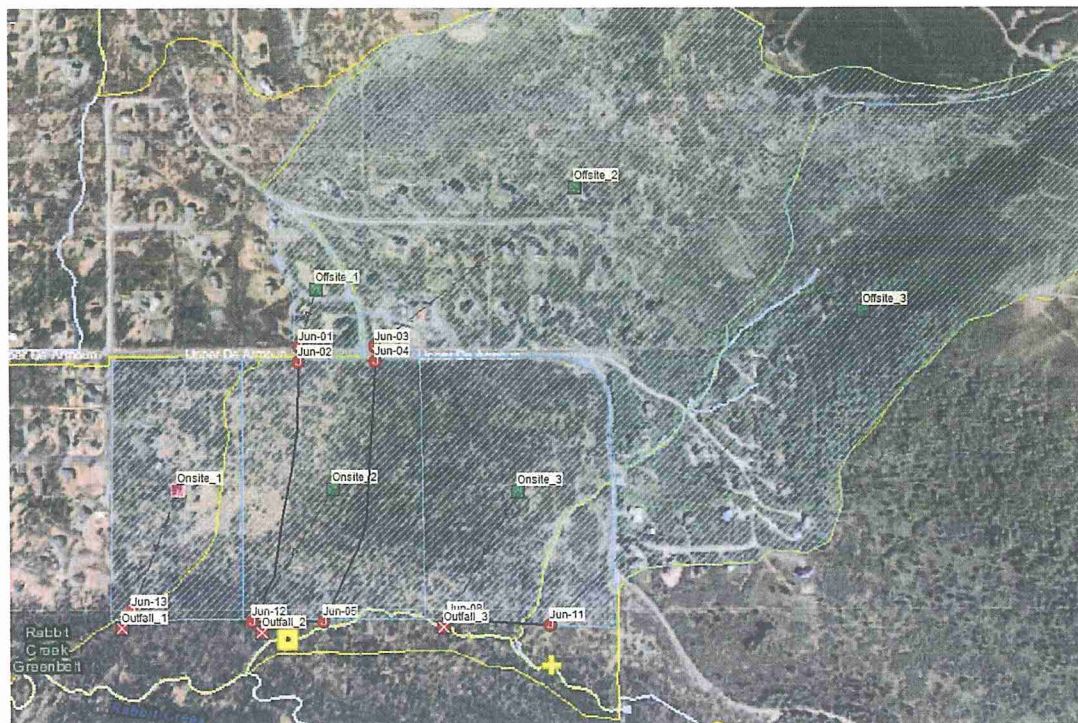
a. Orographic Map



b. Pre-development Watershed Map



c. Post-development Watershed Map



d. Pre-development Calculations

10-Year, 24-Hour

Project Description

File Name Lewis&Clark Predev III.SPF

Analysis Options

Flow Units cfs

Subbasin Hydrograph Method. SCS TR-55

Time of Concentration..... SCS TR-55

Link Routing Method Hydrodynamic

Storage Node Exfiltration.. Constant rate, free surface area

Starting Date APR-13-2016 00:00:00

Ending Date APR-14-2016 06:00:00

Report Time Step 00:05:00

Element Count

Number of rain gages 1

Number of subbasins 6

Number of nodes 12

Number of links 9

Raingage Summary

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage	10 YR	CUMULATIVE	6.00

Subbasin Summary

Subbasin ID	Total Area acres
Offsite_1	5.20
Offsite_2	100.00
Offsite_3	40.00
Onsite_1	15.00
Onsite_2	28.00
Onsite_3	36.00

Node Summary

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft ²	External Inflow
Jun-01	JUNCTION	1110.60	1113.60	0.00	
Jun-02	JUNCTION	1108.94	1111.94	0.00	
Jun-03	JUNCTION	1145.73	1148.73	0.00	
Jun-04	JUNCTION	1143.86	1146.86	0.00	
Jun-05	JUNCTION	970.00	972.00	0.00	
Jun-08	JUNCTION	1022.00	1024.00	0.00	
Jun-11	JUNCTION	1062.00	1064.00	0.00	
Jun-12	JUNCTION	962.00	966.00	0.00	
Jun-13	JUNCTION	922.00	924.00	0.00	
Outfall_1	OUTFALL	920.00	922.00	0.00	
Outfall_2	OUTFALL	960.00	962.00	0.00	
Outfall_3	OUTFALL	1020.00	1022.00	0.00	

Link Summary

Link	From Node	To Node	Element	Length	Slope	Manning's
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ID			Type	ft	%	Roughness
Link-01	Jun-01	Jun-02	CONDUIT	39.0	4.2564	0.0130
Link-02	Jun-03	Jun-04	CONDUIT	41.5	4.5060	0.0130
Link-10	Jun-05	Jun-12	CHANNEL	60.0	10.0000	0.0320
Link-13	Jun-08	Outfall_3	CHANNEL	20.0	10.0000	0.0320
Link-17	Jun-12	Outfall_2	CHANNEL	20.0	10.0000	0.0320
Link-18	Jun-02	Jun-12	CHANNEL	1150.0	12.7774	0.0320
Link-19	Jun-04	Jun-05	CHANNEL	1350.0	12.8785	0.0320
Link-20	Jun-13	Outfall_1	CHANNEL	20.0	10.0000	0.0320
Link-23	Jun-11	Jun-08	CHANNEL	500.0	8.0000	0.0320

Cross Section Summary

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft ²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50	46.67
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50	48.02
Link-10	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-13	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-17	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-18	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.50
Link-19	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.75
Link-20	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-23	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	204.42

	Volume acre-ft	Depth inches
Runoff Quantity Continuity		

Total Precipitation	66.313	3.549
Surface Runoff	1.352	0.072
Continuity Error (%)	-0.000	

	Volume acre-ft	Volume Mgallons
Flow Routing Continuity		

External Inflow	0.000	0.000
External Outflow	13.524	4.407
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

Composite Curve Number Computations Report

Subbasin Offsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Fair	3.77	B	60.00
Paved parking & roofs	1.43	B	98.00
Composite Area & Weighted CN	5.20		70.45

Subbasin Offsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	95.00	B	55.00
Paved parking & roofs	5.00	B	98.00
Composite Area & Weighted CN	100.00		57.15

Subbasin Offsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	37.00	B	55.00
Paved parking & roofs	3.00	B	98.00
Composite Area & Weighted CN	40.00		58.23

Subbasin Onsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	11.79	C	70.00
Paved parking & roofs	0.59	C	98.00
Wetlands	2.62	-	90.00
Composite Area & Weighted CN	15.00		74.59

Subbasin Onsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	24.34	C	70.00
Paved parking & roofs	0.32	C	98.00
Wetlands	3.34	-	90.00
Composite Area & Weighted CN	28.00		72.71

Subbasin Onsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	32.75	C	70.00
Paved parking & roofs	0.55	C	98.00
Wetlands	2.70	-	90.00
Composite Area & Weighted CN	36.00		71.93

***** SCS TR-55 Time of Concentration Computations Report *****

Sheet Flow Equation

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^{0.5}) (unpaved surface)
V = 20.3282 * (Sf^{0.5}) (paved surface)
V = 15.0 * (Sf^{0.5}) (grassed waterway surface)
V = 10.0 * (Sf^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (Sf^{0.5}) (cultivated straight rows surface)
V = 7.0 * (Sf^{0.5}) (short grass pasture surface)
V = 5.0 * (Sf^{0.5}) (woodland surface)
V = 2.5 * (Sf^{0.5}) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^{0.5})) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Offsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	23.20	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	8.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	4.24	0.00	0.00
Computed Flow Time (minutes):	1.18	0.00	0.00
Total TOC (minutes):	24.38		

Subbasin Offsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	3.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.05	0.00	0.00
Computed Flow Time (minutes):	49.55	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	2000.00	1500.00	890.00
Slope (%):	27.00	10.00	8.00
Surface Type:	Woodland	Woodland	Grassed waterway
Velocity (ft/sec):	2.60	1.58	4.24
Computed Flow Time (minutes):	12.82	15.82	3.50
Total TOC (minutes):	81.69		

Subbasin Offsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	40.39	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1500.00	500.00	0.00
Slope (%):	25.00	10.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	2.50	5.10	0.00
Computed Flow Time (minutes):	10.00	1.63	0.00
Total TOC (minutes):	52.03		

Subbasin Onsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
--	-----------	-----------	-----------

Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	1.80	0.00	0.00
Computed Flow Time (minutes):	11.11	0.00	0.00
Total TOC (minutes):	38.67		

Subbasin Onsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	1.80	0.00	0.00
Computed Flow Time (minutes):	11.11	0.00	0.00
Total TOC (minutes):	38.67		

Subbasin Onsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1100.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	1.80	0.00	0.00
Computed Flow Time (minutes):	10.19	0.00	0.00
Total TOC (minutes):	37.75		

***** Subbasin Runoff Summary *****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days hh:mm:ss
Offsite_1	3.54	1.06	2.25	70.450	0 00:24:22
Offsite_2	3.54	0.44	4.17	57.150	0 01:21:41
Offsite_3	3.54	0.48	2.31	58.230	0 00:52:01
Onsite_1	3.54	1.30	6.88	74.590	0 00:38:40

Onsite_2	3.54	1.19	11.21	72.710	0	00:38:40
Onsite_3	3.54	1.14	13.77	71.930	0	00:37:45

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum EGL Attained ft	Time of Max Occurrence days hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
Jun-01	0.12	0.40	1111.00	0 10:15	0	0	0:00:00
Jun-02	0.04	0.15	1109.09	0 10:16	0	0	0:00:00
Jun-03	0.36	0.55	1146.28	0 11:35	0	0	0:00:00
Jun-04	0.14	0.22	1144.08	0 11:38	0	0	0:00:00
Jun-05	0.22	0.45	970.45	0 10:26	0	0	0:00:00
Jun-08	0.19	0.56	1022.56	0 10:25	0	0	0:00:00
Jun-11	0.10	0.18	1062.18	0 10:50	0	0	0:00:00
Jun-12	0.24	0.52	962.52	0 10:26	0	0	0:00:00
Jun-13	0.09	0.34	922.34	0 10:25	0	0	0:00:00
Outfall_1	0.09	0.32	920.32	0 10:25	0	0	0:00:00
Outfall_2	0.22	0.46	960.46	0 10:26	0	0	0:00:00
Outfall_3	0.18	0.49	1020.49	0 10:25	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days hh:mm
Jun-01	JUNCTION	2.24	2.24	0 10:15	0.00	
Jun-02	JUNCTION	0.00	2.24	0 10:15	0.00	
Jun-03	JUNCTION	4.17	4.17	0 11:35	0.00	
Jun-04	JUNCTION	0.00	4.17	0 11:35	0.00	
Jun-05	JUNCTION	11.19	11.82	0 10:25	0.00	
Jun-08	JUNCTION	13.67	14.94	0 10:25	0.00	
Jun-11	JUNCTION	2.31	2.31	0 10:49	0.00	
Jun-12	JUNCTION	0.00	13.48	0 10:25	0.00	
Jun-13	JUNCTION	6.84	6.84	0 10:24	0.00	
Outfall_1	OUTFALL	0.00	6.84	0 10:25	0.00	
Outfall_2	OUTFALL	0.00	13.46	0 10:26	0.00	
Outfall_3	OUTFALL	0.00	14.91	0 10:25	0.00	

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall_1	80.60	1.31	6.84
Outfall_2	86.93	5.19	13.46
Outfall_3	81.86	4.05	14.91
System	83.13	10.56	35.15

Link Flow Summary

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes
Link-01	CONDUIT	0 10:15	8.67	2.93	2.24	46.67	0.05	0.14	0
Link-02	CONDUIT	0 11:35	9.93	2.81	4.17	48.02	0.09	0.19	0
Link-10	CHANNEL	0 10:26	6.92	1.89	11.75	228.55	0.05	0.22	0
Link-13	CHANNEL	0 10:25	7.03	5.68	14.91	228.55	0.07	0.26	0
Link-17	CHANNEL	0 10:26	6.84	5.68	13.46	228.55	0.06	0.25	0
Link-18	CHANNEL	0 10:16	2.08	1.00	2.20	63.50	0.03	0.33	0
Link-19	CHANNEL	0 11:38	4.23	1.00	4.17	63.75	0.07	0.29	0
Link-20	CHANNEL	0 10:25	5.67	5.68	6.84	228.55	0.03	0.16	0

Outfall_2	OUTFALL	960.00	962.00	0.00
Outfall_3	OUTFALL	1020.00	1022.00	0.00

Link Summary

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01	Jun-01	Jun-02	CONDUIT	39.0	4.2564	0.0130
Link-02	Jun-03	Jun-04	CONDUIT	41.5	4.5060	0.0130
Link-10	Jun-05	Jun-12	CHANNEL	60.0	10.0000	0.0320
Link-13	Jun-08	Outfall_3	CHANNEL	20.0	10.0000	0.0320
Link-17	Jun-12	Outfall_2	CHANNEL	20.0	10.0000	0.0320
Link-18	Jun-02	Jun-12	CHANNEL	1150.0	12.7774	0.0320
Link-19	Jun-04	Jun-05	CHANNEL	1350.0	12.8785	0.0320
Link-20	Jun-13	Outfall_1	CHANNEL	20.0	10.0000	0.0320
Link-23	Jun-11	Jun-08	CHANNEL	500.0	8.0000	0.0320

Cross Section Summary

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft ²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50	46.67
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50	48.02
Link-10	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-13	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-17	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-18	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.50
Link-19	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.75
Link-20	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-23	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	204.42

	Volume acre-ft	Depth inches
Runoff Quantity Continuity		

Total Precipitation	92.904	4.973
Surface Runoff	2.852	0.153
Continuity Error (%)	-0.000	

	Volume acre-ft	Volume Mgallons
Flow Routing Continuity		

External Inflow	0.000	0.000
External Outflow	28.521	9.294
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

Composite Curve Number Computations Report

Subbasin Offsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Fair	3.77	B	60.00
Paved parking & roofs	1.43	B	98.00
Composite Area & Weighted CN	5.20		70.45

Subbasin Offsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	95.00	B	55.00
Paved parking & roofs	5.00	B	98.00
Composite Area & Weighted CN	100.00		57.15

Subbasin Offsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
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Woods, Good	37.00	B	55.00
Paved parking & roofs	3.00	B	98.00
Composite Area & Weighted CN	40.00		58.23

Subbasin Onsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	11.79	C	70.00
Paved parking & roofs	0.59	C	98.00
Wetlands	2.62	-	90.00
Composite Area & Weighted CN	15.00		74.59

Subbasin Onsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	24.34	C	70.00
Paved parking & roofs	0.32	C	98.00
Wetlands	3.34	-	90.00
Composite Area & Weighted CN	28.00		72.71

Subbasin Onsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	32.75	C	70.00
Paved parking & roofs	0.55	C	98.00
Wetlands	2.70	-	90.00
Composite Area & Weighted CN	36.00		71.93

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^{0.5}) (unpaved surface)
V = 20.3282 * (Sf^{0.5}) (paved surface)
V = 15.0 * (Sf^{0.5}) (grassed waterway surface)
V = 10.0 * (Sf^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (Sf^{0.5}) (cultivated straight rows surface)
V = 7.0 * (Sf^{0.5}) (short grass pasture surface)
V = 5.0 * (Sf^{0.5}) (woodland surface)
V = 2.5 * (Sf^{0.5}) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^{0.5})) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)

R = Hydraulic Radius (ft)
 A_g = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's Roughness

 Subbasin Offsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	23.20	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	8.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	4.24	0.00	0.00
Computed Flow Time (minutes):	1.18	0.00	0.00

Total TOC (minutes):	24.38		
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 Subbasin Offsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	3.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.05	0.00	0.00
Computed Flow Time (minutes):	49.55	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	2000.00	1500.00	890.00
Slope (%):	27.00	10.00	8.00
Surface Type:	Woodland	Woodland	Grassed waterway
Velocity (ft/sec):	2.60	1.58	4.24
Computed Flow Time (minutes):	12.82	15.82	3.50

Total TOC (minutes):	81.69		
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 Subbasin Offsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	40.39	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1500.00	500.00	0.00
Slope (%):	25.00	10.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	2.50	5.10	0.00
Computed Flow Time (minutes):	10.00	1.63	0.00

Total TOC (minutes):	52.03		
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Subbasin Onsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	1.80	0.00	0.00
Computed Flow Time (minutes):	11.11	0.00	0.00

Total TOC (minutes): 38.67

Subbasin Onsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	1.80	0.00	0.00
Computed Flow Time (minutes):	11.11	0.00	0.00

Total TOC (minutes): 38.67

Subbasin Onsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1100.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	1.80	0.00	0.00
Computed Flow Time (minutes):	10.19	0.00	0.00

Total TOC (minutes): 37.75

Subbasin Runoff Summary

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days hh:mm:ss
Offsite_1	4.96	2.04	5.01	70.450	0 00:24:22
Offsite_2	4.96	1.09	18.00	57.150	0 01:21:41
Offsite_3	4.96	1.16	10.38	58.230	0 00:52:01
Onsite_1	4.96	2.38	13.81	74.590	0 00:38:40
Onsite_2	4.96	2.23	23.65	72.710	0 00:38:40
Onsite_3	4.96	2.16	29.59	71.930	0 00:37:45

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
Jun-01	0.17	0.62	1111.22	0 10:15	0	0	0:00:00
Jun-02	0.06	0.24	1109.18	0 10:15	0	0	0:00:00
Jun-03	0.64	1.40	1147.13	0 11:04	0	0	0:00:00
Jun-04	0.25	0.51	1144.37	0 11:05	0	0	0:00:00
Jun-05	0.36	0.79	970.79	0 10:31	0	0	0:00:00
Jun-08	0.31	0.98	1022.98	0 10:25	0	0	0:00:00
Jun-11	0.17	0.42	1062.42	0 10:40	0	0	0:00:00
Jun-12	0.40	0.93	962.93	0 10:30	0	0	0:00:00
Jun-13	0.14	0.53	922.53	0 10:20	0	0	0:00:00
Outfall_1	0.13	0.47	920.47	0 10:20	0	0	0:00:00
Outfall_2	0.36	0.77	960.77	0 10:30	0	0	0:00:00
Outfall_3	0.28	0.81	1020.81	0 10:25	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days hh:mm	Maximum Flooded Overflow cfs	Time of Peak Flooded Occurrence days hh:mm
Jun-01	JUNCTION	4.96	4.96	0 10:15	0.00	
Jun-02	JUNCTION	0.00	4.96	0 10:15	0.00	
Jun-03	JUNCTION	17.96	17.96	0 11:04	0.00	
Jun-04	JUNCTION	0.00	17.96	0 11:05	0.00	
Jun-05	JUNCTION	23.40	31.50	0 10:30	0.00	
Jun-08	JUNCTION	29.40	37.84	0 10:24	0.00	
Jun-11	JUNCTION	10.32	10.32	0 10:40	0.00	
Jun-12	JUNCTION	0.00	34.41	0 10:30	0.00	
Jun-13	JUNCTION	13.67	13.67	0 10:20	0.00	
Outfall_1	OUTFALL	0.00	13.68	0 10:20	0.00	
Outfall_2	OUTFALL	0.00	34.39	0 10:30	0.00	
Outfall_3	OUTFALL	0.00	37.79	0 10:25	0.00	

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall_1	86.79	2.26	13.68
Outfall_2	91.62	11.27	34.39
Outfall_3	87.79	7.99	37.79
System	88.73	21.52	85.22

Link Flow Summary

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes
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Link-01	CONDUIT	0	10:15	9.93	2.93	4.96	46.67	0.11	0.22	0
Link-02	CONDUIT	0	11:05	12.18	2.81	17.96	48.02	0.37	0.48	0
Link-10	CHANNEL	0	10:31	9.09	1.89	31.43	228.55	0.14	0.38	0
Link-13	CHANNEL	0	10:25	8.78	5.68	37.79	228.55	0.17	0.45	0
Link-17	CHANNEL	0	10:30	8.60	5.68	34.39	228.55	0.15	0.43	0
Link-18	CHANNEL	0	10:15	2.51	1.00	4.92	63.50	0.08	0.56	0
Link-19	CHANNEL	0	11:05	6.89	1.00	17.95	63.75	0.28	0.63	0
Link-20	CHANNEL	0	10:20	6.87	5.68	13.68	228.55	0.06	0.25	0
Link-23	CHANNEL	0	10:40	3.81	1.00	10.32	204.42	0.05	0.34	0

Highest Flow Instability Indexes

All links are stable.

WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-12.

Analysis began on: Mon Sep 26 13:07:07 2016

Analysis ended on: Mon Sep 26 13:07:09 2016

Total elapsed time: 00:00:02

e. Post-development Calculations

10-Year, 24-hour

R-8 Zoning

Project Description

File Name Lewis&Clark Postdev R-8 II.SPF

Analysis Options

Flow Units cfs

Subbasin Hydrograph Method. SCS TR-55

Time of Concentration..... SCS TR-55

Link Routing Method Hydrodynamic

Storage Node Exfiltration.. Constant rate, free surface area

Starting Date APR-13-2016 00:00:00

Ending Date APR-14-2016 06:00:00

Report Time Step 00:05:00

Element Count

Number of rain gages 1

Number of subbasins 6

Number of nodes 12

Number of links 9

Raingage Summary

Gage ID	Data Source	Data Type	Recording Interval min
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Rain Gage	10 YR	CUMULATIVE	6.00
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Subbasin Summary

Subbasin ID	Total Area acres
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Offsite_1	5.20
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Offsite_2	100.00
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Offsite_3	40.00
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Onsite_1	25.60
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Onsite_2	25.70
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Onsite_3	25.70
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Node Summary

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Fonded Area ft ²	External Inflow
Jun-01	JUNCTION	1110.60	1113.60	0.00	
Jun-02	JUNCTION	1108.94	1111.94	0.00	
Jun-03	JUNCTION	1145.73	1148.73	0.00	
Jun-04	JUNCTION	1143.86	1146.86	0.00	
Jun-05	JUNCTION	970.00	972.00	0.00	
Jun-08	JUNCTION	1022.00	1024.00	0.00	
Jun-11	JUNCTION	1062.00	1064.00	0.00	
Jun-12	JUNCTION	962.00	966.00	0.00	
Jun-13	JUNCTION	922.00	924.00	0.00	
Outfall_1	OUTFALL	920.00	922.00	0.00	
Outfall_2	OUTFALL	960.00	962.00	0.00	
Outfall_3	OUTFALL	1020.00	1022.00	0.00	

Link Summary

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01	Jun-01	Jun-02	CONDUIT	39.0	4.2564	0.0130
Link-02	Jun-03	Jun-04	CONDUIT	41.5	4.5060	0.0130
Link-10	Jun-05	Jun-12	CHANNEL	60.0	10.0000	0.0320
Link-13	Jun-08	Outfall_3	CHANNEL	20.0	10.0000	0.0320
Link-17	Jun-12	Outfall_2	CHANNEL	20.0	10.0000	0.0320
Link-18	Jun-02	Jun-12	CHANNEL	1150.0	12.7774	0.0320
Link-19	Jun-04	Jun-05	CHANNEL	1350.0	12.8785	0.0320
Link-20	Jun-13	Outfall_1	CHANNEL	20.0	10.0000	0.0320
Link-23	Jun-11	Jun-08	CHANNEL	500.0	8.0000	0.0320

Cross Section Summary

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft ²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50	46.67
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50	48.02
Link-10	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-13	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-17	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-18	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.50
Link-19	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.75
Link-20	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-23	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	204.42

Runoff Quantity Continuity

	Volume acre-ft	Depth inches
Total Precipitation	65.722	3.549
Surface Runoff	1.356	0.073
Continuity Error (%)	-0.000	

Flow Routing Continuity

	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	13.562	4.419
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

Composite Curve Number Computations Report

Subbasin Offsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Fair	3.77	B	60.00
Paved parking & roofs	1.43	B	98.00
Composite Area & Weighted CN	5.20		70.45

Subbasin Offsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	95.00	B	55.00
Paved parking & roofs	5.00	B	98.00
Composite Area & Weighted CN	100.00		57.15

Subbasin Offsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	37.00	B	55.00
Paved parking & roofs	3.00	B	98.00
Composite Area & Weighted CN	40.00		58.23

Subbasin Onsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	1.10	C	74.00
Woods, Good	20.80	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	0.90	C	98.00
Composite Area & Weighted CN	25.60		73.34

Subbasin Onsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	1.10	C	74.00
Woods, Good	20.90	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	0.90	C	98.00
Composite Area & Weighted CN	25.70		73.33

Subbasin Onsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	1.10	C	74.00
Woods, Good	20.90	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	0.90	C	98.00
Composite Area & Weighted CN	25.70		73.33

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where:

T_c = Time of Concentration (hrs)
n = Manning's Roughness
L_f = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
V = 20.3282 * (S_f^{0.5}) (paved surface)
V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
V = 5.0 * (S_f^{0.5}) (woodland surface)
V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
T_c = (L_f / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

$V = (1.49 * (R^{2/3}) * (Sf^{0.5})) / n$
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Offsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	23.20	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	8.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	4.24	0.00	0.00
Computed Flow Time (minutes):	1.18	0.00	0.00

Total TOC (minutes): 24.38

Subbasin Offsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	3.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.05	0.00	0.00
Computed Flow Time (minutes):	49.55	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	2000.00	1500.00	890.00
Slope (%):	27.00	10.00	8.00
Surface Type:	Woodland	Woodland	Grassed waterway
Velocity (ft/sec):	2.60	1.58	4.24
Computed Flow Time (minutes):	12.82	15.82	3.50

Total TOC (minutes): 81.69

Subbasin Offsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
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Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	40.39	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1500.00	500.00	0.00
Slope (%):	25.00	10.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	2.50	5.10	0.00
Computed Flow Time (minutes):	10.00	1.63	0.00
Total TOC (minutes):	52.03		

Subbasin Onsite_1

Sheet Flow Computations

Manning's Roughness:	Subarea A	Subarea B	Subarea C
	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00
Total TOC (minutes):	31.26		

Subbasin Onsite_2

Sheet Flow Computations

Manning's Roughness:	Subarea A	Subarea B	Subarea C
	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00
Total TOC (minutes):	31.26		

Subbasin Onsite_3

Sheet Flow Computations

Manning's Roughness:	Subarea A	Subarea B	Subarea C
	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00
Total TOC (minutes):	31.26		

***** Subbasin Runoff Summary *****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days hh:mm:ss
Offsite_1	3.54	1.06	2.25	70.450	0 00:24:22
Offsite_2	3.54	0.44	4.17	57.150	0 01:21:41
Offsite_3	3.54	0.48	2.31	58.230	0 00:52:01
Onsite_1	3.54	1.23	12.13	73.340	0 00:31:15
Onsite_2	3.54	1.23	12.17	73.330	0 00:31:15
Onsite_3	3.54	1.23	12.17	73.330	0 00:31:15

***** Node Depth Summary *****

Node ID	Average Depth Attained ft	Maximum Depth ft	Maximum HGL Attained ft	Time of Max Occurrence days hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
Jun-01	0.12	0.40	1111.00	0 10:15	0	0	0:00:00
Jun-02	0.04	0.15	1109.09	0 10:16	0	0	0:00:00
Jun-03	0.36	0.55	1146.28	0 11:35	0	0	0:00:00
Jun-04	0.14	0.22	1144.08	0 11:38	0	0	0:00:00
Jun-05	0.16	0.24	970.24	0 11:41	0	0	0:00:00
Jun-08	0.17	0.51	1022.51	0 10:20	0	0	0:00:00
Jun-11	0.10	0.18	1062.18	0 10:50	0	0	0:00:00
Jun-12	0.23	0.54	962.54	0 10:20	0	0	0:00:00
Jun-13	0.12	0.49	922.49	0 10:19	0	0	0:00:00
Outfall_1	0.12	0.43	920.43	0 10:20	0	0	0:00:00
Outfall_2	0.22	0.48	960.48	0 10:20	0	0	0:00:00
Outfall_3	0.16	0.45	1020.45	0 10:20	0	0	0:00:00

***** Node Flow Summary *****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days hh:mm
Jun-01	JUNCTION	2.24	2.24	0 10:14	0.00	
Jun-02	JUNCTION	0.00	2.24	0 10:15	0.00	
Jun-03	JUNCTION	4.17	4.17	0 11:35	0.00	
Jun-04	JUNCTION	0.00	4.17	0 11:35	0.00	
Jun-05	JUNCTION	0.00	4.17	0 11:38	0.00	
Jun-08	JUNCTION	12.06	12.92	0 10:19	0.00	
Jun-11	JUNCTION	2.31	2.31	0 10:49	0.00	
Jun-12	JUNCTION	12.06	14.31	0 10:19	0.00	
Jun-13	JUNCTION	12.02	12.02	0 10:19	0.00	
Outfall_1	OUTFALL	0.00	12.02	0 10:20	0.00	
Outfall_2	OUTFALL	0.00	14.26	0 10:20	0.00	
Outfall_3	OUTFALL	0.00	12.88	0 10:20	0.00	

***** Outfall Loading Summary *****

Outfall Node ID	Flow Frequency	Average Flow	Peak Inflow
-----------------	----------------	--------------	-------------

	(%)	cfs	cfs
Outfall_1	80.16	2.06	12.02
Outfall_2	86.82	5.00	14.26
Outfall_3	82.14	3.31	12.88
System	83.04	10.37	39.13

Link Flow Summary

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes
Link-01	CONDUIT	0 10:15	8.67	2.93	2.24	46.67	0.05	0.14	0
Link-02	CONDUIT	0 11:35	9.93	2.81	4.17	48.02	0.09	0.19	0
Link-10	CHANNEL	0 11:41	5.00	1.89	4.17	228.55	0.02	0.12	0
Link-13	CHANNEL	0 10:20	6.77	5.68	12.88	228.55	0.06	0.24	0
Link-17	CHANNEL	0 10:20	6.95	5.68	14.26	228.55	0.06	0.26	0
Link-18	CHANNEL	0 10:16	1.77	1.00	2.20	63.50	0.03	0.34	0
Link-19	CHANNEL	0 11:38	5.21	1.00	4.17	63.75	0.07	0.23	0
Link-20	CHANNEL	0 10:20	6.64	5.68	12.02	228.55	0.05	0.23	0
Link-23	CHANNEL	0 10:50	2.53	1.00	2.31	204.42	0.01	0.16	0

Highest Flow Instability Indexes

All links are stable.

WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-12.

Analysis began on: Mon Sep 26 13:12:27 2016
Analysis ended on: Mon Sep 26 13:12:28 2016
Total elapsed time: 00:00:01

R-6 Zoning

Project Description

File Name Lewis&Clark Postdev R-6 II.SPF

Analysis Options

Flow Units cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method Hydrodynamic
Storage Node Exfiltration.. Constant rate, free surface area
Starting Date APR-13-2016 00:00:00
Ending Date APR-14-2016 06:00:00
Report Time Step 00:05:00

Element Count

Number of rain gages 1
Number of subbasins 6
Number of nodes 12
Number of links 9

Raingage Summary

Gage ID Data Source Data Type Recording Interval
min

Rain Gage 10 YR CUMULATIVE 6.00

Subbasin Summary

Subbasin Total Area

ID	acres
-----	-----
Offsite_1	5.20
Offsite_2	100.00
Offsite_3	40.00
Onsite_1	25.60
Onsite_2	25.70
Onsite_3	25.70

Node Summary

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
-----	-----	-----	-----	-----	-----
Jun-01	JUNCTION	1110.60	1113.60	0.00	
Jun-02	JUNCTION	1108.94	1111.94	0.00	
Jun-03	JUNCTION	1145.73	1148.73	0.00	
Jun-04	JUNCTION	1143.86	1146.86	0.00	
Jun-05	JUNCTION	970.00	972.00	0.00	
Jun-08	JUNCTION	1022.00	1024.00	0.00	
Jun-11	JUNCTION	1062.00	1064.00	0.00	
Jun-12	JUNCTION	962.00	966.00	0.00	
Jun-13	JUNCTION	922.00	924.00	0.00	
Outfall_1	OUTFALL	920.00	922.00	0.00	
Outfall_2	OUTFALL	960.00	962.00	0.00	
Outfall_3	OUTFALL	1020.00	1022.00	0.00	

Link Summary

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
-----	-----	-----	-----	-----	-----	-----
Link-01	Jun-01	Jun-02	CONDUIT	39.0	4.2564	0.0130
Link-02	Jun-03	Jun-04	CONDUIT	41.5	4.5060	0.0130
Link-10	Jun-05	Jun-12	CHANNEL	60.0	10.0000	0.0320
Link-13	Jun-08	Outfall_3	CHANNEL	20.0	10.0000	0.0320
Link-17	Jun-12	Outfall_2	CHANNEL	20.0	10.0000	0.0320
Link-18	Jun-02	Jun-12	CHANNEL	1150.0	12.7774	0.0320
Link-19	Jun-04	Jun-05	CHANNEL	1350.0	12.8785	0.0320
Link-20	Jun-13	Outfall_1	CHANNEL	20.0	10.0000	0.0320
Link-23	Jun-11	Jun-08	CHANNEL	500.0	8.0000	0.0320

Cross Section Summary

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
-----	-----	-----	-----	-----	-----	-----	-----
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50	46.67
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50	48.02
Link-10	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-13	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-17	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-18	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.50
Link-19	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.75
Link-20	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-23	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	204.42

***** Runoff Quantity Continuity *****	Volume acre-ft	Depth inches
-----	-----	-----
Total Precipitation	65.722	3.549
Surface Runoff	1.394	0.075
Continuity Error (%)	-0.000	

***** Flow Routing Continuity *****	Volume acre-ft	Volume Mgallons
-----	-----	-----
External Inflow	0.000	0.000
External Outflow	13.938	4.542
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

Composite Curve Number Computations Report

Subbasin Offsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Fair	3.77	B	60.00
Paved parking & roofs	1.43	B	98.00
Composite Area & Weighted CN	5.20		70.45

Subbasin Offsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	95.00	B	55.00
Paved parking & roofs	5.00	B	98.00
Composite Area & Weighted CN	100.00		57.15

Subbasin Offsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	37.00	B	55.00
Paved parking & roofs	3.00	B	98.00
Composite Area & Weighted CN	40.00		58.23

Subbasin Onsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	2.30	C	74.00
Woods, Good	18.90	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	1.60	C	98.00
Composite Area & Weighted CN	25.60		74.30

Subbasin Onsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	2.30	C	74.00
Woods, Good	19.00	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	1.60	C	98.00
Composite Area & Weighted CN	25.70		74.28

Subbasin Onsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	2.30	C	74.00
Woods, Good	19.00	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	1.60	C	98.00
Composite Area & Weighted CN	25.70		74.28

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

```

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

```

Where:

```

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

```

Channel Flow Equation

```

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

```

Where:

```

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

```

Subbasin Offsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	23.20	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	8.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	4.24	0.00	0.00
Computed Flow Time (minutes):	1.18	0.00	0.00

Total TOC (minutes):	24.38		
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Subbasin Offsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	3.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.05	0.00	0.00
Computed Flow Time (minutes):	49.55	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	2000.00	1500.00	890.00
Slope (%):	27.00	10.00	8.00
Surface Type:	Woodland	Woodland	Grassed waterway
Velocity (ft/sec):	2.60	1.58	4.24
Computed Flow Time (minutes):	12.82	15.82	3.50

Total TOC (minutes): 81.69

Subbasin Offsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	40.39	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1500.00	500.00	0.00
Slope (%):	25.00	10.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	2.50	5.10	0.00
Computed Flow Time (minutes):	10.00	1.63	0.00

Total TOC (minutes): 52.03

Subbasin Onsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00

Total TOC (minutes): 31.26

Subbasin Onsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00

Total TOC (minutes): 31.26

Subbasin Onsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00

=====
Total TOC (minutes): 31.26
=====

Subbasin Runoff Summary

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days hh:mm:ss
Offsite_1	3.54	1.06	2.25	70.450	0 00:24:22
Offsite_2	3.54	0.44	4.17	57.150	0 01:21:41
Offsite_3	3.54	0.48	2.31	58.230	0 00:52:01
Onsite_1	3.54	1.29	12.96	74.300	0 00:31:15
Onsite_2	3.54	1.28	13.00	74.280	0 00:31:15
Onsite_3	3.54	1.28	13.00	74.280	0 00:31:15

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
Jun-01	0.12	0.40	1111.00	0 10:15	0	0	0:00:00
Jun-02	0.04	0.15	1109.09	0 10:16	0	0	0:00:00
Jun-03	0.36	0.55	1146.28	0 11:35	0	0	0:00:00
Jun-04	0.14	0.22	1144.08	0 11:38	0	0	0:00:00
Jun-05	0.16	0.24	970.24	0 11:41	0	0	0:00:00
Jun-08	0.18	0.53	1022.53	0 10:20	0	0	0:00:00
Jun-11	0.10	0.18	1062.18	0 10:50	0	0	0:00:00
Jun-12	0.24	0.56	962.56	0 10:20	0	0	0:00:00
Jun-13	0.13	0.51	922.51	0 10:20	0	0	0:00:00
Outfall_1	0.12	0.45	920.45	0 10:20	0	0	0:00:00
Outfall_2	0.22	0.49	960.49	0 10:20	0	0	0:00:00
Outfall_3	0.17	0.47	1020.47	0 10:20	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days hh:mm
Jun-01	JUNCTION	2.24	2.24	0 10:14	0.00	
Jun-02	JUNCTION	0.00	2.24	0 10:15	0.00	
Jun-03	JUNCTION	4.17	4.17	0 11:35	0.00	
Jun-04	JUNCTION	0.00	4.17	0 11:35	0.00	
Jun-05	JUNCTION	0.00	4.17	0 11:38	0.00	
Jun-08	JUNCTION	12.89	13.74	0 10:20	0.00	
Jun-11	JUNCTION	2.31	2.31	0 10:49	0.00	
Jun-12	JUNCTION	12.89	15.13	0 10:19	0.00	
Jun-13	JUNCTION	12.85	12.85	0 10:19	0.00	
Outfall_1	OUTFALL	0.00	12.85	0 10:20	0.00	

Outfall_2	OUTFALL	0.00	15.08	0	10:20	0.00
Outfall_3	OUTFALL	0.00	13.70	0	10:20	0.00

 Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall_1	80.23	2.17	12.85
Outfall_2	87.15	5.09	15.08
Outfall_3	82.53	3.40	13.70
System	83.30	10.66	41.60

 Link Flow Summary

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes
Link-01	CONDUIT	0 10:15	8.67	2.93	2.24	46.67	0.05	0.14	0
Link-02	CONDUIT	0 11:35	9.93	2.81	4.17	48.02	0.09	0.19	0
Link-10	CHANNEL	0 11:41	5.00	1.89	4.17	228.55	0.02	0.12	0
Link-13	CHANNEL	0 10:20	6.88	5.68	13.70	228.55	0.06	0.25	0
Link-17	CHANNEL	0 10:20	7.05	5.68	15.08	228.55	0.07	0.26	0
Link-18	CHANNEL	0 10:16	1.70	1.00	2.20	63.50	0.03	0.35	0
Link-19	CHANNEL	0 11:38	5.21	1.00	4.17	63.75	0.07	0.23	0
Link-20	CHANNEL	0 10:20	6.76	5.68	12.85	228.55	0.06	0.24	0
Link-23	CHANNEL	0 10:50	2.49	1.00	2.31	204.42	0.01	0.16	0

 Highest Flow Instability Indexes

 All links are stable.

WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-12.

Analysis began on: Mon Sep 26 13:16:36 2016
 Analysis ended on: Mon Sep 26 13:16:38 2016
 Total elapsed time: 00:00:02

100-Year, 24-hour

R-8 Zoning

 Project Description

 File Name Lewis&Clark Postdev R-8 II.SPF

 Analysis Options

 Flow Units cfs
 Subbasin Hydrograph Method. SCS TR-55
 Time of Concentration..... SCS TR-55
 Link Routing Method Hydrodynamic
 Storage Node Exfiltration.. Constant rate, free surface area
 Starting Date APR-13-2016 00:00:00
 Ending Date APR-14-2016 06:00:00
 Report Time Step 00:05:00

 Element Count

 Number of rain gages 1
 Number of subbasins 6
 Number of nodes 12
 Number of links 9

Raingage Summary

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage	100 YR	CUMULATIVE	6.00

Subbasin Summary

Subbasin ID	Total Area acres
Offsite_1	5.20
Offsite_2	100.00
Offsite_3	40.00
Onsite_1	25.60
Onsite_2	25.70
Onsite_3	25.70

Node Summary

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft ²	External Inflow
Jun-01	JUNCTION	1110.60	1113.60	0.00	
Jun-02	JUNCTION	1108.94	1111.94	0.00	
Jun-03	JUNCTION	1145.73	1148.73	0.00	
Jun-04	JUNCTION	1143.86	1146.86	0.00	
Jun-05	JUNCTION	970.00	972.00	0.00	
Jun-08	JUNCTION	1022.00	1024.00	0.00	
Jun-11	JUNCTION	1062.00	1064.00	0.00	
Jun-12	JUNCTION	962.00	966.00	0.00	
Jun-13	JUNCTION	922.00	924.00	0.00	
Outfall_1	OUTFALL	920.00	922.00	0.00	
Outfall_2	OUTFALL	960.00	962.00	0.00	
Outfall_3	OUTFALL	1020.00	1022.00	0.00	

Link Summary

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01	Jun-01	Jun-02	CONDUIT	39.0	4.2564	0.0130
Link-02	Jun-03	Jun-04	CONDUIT	41.5	4.5060	0.0130
Link-10	Jun-05	Jun-12	CHANNEL	60.0	10.0000	0.0320
Link-13	Jun-08	Outfall_3	CHANNEL	20.0	10.0000	0.0320
Link-17	Jun-12	Outfall_2	CHANNEL	20.0	10.0000	0.0320
Link-18	Jun-02	Jun-12	CHANNEL	1150.0	12.7774	0.0320
Link-19	Jun-04	Jun-05	CHANNEL	1350.0	12.8785	0.0320
Link-20	Jun-13	Outfall_1	CHANNEL	20.0	10.0000	0.0320
Link-23	Jun-11	Jun-08	CHANNEL	500.0	8.0000	0.0320

Cross Section Summary

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft ²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50	46.67
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50	48.02
Link-10	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-13	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-17	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-18	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.50
Link-19	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.75
Link-20	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-23	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	204.42

Runoff Quantity Continuity

	Volume acre-ft	Depth inches
Total Precipitation	92.076	4.973
Surface Runoff	2.847	0.154
Continuity Error (%)	-0.000	


```

*****
Flow Routing Continuity
*****
Volume      Volume
acre-ft     Mgallons
-----
External Inflow ..... 0.000 0.000
External Outflow ..... 28.474 9.279
Initial Stored Volume ... 0.000 0.000
Final Stored Volume ..... 0.000 0.000
Continuity Error (%) ..... -0.000

```

```

*****
Composite Curve Number Computations Report
*****

```

```

-----
Subbasin Offsite_1
-----

```

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Fair	3.77	B	60.00
Paved parking & roofs	1.43	B	98.00
Composite Area & Weighted CN	5.20		70.45

```

-----
Subbasin Offsite_2
-----

```

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	95.00	B	55.00
Paved parking & roofs	5.00	B	98.00
Composite Area & Weighted CN	100.00		57.15

```

-----
Subbasin Offsite_3
-----

```

Soil/Surface Description	Area (acres)	Soil Group	CN
Woods, Good	37.00	B	55.00
Paved parking & roofs	3.00	B	98.00
Composite Area & Weighted CN	40.00		58.23

```

-----
Subbasin Onsite_1
-----

```

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	1.10	C	74.00
Woods, Good	20.80	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	0.90	C	98.00
Composite Area & Weighted CN	25.60		73.34

```

-----
Subbasin Onsite_2
-----

```

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	1.10	C	74.00
Woods, Good	20.90	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	0.90	C	98.00
Composite Area & Weighted CN	25.70		73.33

```

-----
Subbasin Onsite_3
-----

```

Soil/Surface Description	Area (acres)	Soil Group	CN
> 75% grass cover, Good	1.10	C	74.00
Woods, Good	20.90	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	0.90	C	98.00
Composite Area & Weighted CN	25.70		73.33

```

*****
SCS TR-55 Time of Concentration Computations Report
*****

```

Sheet Flow Equation

$$T_c = (0.007 * ((n * L_f)^{0.8}) / ((P^{0.5}) * (S_f^{0.4})))$$

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Offsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	23.20	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	8.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	4.24	0.00	0.00
Computed Flow Time (minutes):	1.18	0.00	0.00

Total TOC (minutes):	24.38
----------------------	-------

Subbasin Offsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00

Slope (%):	3.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.05	0.00	0.00
Computed Flow Time (minutes):	49.55	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	2000.00	1500.00	890.00
Slope (%):	27.00	10.00	8.00
Surface Type:	Woodland	Woodland	Grassed waterway
Velocity (ft/sec):	2.60	1.58	4.24
Computed Flow Time (minutes):	12.82	15.82	3.50
Total TOC (minutes):	81.69		

Subbasin Offsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	40.39	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1500.00	500.00	0.00
Slope (%):	25.00	10.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	2.50	5.10	0.00
Computed Flow Time (minutes):	10.00	1.63	0.00
Total TOC (minutes):	52.03		

Subbasin Onsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00
Total TOC (minutes):	31.26		

Subbasin Onsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00
Total TOC (minutes):	31.26		

Subbasin Onsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00
Total TOC (minutes):	31.26		

Subbasin Runoff Summary

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days hh:mm:ss
Offsite_1	4.96	2.04	5.01	70.450	0 00:24:22
Offsite_2	4.96	1.09	18.00	57.150	0 01:21:41
Offsite_3	4.96	1.16	10.38	58.230	0 00:52:01
Onsite_1	4.96	2.28	25.03	73.340	0 00:31:15
Onsite_2	4.96	2.28	25.11	73.330	0 00:31:15
Onsite_3	4.96	2.28	25.11	73.330	0 00:31:15

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum EGL Attained ft	Time of Max Occurrence days hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
Jun-01	0.17	0.62	1111.22	0 10:15	0	0	0:00:00
Jun-02	0.06	0.24	1109.18	0 10:15	0	0	0:00:00
Jun-03	0.64	1.40	1147.13	0 11:05	0	0	0:00:00
Jun-04	0.25	0.51	1144.37	0 11:05	0	0	0:00:00
Jun-05	0.28	0.57	970.57	0 11:06	0	0	0:00:00
Jun-08	0.28	0.89	1022.89	0 10:20	0	0	0:00:00
Jun-11	0.17	0.42	1062.42	0 10:39	0	0	0:00:00
Jun-12	0.40	0.92	962.92	0 10:20	0	0	0:00:00
Jun-13	0.19	0.76	922.76	0 10:19	0	0	0:00:00
Outfall_1	0.17	0.65	920.65	0 10:19	0	0	0:00:00
Outfall_2	0.35	0.76	960.76	0 10:20	0	0	0:00:00
Outfall_3	0.25	0.74	1020.74	0 10:20	0	0	0:00:00

Node Flow Summary

Node	Element	Maximum	Peak	Time of Maximum	Time of Peak
------	---------	---------	------	-----------------	--------------

ID	Type	Lateral Inflow cfs	Inflow cfs	Peak Inflow Occurrence days hh:mm	Flooding Overflow cfs	Flooding Occurrence days hh:mm
Jun-01	JUNCTION	4.96	4.96	0 10:15	0.00	
Jun-02	JUNCTION	0.00	4.96	0 10:15	0.00	
Jun-03	JUNCTION	17.96	17.96	0 11:05	0.00	
Jun-04	JUNCTION	0.00	17.96	0 11:05	0.00	
Jun-05	JUNCTION	0.00	17.95	0 11:05	0.00	
Jun-08	JUNCTION	24.74	31.86	0 10:20	0.00	
Jun-11	JUNCTION	10.32	10.32	0 10:39	0.00	
Jun-12	JUNCTION	24.74	33.80	0 10:19	0.00	
Jun-13	JUNCTION	24.66	24.66	0 10:19	0.00	
Outfall_1	OUTFALL	0.00	24.66	0 10:19	0.00	
Outfall_2	OUTFALL	0.00	33.64	0 10:20	0.00	
Outfall_3	OUTFALL	0.00	31.79	0 10:20	0.00	

 Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall_1	86.27	3.68	24.66
Outfall_2	91.60	10.96	33.64
Outfall_3	88.15	6.67	31.79
System	88.67	21.31	89.91

 Link Flow Summary

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes
Link-01	CONDUIT	0 10:15	9.93	2.93	4.96	46.67	0.11	0.22	0
Link-02	CONDUIT	0 11:05	12.18	2.81	17.96	48.02	0.37	0.48	0
Link-10	CHANNEL	0 11:06	7.81	1.89	17.94	228.55	0.08	0.28	0
Link-13	CHANNEL	0 10:20	8.45	5.68	31.79	228.55	0.14	0.41	0
Link-17	CHANNEL	0 10:20	8.56	5.68	33.64	228.55	0.15	0.42	0
Link-18	CHANNEL	0 10:15	2.21	1.00	4.92	63.50	0.08	0.57	0
Link-19	CHANNEL	0 11:05	8.16	1.00	17.95	63.75	0.28	0.54	0
Link-20	CHANNEL	0 10:19	7.96	5.68	24.66	228.55	0.11	0.35	0
Link-23	CHANNEL	0 10:39	4.30	1.00	10.32	204.42	0.05	0.32	0

 Highest Flow Instability Indexes

 All links are stable.

WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-12.

Analysis began on: Mon Sep 26 13:19:13 2016
 Analysis ended on: Mon Sep 26 13:19:14 2016
 Total elapsed time: 00:00:01

R-6 Zoning

Project Description

File Name Lewis&Clark Postdev R-6 II.SPF

Analysis Options

Flow Units cfs
 Subbasin Hydrograph Method. SCS TR-55
 Time of Concentration..... SCS TR-55
 Link Routing Method Hydrodynamic
 Storage Node Exfiltration.. Constant rate, free surface area
 Starting Date APR-13-2016 00:00:00
 Ending Date APR-14-2016 06:00:00
 Report Time Step 00:05:00

Element Count

Number of rain gages 1

Number of subbasins 6

Number of nodes 12

Number of links 9

Raingage Summary

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage	100 YR	CUMULATIVE	6.00

Subbasin Summary

Subbasin ID	Total Area acres
Offsite_1	5.20
Offsite_2	100.00
Offsite_3	40.00
Onsite_1	25.60
Onsite_2	25.70
Onsite_3	25.70

Node Summary

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft ²	External Inflow
Jun-01	JUNCTION	1110.60	1113.60	0.00	
Jun-02	JUNCTION	1108.94	1111.94	0.00	
Jun-03	JUNCTION	1145.73	1148.73	0.00	
Jun-04	JUNCTION	1143.86	1146.86	0.00	
Jun-05	JUNCTION	970.00	972.00	0.00	
Jun-08	JUNCTION	1022.00	1024.00	0.00	
Jun-11	JUNCTION	1062.00	1064.00	0.00	
Jun-12	JUNCTION	962.00	966.00	0.00	
Jun-13	JUNCTION	922.00	924.00	0.00	
Outfall_1	OUTFALL	920.00	922.00	0.00	
Outfall_2	OUTFALL	960.00	962.00	0.00	
Outfall_3	OUTFALL	1020.00	1022.00	0.00	

Link Summary

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01	Jun-01	Jun-02	CONDUIT	39.0	4.2564	0.0130
Link-02	Jun-03	Jun-04	CONDUIT	41.5	4.5060	0.0130
Link-10	Jun-05	Jun-12	CHANNEL	60.0	10.0000	0.0320
Link-13	Jun-08	Outfall_3	CHANNEL	20.0	10.0000	0.0320
Link-17	Jun-12	Outfall_2	CHANNEL	20.0	10.0000	0.0320
Link-18	Jun-02	Jun-12	CHANNEL	1150.0	12.7774	0.0320
Link-19	Jun-04	Jun-05	CHANNEL	1350.0	12.8785	0.0320
Link-20	Jun-13	Outfall_1	CHANNEL	20.0	10.0000	0.0320
Link-23	Jun-11	Jun-08	CHANNEL	500.0	8.0000	0.0320

Cross Section Summary

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft ²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50	46.67
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50	48.02
Link-10	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-13	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-17	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-18	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.50

Link-19	TRAPEZOIDAL	1.00	7.00	1	5.00	0.67	63.75
Link-20	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	228.55
Link-23	TRAPEZOIDAL	2.00	11.00	1	14.00	1.17	204.42

*****	Volume	Depth
Runoff Quantity Continuity	acre-ft	inches
*****	-----	-----
Total Precipitation	92.076	4.973
Surface Runoff	2.898	0.157
Continuity Error (%)	-0.000	

*****	Volume	Volume
Flow Routing Continuity	acre-ft	Mgallons
*****	-----	-----
External Inflow	0.000	0.000
External Outflow	28.986	9.446
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

Composite Curve Number Computations Report

Subbasin Offsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
-----	-----	-----	-----
Woods, Fair	3.77	B	60.00
Paved parking & roofs	1.43	B	98.00
Composite Area & Weighted CN	5.20		70.45

Subbasin Offsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
-----	-----	-----	-----
Woods, Good	95.00	B	55.00
Paved parking & roofs	5.00	B	98.00
Composite Area & Weighted CN	100.00		57.15

Subbasin Offsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
-----	-----	-----	-----
Woods, Good	37.00	B	55.00
Paved parking & roofs	3.00	B	98.00
Composite Area & Weighted CN	40.00		58.23

Subbasin Onsite_1

Soil/Surface Description	Area (acres)	Soil Group	CN
-----	-----	-----	-----
> 75% grass cover, Good	2.30	C	74.00
Woods, Good	18.90	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	1.60	C	98.00
Composite Area & Weighted CN	25.60		74.30

Subbasin Onsite_2

Soil/Surface Description	Area (acres)	Soil Group	CN
-----	-----	-----	-----
> 75% grass cover, Good	2.30	C	74.00
Woods, Good	19.00	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	1.60	C	98.00
Composite Area & Weighted CN	25.70		74.28

Subbasin Onsite_3

Soil/Surface Description	Area (acres)	Soil Group	CN
-----	-----	-----	-----

> 75% grass cover, Good	2.30	C	74.00
Woods, Good	19.00	C	70.00
Wetlands	2.80	-	90.00
Paved parking & roofs	1.60	C	98.00
Composite Area & Weighted CN	25.70		74.28

 SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where:

Tc = Time of Concentration (hrs)
 n = Manning's Roughness
 Lf = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^{0.5}) (unpaved surface)
 V = 20.3282 * (Sf^{0.5}) (paved surface)
 V = 15.0 * (Sf^{0.5}) (grassed waterway surface)
 V = 10.0 * (Sf^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (Sf^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (Sf^{0.5}) (short grass pasture surface)
 V = 5.0 * (Sf^{0.5}) (woodland surface)
 V = 2.5 * (Sf^{0.5}) (forest w/heavy litter surface)
 Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
 Lf = Flow Length (ft)
 V = Velocity (ft/sec)
 Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^{2/3}) * (Sf^{0.5})) / n
 R = Aq / Wp
 Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
 Lf = Flow Length (ft)
 R = Hydraulic Radius (ft)
 Aq = Flow Area (ft²)
 Wp = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 Sf = Slope (ft/ft)
 n = Manning's Roughness

Subbasin Offsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.11	0.00	0.00
Computed Flow Time (minutes):	23.20	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	300.00	0.00	0.00
Slope (%):	8.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	4.24	0.00	0.00
Computed Flow Time (minutes):	1.18	0.00	0.00

Total TOC (minutes):	24.38
----------------------	-------

Subbasin Offsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	3.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.05	0.00	0.00
Computed Flow Time (minutes):	49.55	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	2000.00	1500.00	890.00
Slope (%):	27.00	10.00	8.00
Surface Type:	Woodland	Woodland	Grassed waterway
Velocity (ft/sec):	2.60	1.58	4.24
Computed Flow Time (minutes):	12.82	15.82	3.50

Total TOC (minutes): 81.69

Subbasin Offsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	5.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.06	0.00	0.00
Computed Flow Time (minutes):	40.39	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1500.00	500.00	0.00
Slope (%):	25.00	10.00	0.00
Surface Type:	Woodland	Unpaved	Unpaved
Velocity (ft/sec):	2.50	5.10	0.00
Computed Flow Time (minutes):	10.00	1.63	0.00

Total TOC (minutes): 52.03

Subbasin Onsite_1

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00

Total TOC (minutes): 31.26

Subbasin Onsite_2

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00
Total TOC (minutes):	31.26		

Subbasin Onsite_3

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.80	0.00	0.00
Flow Length (ft):	150.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.52	0.00	0.00
Velocity (ft/sec):	0.09	0.00	0.00
Computed Flow Time (minutes):	27.56	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	1200.00	0.00	0.00
Slope (%):	13.00	0.00	0.00
Surface Type:	Grassed waterway	Unpaved	Unpaved
Velocity (ft/sec):	5.41	0.00	0.00
Computed Flow Time (minutes):	3.70	0.00	0.00
Total TOC (minutes):	31.26		

Subbasin Runoff Summary

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days hh:mm:ss
Offsite_1	4.96	2.04	5.01	70.450	0 00:24:22
Offsite_2	4.96	1.09	18.00	57.150	0 01:21:41
Offsite_3	4.96	1.16	10.38	58.230	0 00:52:01
Onsite_1	4.96	2.36	26.23	74.300	0 00:31:15
Onsite_2	4.96	2.36	26.30	74.280	0 00:31:15
Onsite_3	4.96	2.36	26.30	74.280	0 00:31:15

Node Depth Summary

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
Jun-01	0.17	0.62	1111.22	0 10:14	0	0	0:00:00
Jun-02	0.06	0.24	1109.18	0 10:15	0	0	0:00:00
Jun-03	0.64	1.40	1147.13	0 11:04	0	0	0:00:00
Jun-04	0.25	0.51	1144.37	0 11:05	0	0	0:00:00
Jun-05	0.28	0.57	970.57	0 11:06	0	0	0:00:00
Jun-08	0.28	0.90	1022.90	0 10:20	0	0	0:00:00
Jun-11	0.17	0.42	1062.42	0 10:39	0	0	0:00:00
Jun-12	0.40	0.93	962.93	0 10:20	0	0	0:00:00
Jun-13	0.19	0.78	922.78	0 10:15	0	0	0:00:00

Outfall_1	0.18	0.66	920.66	0	10:15	0	0	0:00:00
Outfall_2	0.35	0.78	960.78	0	10:20	0	0	0:00:00
Outfall_3	0.26	0.75	1020.75	0	10:20	0	0	0:00:00

Node Flow Summary

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days hh:mm
Jun-01	JUNCTION	4.96	4.96	0 10:14	0.00	
Jun-02	JUNCTION	0.00	4.96	0 10:15	0.00	
Jun-03	JUNCTION	17.96	17.96	0 11:04	0.00	
Jun-04	JUNCTION	0.00	17.96	0 11:05	0.00	
Jun-05	JUNCTION	0.00	17.95	0 11:05	0.00	
Jun-08	JUNCTION	25.87	32.94	0 10:20	0.00	
Jun-11	JUNCTION	10.32	10.32	0 10:39	0.00	
Jun-12	JUNCTION	25.87	34.89	0 10:20	0.00	
Jun-13	JUNCTION	25.83	25.83	0 10:15	0.00	
Outfall_1	OUTFALL	0.00	25.85	0 10:15	0.00	
Outfall_2	OUTFALL	0.00	34.73	0 10:20	0.00	
Outfall_3	OUTFALL	0.00	32.87	0 10:20	0.00	

Outfall Loading Summary

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Outfall_1	86.49	3.78	25.85
Outfall_2	91.86	11.04	34.73
Outfall_3	88.38	6.77	32.87
System	88.91	21.59	93.18

Link Flow Summary

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes
Link-01	CONDUIT	0 10:15	9.93	2.93	4.96	46.67	0.11	0.22	0
Link-02	CONDUIT	0 11:05	12.18	2.81	17.96	48.02	0.37	0.48	0
Link-10	CHANNEL	0 11:06	7.81	1.89	17.94	228.55	0.08	0.28	0
Link-13	CHANNEL	0 10:20	8.51	5.68	32.87	228.55	0.14	0.41	0
Link-17	CHANNEL	0 10:20	8.62	5.68	34.73	228.55	0.15	0.43	0
Link-18	CHANNEL	0 10:15	2.16	1.00	4.92	63.50	0.08	0.58	0
Link-19	CHANNEL	0 11:05	8.16	1.00	17.95	63.75	0.28	0.54	0
Link-20	CHANNEL	0 10:15	8.05	5.68	25.85	228.55	0.11	0.36	0
Link-23	CHANNEL	0 10:39	4.26	1.00	10.32	204.42	0.05	0.32	0

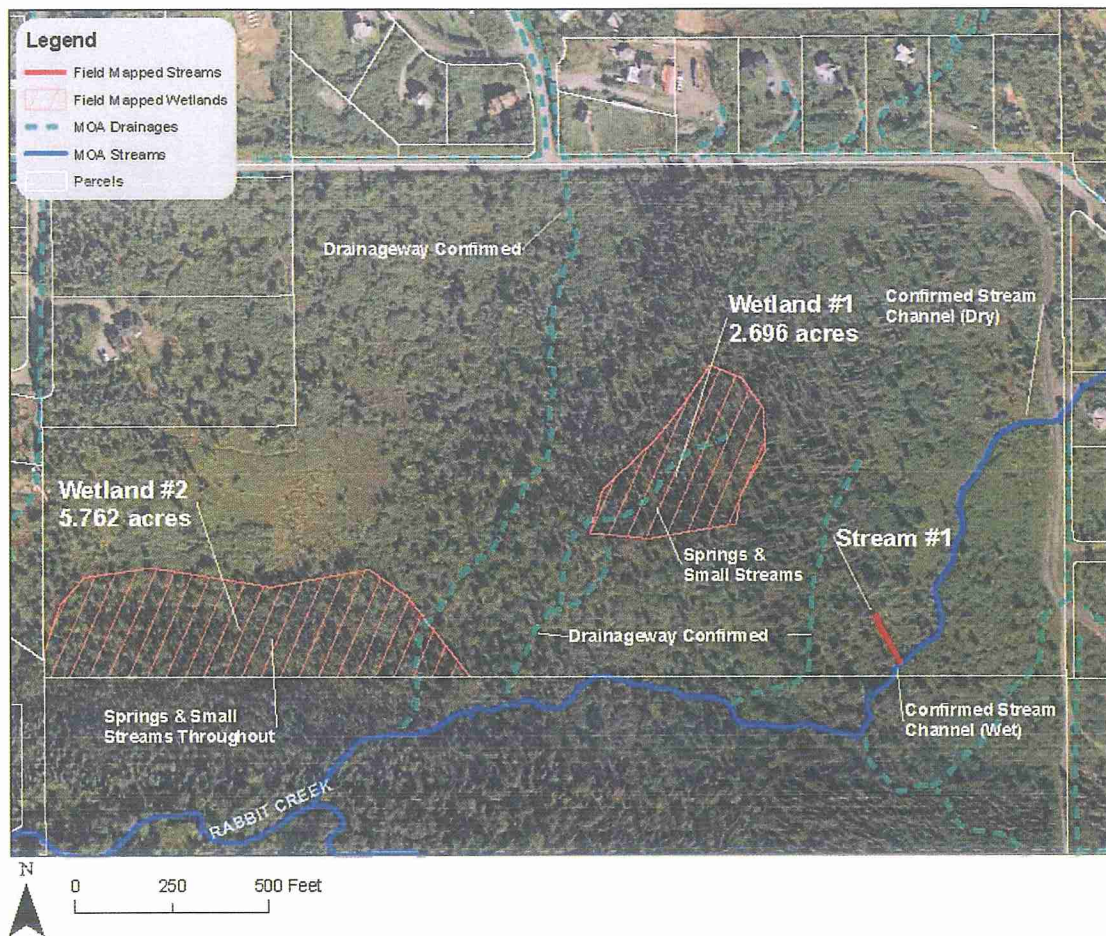
Highest Flow Instability Indexes

All links are stable.

WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-12.

Analysis began on: Mon Sep 26 13:21:32 2016
Analysis ended on: Mon Sep 26 13:21:33 2016
Total elapsed time: 00:00:01

f. Wetland Mapping





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**LEWIS & CLARK SUBDIVISION
UPPER DEARMOUN ROAD CONDITION ASSESSMENT
3-24-17**

The following assessment of Upper DeArmoun Road is intended to provide a planning level review of the current road condition and the impact, if any, that the Lewis and Clark Subdivision will have due to increased traffic loading. Lewis and Clark Subdivision is a proposed 80 acre development in Anchorage, Alaska. The project intends to rezone from the current R-8 zoning to R-6 with a Special Limitation to limit the total number of lots to 30. Access to the development would be provided via two secondary roads that would connect onto Upper DeArmoun generally between Michael Road and Jeanne Road.

Triad Engineering has reviewed the traffic letter dated January 20th, 2017 provided by Kinney Engineering, LLC and notes the following:

- Upper DeArmoun Road is classified as a neighborhood collector (IC) which is designated to carry 2,000 to 10,000 vehicles per day.
- ADOT traffic counts for 2014 show an annual average daily traffic (AADT) for Upper DeArmoun Road as 789 vehicles per day.
- Traffic from the Lewis and Clark Subdivision development, based on 30 lots, would increase traffic loading on Upper DeArmoun Road by 286 trips per day.
- The resulting AADT on Upper DeArmoun Road of 1,075 trips per day is *"well below the appropriate volumes for a neighborhood collector¹."*

Kinney Engineering further provides a brief evaluation of the current condition of Upper DeArmoun Road and finds, based on the data available, that the poor pavement condition is likely due to pavement age and the result of seasonal movement and cracking, not indicative of overloading or structural failure.

Triad Engineering has reviewed aerial photography of Upper DeArmoun Road as well as performed site visits in the summer of 2016 to assess the current road condition. Evidence between Michael and Jeanne Roads shows the majority of surface flaws to be longitudinal and transverse cracking of the pavement surface. Alligator cracking, potholes, rutting or frost heaves, which are typical signs of subbase failure, were not visually evident.

In general, longitudinal and transverse cracking can be attributed to pavement fatigue (age), reflective cracking, poor pavement joint construction and seasonal temperature cycles. Structural failure of the road, due to overloading for instance, would typically lead to alligator cracking, potholes and rutting.

¹ Webb, W. (2017, January 20). Lewis and Clark Subdivision Rezone Traffic Letter [Letter to Todd Brownson].

The cracks within Upper DeArmoun Road have been sealed with an asphalt sealant to prevent moisture from entering the subgrade. This is standard practice from a maintenance standpoint. Due to the extensive sealing performed along this portion of Upper DeArmoun Road, an overlay (or milling and repaving), as part of the ongoing maintenance of the road, would appear prudent.

In summary, based on the above information, Triad Engineering concurs with the evaluation provided by Kinney Engineering that the current road condition of Upper DeArmoun Road is likely due to pavement age and the seasonal movement that occurs with that age. Pavement replacement due to old age, whether by overlay or milling and repaving, is a maintenance obligation and falls under the responsibility of the Glen Alps Road Service Area, not a future developer. Furthermore, the addition of 286 trips per day from the proposed Lewis and Clark development would not significantly impact the current condition of the road.

Submitted By:

Brandon Marcott, P.E.

Preliminary Determination of Wetlands & Waters

MOA Parcel 1707306000;
SEC 25, T12N, R3W, SM;
SW corner of Upper DeArmoun Rd and Canyon Rd.

Municipality of Anchorage, Alaska

22 December 2014

Prepared by

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Attachments

- 1 - Maps
- 2 - Data Sheets
- 3 - Pictures

Introduction

This report summarizes a delineation of wetlands and waters performed by Patrick Athey of Hemlock Scientific, LLC at MOA Parcel 1707306000, located at the southwest corner of Upper Dearmoun Rd and Canyon Rd., within the Hillside district of Anchorage, Alaska. The location of the parcel is illustrated in Map 1.

Methods

Wetland determinations and boundary mapping was performed at the property during August and September of 2011. Field adjustment of wetland boundaries and mapping of additional wetlands were made in August 2012. Determination of wetlands and the boundaries of wetlands with non-wetlands were made according to the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Version 2.0) dated September 2007 and the 1987 Corps of Engineers Wetland Delineation Manual.

The primary tasks for the work included: 1) a review of existing maps and ecological data, 2) collection of field data at observation points to determine the presence or absence of wetlands, and 3) field delineation of the boundaries separating wetlands and uplands.

Existing data that was reviewed as part of this work included, USGS Topographic Series Maps, Municipality of Anchorage Wetland Atlas, Soil Survey of the Anchorage Area, Alaska published by the Natural Resources Conservation Service, and National Wetlands Inventory (NWI) Maps.

The methodology used for delineating wetlands is known as the triple parameter approach as described in the Alaska Regional Supplement. The premise of this approach is that the three essential characteristics of wetlands (hydrophytic vegetation, hydric soils, and wetland hydrology) must all be present to have a positive wetland determination. These methods were used to achieve accurate characterization of the wetland community at specific observation points and to correlate the findings with existing data (aerial photography, soils mapping, and other maps where these were available). The determination points were numbered sequentially (e.g., "DP-1") for tracking on wetland determination data forms published in the Alaska Regional Supplement. Completed Wetland Data Forms are included as Attachment 2. Photos of wetland features and site conditions encountered in the field investigation are provided in Attachment 3.

Soils were evaluated for hydric indicators by digging test pits and comparing the soil to the listed indicators provided in the Regional Guidance document. Soil colors were evaluated with a Munsell Soil Color Chart (Kollmogren, 1990). Observations were correlated with the soil type descriptions in the soil surveys were used to identify mapped soil types. Field conditions were compared to the published soil series mapping for the area, the *Soil Survey of Anchorage Area, Alaska* (NRCS, 2001). The NRCS soils are displayed in Map 3 along with the National Wetland Inventory (NWI) designations. Additionally, the location of field Determination Points (DPs) are provided on Map 3. The NRCS-mapped soil units on the property are summarized in Table 1.

Table 1. NRCS Soil Map Units

Symbol	Soil Unit Name ¹
412	Deception-Estelle-Kichatna complex, 20 to 45 percent slopes
414	Deception-Estelle-Kichatna complex, undulating and hilly
417	Doroshin peat, 0 to 7 percent slopes (listed hydric soil)
426	Jacobsen-Disappear-Doroshin complex, 3 to 7 percent slopes
427	Jacobsen-Disappear-Doroshin complex, 7 to 12 percent slopes
438	Moose River-Niklason complex, occasionally flooded, 0 to 3 percent slopes (listed hydric)

¹From NRCS (2001).

Water must be present in order for wetlands to exist; however, it does not need to be present throughout the entire year. Wetland hydrology is considered to be present when there is permanent or periodic inundation or soil saturation for a significant period of time during the growing season, which is specified as two weeks or more by Alaska Regional Guidance. Indicators of wetland hydrology include areas of ponding or soil saturation, evidence of previous water inundation such as dry algae on bare soil, watermarks on soils or leaves, and drainage patterns among others. Where positive indicators are observed, it is assumed that wetland hydrology occurs for a significant period of the growing season. Test pits were inspected to confirm the presence of indicators below ground surface (e.g., saturation, high water table).

Dominant plant species were characterized in a 30-foot diameter circle centered at the soil pit. Within this circle, the cover of each plant species was estimated to obtain representative data of the vegetation components. The vegetation cover of each species and its assigned wetland indicator status were used to calculate indices of hydrophytic vegetation. Plant species were identified using regional plant guides, including Collet (2002), Dickenson (1999), Hulten (1968), Johnson, et al. (1995), Pratt (1989), Tande and Lipkin (2003), Viereck and Little (1972), among others. Plant species names used on data forms followed the nomenclature of Reed (1988) which also provides the wetland indicator status of the plants.

The geographic coordinates of wetland Determination Points (DPs), wetland boundaries, streams, and other features were recorded in the field with a handheld GPS unit.

The potential presence of wetlands was evaluated also by inspection of the Anchorage Wetland Management Plan mapping, which is presented in Map 4 along with the location of the DPs.

Findings

Potential jurisdictional wetlands were found within the property as determined by a detailed evaluation of vegetation, soils, and hydrology at established determination points and supported with observations throughout the area. The boundaries of wetlands with adjacent uplands were flagged in the field and the positions recorded with a hand-held GPS unit.

The results of the field delineation are presented in Maps 5 through 8 (Attachment 1). Table 2 provides a summary of the wetlands and other aquatic features. A total of eight (8) wetland

polygons were identified and mapped on the subject property. Additionally, there are surface water features on the property including two ponds formed by beaver dams on Fire Creek and four other small streams.

Inspection of the property occurred during the normal growing season in southcentral Alaska during late August through early September 2014. The local precipitation patterns were consulted to determine if hydrology indicators observed at the site were representative of normal conditions. In this case, the climate records for Anchorage (National Weather Service at Anchorage) indicate above-average precipitation in the months from June through September 2014. During the time prior to the investigation, there was an excess more than 3.25 inches above normal for the cumulative precipitation annually and seasonally (Table 3).

These data are used to estimate general weather patterns that may exist at the investigation site, though it is important to note that precipitation patterns within the Anchorage area may vary somewhat depending upon altitude and geography. The inspections were done in August and early September, described as the wet season in southcentral Alaska by the Alaska Regional Manual (Corps, 2007). The observed conditions at the time of inspection are considered to represent the height of soil moisture accumulation near the end of wetter-than-normal growing season. Overall, the data support the observation that hydrology and soil moisture conditions observed during the field work are representative of normal environmental conditions for the area and the lack of saturation or high water tables was not due to abnormally low precipitation occurring prior to the inspection.

Table 2. Summary of Wetlands and Other Aquatic Sites in Tract 40-A

Habitat	Cowardin	Acres	Lineal Ft
Wetland			
Wetland #1	PFO4/EM1B	2.696	.
Wetland #2	PFO4/EM1C	5.762	.
Stream			
Rabbit Creek	R3US5	.	920
Stream 1	R3US5	.	144
Total		8.458	1,064

Table 3. Cumulative Precipitation (Anchorage) for Field Inspection Dates

Precipitation (In)	Observed	Normal	Departure
August 26, 2014			
Since Jun 1	8.29	5.71	3.21
Since Jan 1	12.15	8.95	3.2
September 3, 2014			
Since Jun 1	9.08	6.37	3.40
Since Jan 1	13.53	10.22	3.31
September 9, 2014			
Since Jun 1	10.30	6.90	3.40
Since Jan 1	13.53	10.22	3.31

The wetland hydrology indicators were evaluated carefully to consider the potential for false positive results, which could influence the accurate determination of wetland hydrology and wetlands. In particular, the lack of saturation was considered a very strong indicator of negative wetland hydrology. Conversely, the presence of saturation in the upper 12-inches of soil without an associated high water table was not considered a particularly strong indicator of wetland hydrology and was evaluated carefully with evidence of hydric soils and hydrophytic vegetation occurring at a particular location.

Wetland #1 is located in the central part of the property and includes 2.696 acres of herbaceous and graminoid wetlands, springs, and small streams. The general habitat is open black spruce (*Picea mariana*; FACW) forest with open meadows. The soils are predominantly saturated organic histosol. Tree density in this wetland is sparse and numerous shrubs, herbs, and hydrophytic graminoid groundcover species occur. The wetland-associated moss *Sphagnum* spp. is prevalent in the wetland areas. The lack of *Sphagnum* was found to be a general indicator of non-hydric soil and non-wetland conditions on the parcel.

Soils in this wetland were found to consist of histosols and histic epipedons with a depleted underlying mineral substrate. The soils in this area are mapped by NRCS as Unit No. 427—Jacobsen-Disappear-Doroshin complex, 7 to 12 percent slopes, which is a listed hydric soil. The soil conditions observed in the field generally match the descriptions for these soil types. The boundary of Wetland #1 with adjacent uplands was determined through soil probing for soil saturation and changes in groundcover vegetation, including the presence of *Sphagnum* moss.

Table 4. Summary of Determination Point Data

Location ID	Vegetation	Hydrology	Soil	Wetland
DP-1	-	-	-	-
DP-2	X	-	-	-
DP-3	X	-	-	-
DP-4	X	-	-	-
DP-5	X	X	X	X
DP-6	X	X	X	X
DP-7	X	X	X	X
DP-8	X	-	-	-
DP-9	-	-	-	-
DP-10	X	-	-	-
DP-11	-	-	-	-
DP-12	-	-	-	-
DP-13	-	-	-	-
DP-15	-	-	-	-
DP-16	-	-	-	-
DP-17	X	-	-	-
DP-18	X	-	-	-
DP-19	-	-	-	-
DP-20	X	-	-	-
DP-21	X	X	X	X
DP-22	X	-	-	-
DP-23	X	X	X	X
DP-24	X	X	X	X
DP-25	-	-	-	-
DP-26	-	-	-	-

X – Positive Determination Result

The observations made in Wetland #1 are documented in data sheets for DP-5, -6, and -7; surrounding uplands are documented in data sheets for DP-8, DP-13, and DP-4. This wetland can be characterized as *Palustrine, Needle-Leaved Forested / Emergent Persistent, Saturated* (PFO4/EM1B) by the Cowardin system.

Wetland #1 is separated from Rabbit Creek and the Upper Pond by several hundred feet of non-wetlands on relatively steep gradient. Subsurface flow through the loam soils in downslope uplands likely provides a hydrological connection with Rabbit Creek.



Wetland #1.

Wetland #2 is located in the south part of the property and includes 5.762 acres of seasonally flooded black spruce forest and emergent marsh on a sloping terrace that drains south to Rabbit Creek. Several springs emerge from the base of the slope separating the uplands to the north and flow as small streams to the south. Much of the area is densely wooded with black spruce, birch, and alder; some of the large spruce trees succumbed to beetle kill and litter the area, making foot access difficult. The emergent vegetation is characterized by bluejoint reed grass *Calamagrostis canadensis* (FAC) and sedges *Carex* spp. (most species are FAC, FACW, or OBL).

Soils in this wetland are histosols and histic epipedons with a depleted underlying mineral substrate. The area is mapped by NRCS as Unit No. 438—Moose River-Niklason complex, occasionally flooded, 0 to 3 percent, which is a listed hydric soil. The soil conditions observed in the field generally match the descriptions for these soil types.

This wetland can be characterized as *Palustrine, Needle-Leaved Forested / Emergent Persistent, Seasonally Flooded* (PFO4/EM1C) by the Cowardin system.

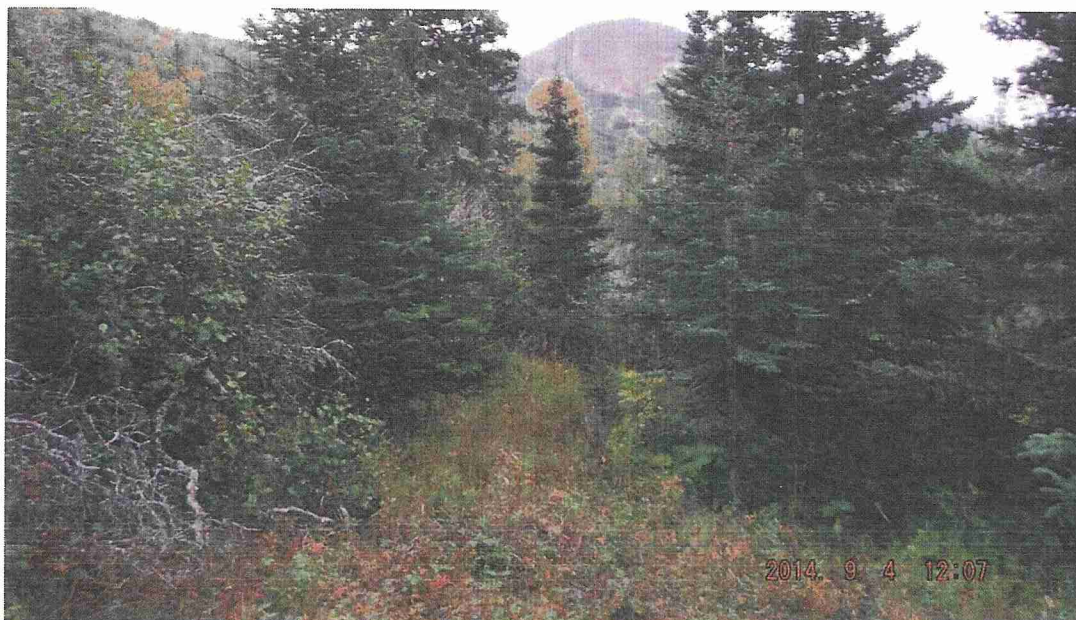
Streams are present on the property including the MOA-mapped Rabbit Creek tributary channel, which enters the parcel on the east side via a culvert beneath Canyon Rd. and extends south following the steep grade in the southeast corner of the parcel. A tributary of the creek was located near the south property line, identified as Stream #1 and was flowing with a small amount of discharge, estimated at less than 1 gallon per minute. Above the confluence with this tributary, the channel Rabbit Creek on the property was dry during the inspection.



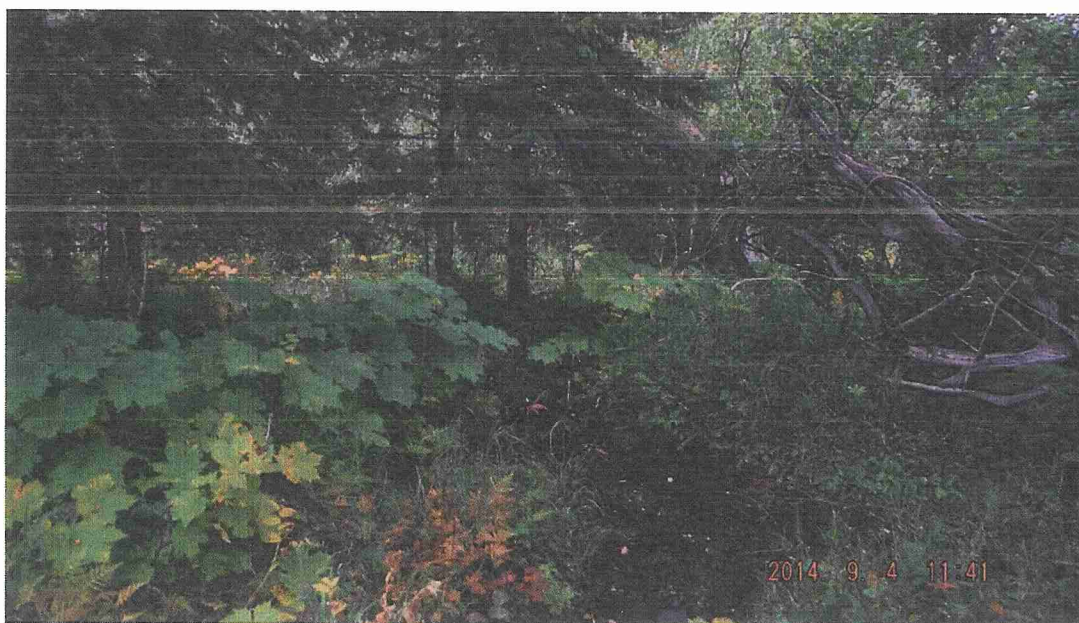
Wetland #2.



Upland Bluejoint Reed Grass Vegetation at DP-9.



Upland Open Forest Vegetation at DP-20.



Stream #1



Rabbit Creek Tributary Channel (obscured in alder brush).

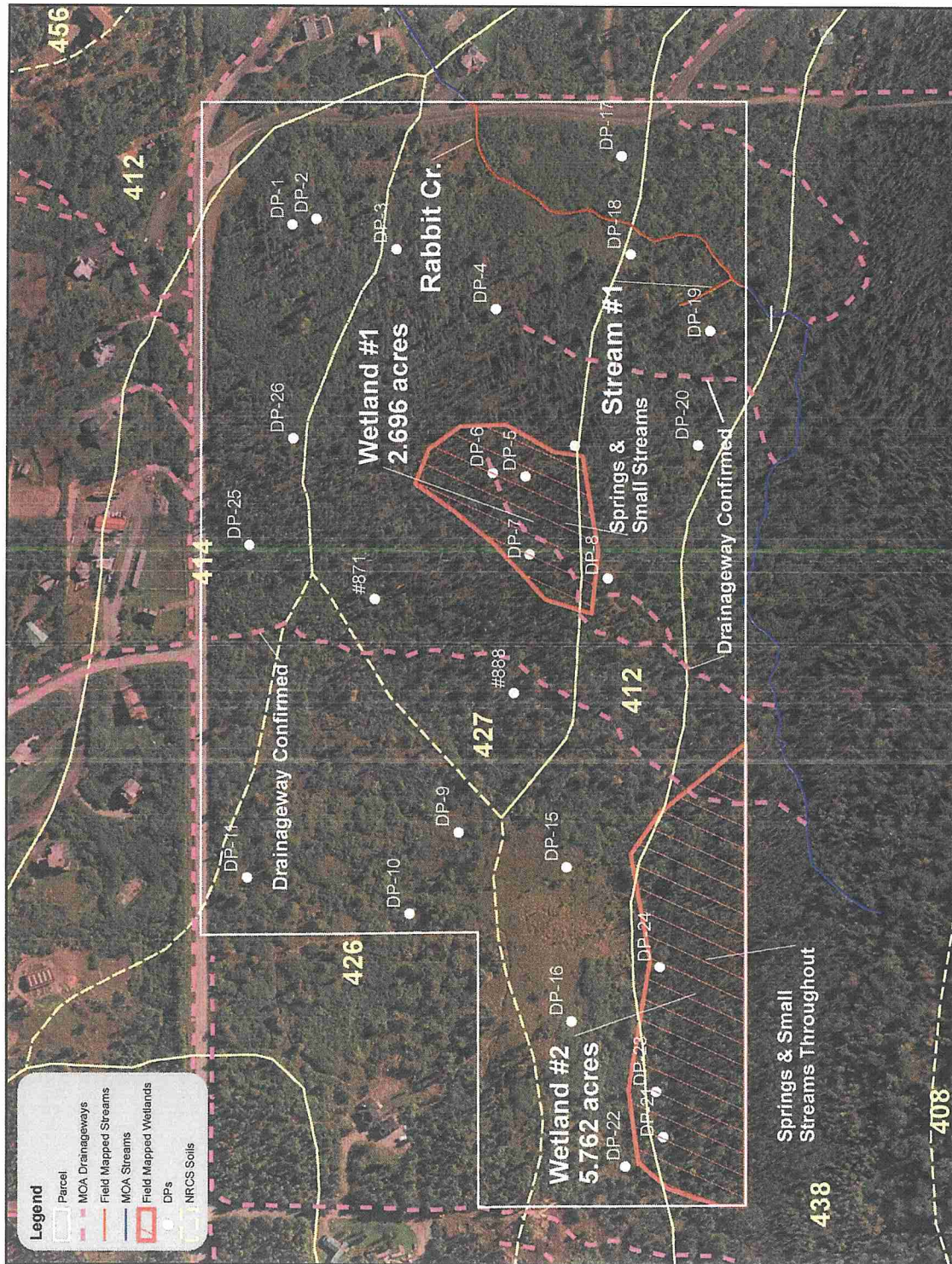
Bibliography

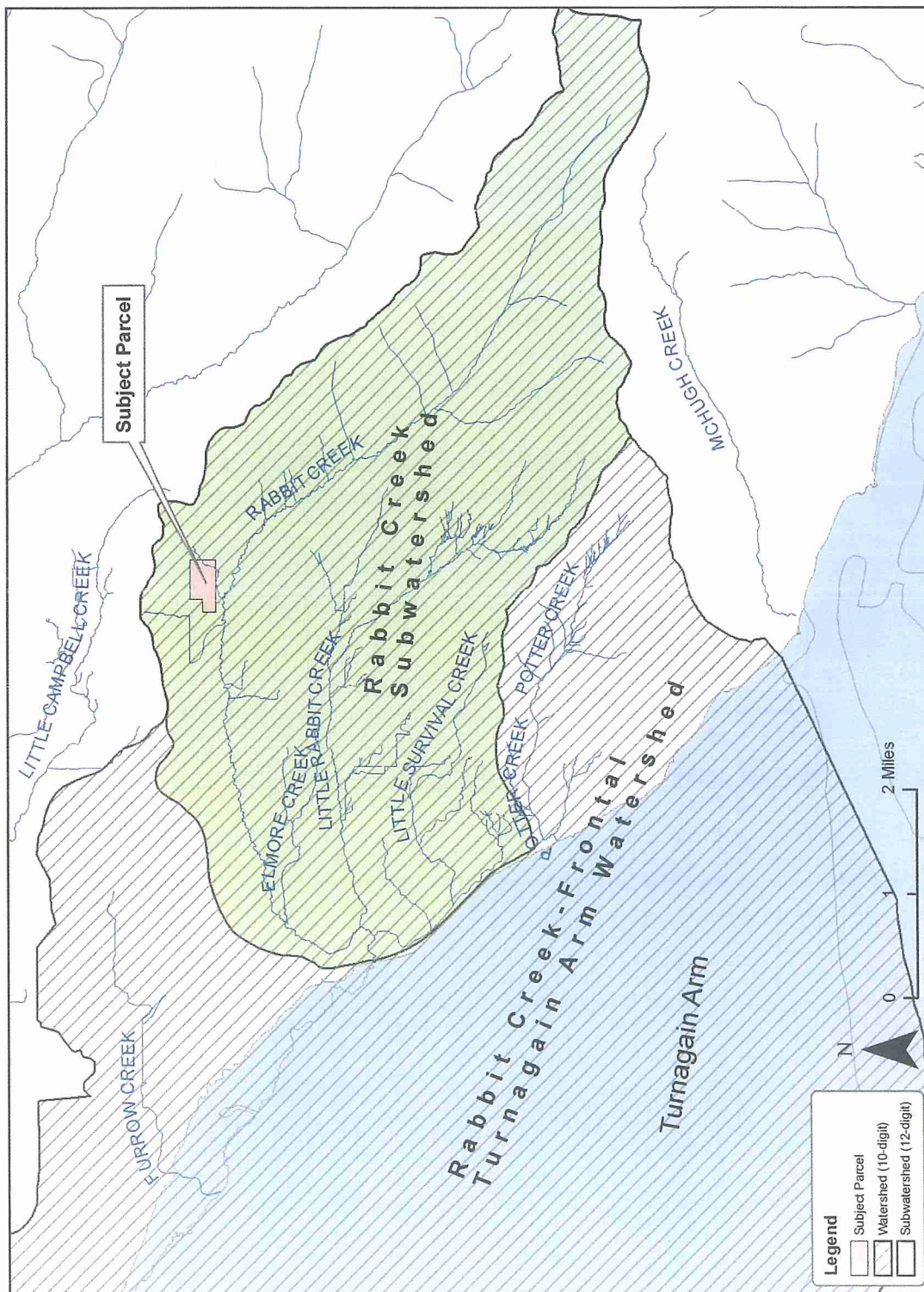
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Attachment 1 Maps

MOA Parcel 1707306000





Attachment 2 Data Forms

MOA Parcel 1707306000

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014

Applicant/Owner: _____ Sampling Point: DP-1

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Concave Slope (%): _____

Subregion: Southcentral Lat: N 61.1007 Long: W 149.7162 Datum: NAD83

Soil Map Unit Name: 414—Deception-Estelle-Kichatna complex, undulating and hilly NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open spruce-birch forest and dense alder shrub growth. Much of the spruce has been beetle-killed and blown down, opening up the canopy for shrubs to thrive.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <i>Betula papyrifera</i> (Southcentral)	25	Yes	FAC	
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: <u>6</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
Total Cover: <u>25</u> 50% of total cover: <u>12.5</u> 20% of total cover: <u>5</u>				
Sapling/Shrub Stratum				Total % Cover of: _____ Multiply by: _____
1. <i>Alnus viridis</i>	75	Yes	FAC	OBL species _____ x 1 = <u>0</u>
2. <i>Oplopanax horridus</i>	25	Yes	FACU	FACW species _____ x 2 = <u>0</u>
3. <i>Rubus idaeus</i>	10	_____	FACU	FAC species <u>165</u> x 3 = <u>495</u>
4. <i>Viburnum edule</i>	10	_____	FACU	FACU species <u>110</u> x 4 = <u>440</u>
5. <i>Actaea rubra</i>	5	_____	FAC	UPL species _____ x 5 = <u>0</u>
6. _____	_____	_____	_____	Column Totals: <u>275</u> (A) <u>935</u> (B)
Total Cover: <u>125</u> 50% of total cover: <u>62.5</u> 20% of total cover: <u>25</u>				Prevalence Index = B/A = <u>3.39</u>
Herb Stratum				Hydrophytic Vegetation Indicators:
1. <i>Calamagrostis canadensis</i>	50	Yes	FAC	No Dominance Test is >50%
2. <i>Gymnocarpium dryopteris</i>	25	Yes	FACU	No Prevalence Index is ≤3.0
3. <i>Urtica dioica</i>	25	Yes	FACU	_____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
4. <i>Athyrium filix-femina</i>	10	_____	FAC	_____ Problematic Hydrophytic Vegetation ¹ (Explain)
5. <i>Galium boreale</i>	10	_____	FACU	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
6. <i>Poa pratensis</i>	5	_____	FACU	
7. _____	_____	_____	_____	Hydrophytic Vegetation Present? Yes _____ No <u>X</u>
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: <u>125</u> 50% of total cover: <u>62.5</u> 20% of total cover: <u>25</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>25</u> (Where applicable)				
Remarks:				

SOIL

Sampling Point: DP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
+2-0	v dk gray brn 10YR3/2 black 10YR2/1	50 50						slightly decomposed plant material
0-4	v dk gray 10YR3/1	100						silt loam, many fine roots, dry
4-14	v dk gray 10YR3/1	100						silt loam & organics, dry, slightly greasy upon wetting
14-26	grey brn 10YR5/2	100						silt loam, few med roots, dry, nonfriable
26-30	brown 10YR5/3	100						silt loam w/ gravel & cobbles, dry; massive; firm

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder Underlying Layer	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue		
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: Surface soil layer is very dark hue but does not exhibit hydric characteristics. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014

Applicant/Owner: _____ Sampling Point: DP-2

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Concave Slope (%): _____

Subregion: Southcentral Lat: N 61.1006 Long: W 149.7162 Datum: NAD83

Soil Map Unit Name: 414—Deception-Estelle-Kichatna complex, undulating and hilly NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <input checked="" type="checkbox"/>	No	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Hydric Soil Present?	Yes	No <input checked="" type="checkbox"/>	
Wetland Hydrology Present?	Yes	No <input checked="" type="checkbox"/>	
Remarks: Site is located on a south-facing mountain slope at the edge of open spruce-birch forest and bluejoint-herb meadow downslope to the south. The vegetation mat is thick and despite the slopes there are no signs of erosion.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:	
1. <i>Picea mariana</i>	5	Yes	FACW		Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: 4 (B)	
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)	
4. _____	_____	_____	_____	Prevalence Index worksheet:	
Total Cover: 5				Total % Cover of:	
50% of total cover: 2.5 20% of total cover: 1				OBL species _____ x 1 = 0	
Sapling/Shrub Stratum				FACW species 5 x 2 = 10	
1. <i>Alnus viridis</i>	50	Yes	FAC	FAC species 140 x 3 = 420	
2. <i>Oplopanax horridus</i>	25	Yes	FACU	FACU species 55 x 4 = 220	
3. <i>Ribes triste</i>	10	_____	FAC	UPL species _____ x 5 = 0	
4. <i>Cornus canadensis</i>	10	_____	FACU	Column Totals: 200 (A) 650 (B)	
5. <i>Rubus idaeus</i>	5	_____	FACU	Prevalence Index = B/A = 3.25	
6. _____	_____	_____	_____	Hydrophytic Vegetation Indicators:	
Total Cover: 100				Yes Dominance Test is >50%	
50% of total cover: 50 20% of total cover: 20				No Prevalence Index is ≤3.0	
Herb Stratum				Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)	
1. <i>Calamagrostis canadensis</i>	75	Yes	FAC	Problematic Hydrophytic Vegetation ¹ (Explain)	
2. <i>Heracleum maximum</i>	10	_____	FACU	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.	
3. <i>Plantago lanceolata</i>	5	_____	FACU	Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No _____	
4. <i>Athyrium filix-femina</i>	5	_____	FAC		
5. _____	_____	_____	_____		
6. _____	_____	_____	_____		
7. _____	_____	_____	_____		
8. _____	_____	_____	_____	Plot size (radius, or length x width) 30-ft diameter % Bare Ground _____	
9. _____	_____	_____	_____		% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 10
10. _____	_____	_____	_____		(Where applicable)
Total Cover: 95				Remarks:	
50% of total cover: 47.5 20% of total cover: 19					

SOIL

Sampling Point: DP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)							
Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
0-4	black 10YR2/1	100				silt loam, no roots, moist, greasy, friable	
4-15	v dk gray 10YR3/1	100				silt loam & organics, dry, slightly greasy upon wetting	
15-23	gray brn 10YR5/2	100				silt loam, few med roots, dry, nonfriable	
23-30	brn 10YR5/3	100				silt loam w/ gravel & cobbles, dry; massive; firm, slightly sticky and slightly plastic	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder Underlying Layer	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue		
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The lower portion of the profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil. The surface accumulation of dark silt loam is likely due to the deposition of leaf matter with its accumulated dust in this high-productivity plant community

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <u>X</u>
--	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmon Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014
 Applicant/Owner: _____ Sampling Point: DP-3
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Flat Slope (%): _____
 Subregion: Southcentral Lat: N 61.1000 Long: W 149.7166 Datum: NAD83
 Soil Map Unit Name: 427—Jacobsen-Disappear-Doroshin complex, 7 to 12 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope at the edge of open spruce-birch forest and bluejoint-herb meadow downslope to the south. The vegetation mat is thick and despite the slopes there are no signs of erosion.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>4</u> (A) Total Number of Dominant Species Across All Strata: <u>5</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>80</u> (A/B) Prevalence Index worksheet: <table border="1"> <thead> <tr> <th>Total % Cover of:</th> <th>Multiply by:</th> </tr> </thead> <tbody> <tr> <td>OBL species <u>10</u></td> <td>x 1 = <u>10</u></td> </tr> <tr> <td>FACW species <u>11</u></td> <td>x 2 = <u>22</u></td> </tr> <tr> <td>FAC species <u>135</u></td> <td>x 3 = <u>405</u></td> </tr> <tr> <td>FACU species <u>60</u></td> <td>x 4 = <u>240</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>216</u></td> <td>(A) <u>677</u> (B)</td> </tr> </tbody> </table> Prevalence Index = B/A = <u>3.13</u>	Total % Cover of:	Multiply by:	OBL species <u>10</u>	x 1 = <u>10</u>	FACW species <u>11</u>	x 2 = <u>22</u>	FAC species <u>135</u>	x 3 = <u>405</u>	FACU species <u>60</u>	x 4 = <u>240</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>216</u>	(A) <u>677</u> (B)
Total % Cover of:	Multiply by:																	
OBL species <u>10</u>	x 1 = <u>10</u>																	
FACW species <u>11</u>	x 2 = <u>22</u>																	
FAC species <u>135</u>	x 3 = <u>405</u>																	
FACU species <u>60</u>	x 4 = <u>240</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>216</u>	(A) <u>677</u> (B)																	
1. <u>Picea mariana</u>	<u>5</u>	Yes	<u>FACW</u>															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
Total Cover: <u>5</u> 50% of total cover: <u>2.5</u> 20% of total cover: <u>1</u>																		
Sapling/Shrub Stratum																		
1. <u>Alnus viridis</u>	<u>50</u>	Yes	<u>FAC</u>															
2. <u>Rubus idaeus</u>	<u>25</u>	Yes	<u>FACU</u>															
3. <u>Rosa acicularis</u>	<u>10</u>	_____	<u>FACU</u>															
4. <u>Cornus canadensis</u>	<u>10</u>	_____	<u>FACU</u>															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
Total Cover: <u>95</u> 50% of total cover: <u>47.5</u> 20% of total cover: <u>19</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>50</u>	Yes	<u>FAC</u>															
2. <u>Equisetum arvense</u>	<u>25</u>	Yes	<u>FAC</u>															
3. <u>Poa pratensis</u>	<u>10</u>	_____	<u>FACU</u>															
4. <u>Carex laeviculmis</u>	<u>10</u>	_____	<u>FACW</u>															
5. <u>Carex echinata</u>	<u>10</u>	_____	<u>OBL</u>															
6. <u>Geocaulon lividum</u>	<u>5</u>	_____	<u>FACU</u>															
7. <u>Geranium erianthum</u>	<u>5</u>	_____	<u>FACU</u>															
8. <u>Sanguisorba canadensis</u>	<u>1</u>	_____	<u>FACW</u>															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>116</u> 50% of total cover: <u>58</u> 20% of total cover: <u>23.2</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____																		
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)																		
Remarks: _____																		

SOIL

Sampling Point: DP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)							
Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
+7-0	black 10YR2/1	50				wood debris and decomposed plant material	
	dk red brn 5YR3/4	50					
0-12	v dk gray 10YR3/1	100				silt loam, many fine roots, dry	
12-15	v dk gray 10YR3/1	100				silt loam, few med roots, dry, nonfriable	
15-29	brn 10YR5/3	50				silt loam w/ gravel & cobbles, dry; massive	
	v dk gray 10YR3/1	50					

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:	Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Thick Dark Surface (A12)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.	
<input type="checkbox"/> Alaska Gleyed (A13)	⁴ Give details of color change in Remarks.	
<input type="checkbox"/> Alaska Redox (A14)		
<input type="checkbox"/> Alaska Gleyed Pores (A15)		

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The lower portion of the profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil. The surface accumulation of dark silt loam is likely due to the deposition of leaf matter with its accumulated dust in this high-productivity plant community

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014
 Applicant/Owner: _____ Sampling Point: DP-4
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Flat Slope (%): _____
 Subregion: Southcentral Lat: N 61.0994 Long: W 149.7174 Datum: NAD83
 Soil Map Unit Name: 427—Jacobsen-Disappear-Doroshin complex, 7 to 12 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes _____	No <u>X</u>	
Wetland Hydrology Present?	Yes _____	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open spruce-birch forest and dense alder shrub growth. Much of the spruce has been beetle-killed and blown down, opening up the canopy for shrubs and herbs to colonize the area.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Betula papyrifera (Southcentral)</u>	<u>5</u>	<u>Yes</u>	<u>FAC</u>	
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: <u>5</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>60</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
Total Cover: <u>5</u>				Total % Cover of: _____ Multiply by: _____
50% of total cover: <u>2.5</u> 20% of total cover: <u>1</u>				OBL species <u>10</u> x 1 = <u>10</u>
Sapling/Shrub Stratum				FACW species <u>11</u> x 2 = <u>22</u>
1. <u>Alnus viridis</u>	<u>50</u>	<u>Yes</u>	<u>FAC</u>	FAC species <u>155</u> x 3 = <u>465</u>
2. <u>Rubus idaeus</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	FACU species <u>90</u> x 4 = <u>360</u>
3. <u>Rosa acicularis</u>	<u>10</u>	_____	<u>FACU</u>	UPL species _____ x 5 = <u>0</u>
4. <u>Cornus canadensis</u>	<u>10</u>	_____	<u>FACU</u>	Column Totals: <u>266</u> (A) <u>857</u> (B)
5. _____	_____	_____	_____	Prevalence Index = B/A = <u>3.22</u>
6. _____	_____	_____	_____	Hydrophytic Vegetation Indicators:
Total Cover: <u>95</u>				<u>Yes</u> Dominance Test is >50%
50% of total cover: <u>47.5</u> 20% of total cover: <u>19</u>				<u>No</u> Prevalence Index is ≤3.0
Herb Stratum				____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
1. <u>Calamagrostis canadensis</u>	<u>75</u>	<u>Yes</u>	<u>FAC</u>	____ Problematic Hydrophytic Vegetation ¹ (Explain)
2. <u>Heracleum maximum</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
3. <u>Equisetum arvense</u>	<u>25</u>	_____	<u>FAC</u>	Hydrophytic Vegetation Present? Yes <u>X</u> No _____
4. <u>Taraxacum officinale</u>	<u>10</u>	_____	<u>FACU</u>	
5. <u>Carex laeviculmis</u>	<u>10</u>	_____	<u>FACW</u>	
6. <u>Carex echinata</u>	<u>10</u>	_____	<u>OBL</u>	
7. <u>Geocaulon lividum</u>	<u>5</u>	_____	<u>FACU</u>	
8. <u>Geranium erianthum</u>	<u>5</u>	_____	<u>FACU</u>	Remarks:
9. <u>Sanguisorba canadensis</u>	<u>1</u>	_____	<u>FACW</u>	
10. _____	_____	_____	_____	
Total Cover: <u>166</u>				
50% of total cover: <u>83</u> 20% of total cover: <u>33.2</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u>				
(Where applicable)				

SOIL

Sampling Point: DP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
+3-0	black 10YR2/1	100					decomposed plant material, roots, silt	
0-10	black 10YR2/1 v dk gray 10YR3/1	50 50					silt loam, many fine roots, dry	
12-15	v dk gray 10YR3/1	100					silt loam, few med roots, dry, nonfriable	
15-27	brn 10YR5/3	100					silt loam w/ gravel & cobbles, dry, massive	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The lower portion of the profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil. The surface accumulation of dark silt loam is likely due to the deposition of leaf matter with its accumulated dust in this high-productivity plant community

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014
 Applicant/Owner: _____ Sampling Point: DP-5
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Concave Slope (%): _____
 Subregion: Southcentral Lat: N 61.0992 Long: W 149.7196 Datum: NAD83
 Soil Map Unit Name: 427—Jacobsen-Disappear-Doroshin complex. 7 to 12 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____
Hydric Soil Present?	Yes <u>X</u>	No _____	
Wetland Hydrology Present?	Yes <u>X</u>	No _____	
Remarks: Site is located on a south-facing mountain slope in open black spruce forest interspersed with sedge-grass meadows and small streams that emerge from the slopes, flow a short distance before re-entering the ground. Much of the spruce has been beetle-killed and blown down, opening up the canopy for shrubs and herbs to colonize the area.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>6</u> (A) Total Number of Dominant Species Across All Strata: <u>6</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B) Prevalence Index worksheet: Total % Cover of: OBL species <u>11</u> x 1 = <u>11</u> FACW species <u>51</u> x 2 = <u>102</u> FAC species <u>60</u> x 3 = <u>180</u> FACU species _____ x 4 = <u>0</u> UPL species _____ x 5 = <u>0</u> Column Totals: <u>122</u> (A) <u>293</u> (B) Prevalence Index = B/A = <u>2.40</u>
1. <u>Picea mariana</u>	<u>25</u>	Yes	FACW	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
Total Cover: <u>25</u> 50% of total cover: <u>12.5</u> 20% of total cover: <u>5</u>				
Sapling/Shrub Stratum				
1. <u>Alnus viridis</u>	<u>10</u>	Yes	FAC	
2. <u>Picea mariana</u>	<u>10</u>	Yes	FACW	
3. <u>Dasiphora fruticosa</u>	<u>10</u>	Yes	FAC	
4. <u>Vaccinium uliginosum</u>	<u>5</u>	_____	FAC	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
Total Cover: <u>35</u> 50% of total cover: <u>17.5</u> 20% of total cover: <u>7</u>				
Herb Stratum				
1. <u>Calamagrostis canadensis</u>	<u>25</u>	Yes	FAC	Hydrophytic Vegetation Indicators: Yes Dominance Test is >50% Yes Prevalence Index is ≤3.0 ___ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
2. <u>Sanguisorba canadensis</u>	<u>10</u>	Yes	FACW	
3. <u>Deschampsia caespitosa</u>	<u>10</u>	_____	FAC	
4. <u>Equisetum fluviatile</u>	<u>10</u>	_____	OBL	
5. <u>Carex laeviculmis</u>	<u>5</u>	_____	FACW	
6. <u>Carex echinata</u>	<u>1</u>	_____	OBL	
7. <u>Parnassia palustris</u>	<u>1</u>	_____	FACW	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: <u>62</u> 50% of total cover: <u>31</u> 20% of total cover: <u>12.4</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				
% Cover of Wetland Bryophytes <u>10</u> Total Cover of Bryophytes <u>10</u> (Where applicable)				
Remarks:				
Hydrophytic Vegetation Present? Yes <u>X</u> No _____				

SOIL

Sampling Point: DP-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)							
Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
0-30	v dk gray bm 10YR3/2 black 10YR2/1	50 50					muck and plant debris, roots; saturated; greasy;

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:	Indicators for Problematic Hydric Soils ³ :	
<input checked="" type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	
<input type="checkbox"/> Thick Dark Surface (A12)		
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.	
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.	
<input type="checkbox"/> Alaska Gleyed Pores (A15)		

Restrictive Layer (if present): Type: <u>Saturation</u> Depth (inches): <u>0</u>	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Remarks: An area of groundwater discharge, small springs emerge from the slope and form streams that flow a short distance then seep back into the ground.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input checked="" type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input checked="" type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>4</u> Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): <u>0</u> Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0</u> (includes capillary fringe)		Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:		
Remarks: There has been an seasonally high cumulative precipitation in the region over the past growing season that likley contributes to the observed wetland hydrology. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).		

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmour Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014

Applicant/Owner: Sampling Point: DP-6

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Concave Slope (%):

Subregion: Southcentral Lat: N 61.0994 Long: W 149.7196 Datum: NAD83

Soil Map Unit Name: 427—Jacobsen-Disappear-Doroshin complex. 7 to 12 percent slopes NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No

Are Vegetation, Soil, or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <input checked="" type="checkbox"/>	No	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No
Hydric Soil Present?	Yes <input checked="" type="checkbox"/>	No	
Wetland Hydrology Present?	Yes <input checked="" type="checkbox"/>	No	
Remarks: Site is located on a south-facing mountain slope in open black spruce forest interspersed with sedge-grass meadows and small streams that emerge from the slopes, flow a short distance before re-entering the ground. Much of the spruce has been beetle-killed and blown down, opening up the canopy for shrubs and herbs to colonize the area.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A) Total Number of Dominant Species Across All Strata: 5 (B) Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B) Prevalence Index worksheet: <table border="1"> <thead> <tr> <th>Total % Cover of:</th> <th>Multiply by:</th> </tr> </thead> <tbody> <tr> <td>OBL species 15</td> <td>x 1 = 15</td> </tr> <tr> <td>FACW species 35</td> <td>x 2 = 70</td> </tr> <tr> <td>FAC species 102</td> <td>x 3 = 306</td> </tr> <tr> <td>FACU species</td> <td>x 4 = 0</td> </tr> <tr> <td>UPL species</td> <td>x 5 = 0</td> </tr> <tr> <td>Column Totals: 152</td> <td>(A) 391 (B)</td> </tr> </tbody> </table> Prevalence Index = B/A = 2.57	Total % Cover of:	Multiply by:	OBL species 15	x 1 = 15	FACW species 35	x 2 = 70	FAC species 102	x 3 = 306	FACU species	x 4 = 0	UPL species	x 5 = 0	Column Totals: 152	(A) 391 (B)
Total % Cover of:	Multiply by:																	
OBL species 15	x 1 = 15																	
FACW species 35	x 2 = 70																	
FAC species 102	x 3 = 306																	
FACU species	x 4 = 0																	
UPL species	x 5 = 0																	
Column Totals: 152	(A) 391 (B)																	
1. <i>Picea mariana</i>	10	Yes	FACW															
2.																		
3.																		
4.																		
Total Cover: 10																		
50% of total cover: 5 20% of total cover: 2																		
Sapling/Shrub Stratum																		
1. <i>Dasiphora fruticosa</i>	25	Yes	FAC															
2. <i>Alnus viridis</i>	10	Yes	FAC															
3. <i>Betula nana</i>	10		FAC															
4. <i>Vaccinium uliginosum</i>	5		FAC															
5. <i>Ledum groenlandicum</i>	5		FAC															
6. <i>Empetrum nigrum</i>	5		FAC															
Total Cover: 60																		
50% of total cover: 30 20% of total cover: 12																		
Herb Stratum																		
1. <i>Calamagrostis canadensis</i>	25	Yes	FAC															
2. <i>Arctagrostis latifolia</i>	25	Yes	FACW															
3. <i>Sanguisorba canadensis</i>	10		FACW															
4. <i>Equisetum fluviatile</i>	10		OBL															
5. <i>Carex laeviculmis</i>	5		FACW															
6. <i>Carex echinata</i>	5		OBL															
7. <i>Geocaulon lividum</i>	1		FACU															
8. <i>Mertensia paniculata</i>	1		FACU															
9.																		
10.																		
Total Cover: 82																		
50% of total cover: 41 20% of total cover: 16.4																		
Plot size (radius, or length x width) 30-ft diameter % Bare Ground																		
% Cover of Wetland Bryophytes 10 Total Cover of Bryophytes 10 (Where applicable)																		
Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No																		
Remarks:																		

SOIL

Sampling Point: DP-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)							
Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
0-30	v dk gray brn 10YR3/2	50					muck and plant debris, roots; saturated; greasy;
	black 10YR2/1	50					

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input checked="" type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: Saturation Depth (inches): 0	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Remarks: An area of groundwater discharge, small springs emerge from the slope and form streams that flow a short distance then seep back into the ground.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input checked="" type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input checked="" type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations: Surface Water Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): 4 Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): 0 Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): 0 (includes capillary fringe)		Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: There has been an seasonally high cumulative precipitation in the region over the past growing season that likely contributes to the observed wetland hydrology. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014
 Applicant/Owner: _____ Sampling Point: DP-7
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Concave Slope (%): _____
 Subregion: Southcentral Lat: N 61.0992 Long: W 149.7207 Datum: NAD83
 Soil Map Unit Name: 427—Jacobsen-Disappear-Doroshin complex, 7 to 12 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____
Hydric Soil Present?	Yes <u>X</u>	No _____	
Wetland Hydrology Present?	Yes <u>X</u>	No _____	
Remarks: Site is located on a south-facing mountain slope in open black spruce forest interspersed with sedge-grass meadows and small streams that emerge from the slopes, flow a short distance before re-entering the ground. Much of the spruce has been beetle-killed and blown down, opening up the canopy for shrubs and herbs to colonize the area.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>5</u> (A) Total Number of Dominant Species Across All Strata: <u>5</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B) Prevalence Index worksheet: <table border="1"> <thead> <tr> <th>Total % Cover of:</th> <th>Multiply by:</th> </tr> </thead> <tbody> <tr> <td>OBL species <u>15</u></td> <td>x 1 = <u>15</u></td> </tr> <tr> <td>FACW species <u>35</u></td> <td>x 2 = <u>70</u></td> </tr> <tr> <td>FAC species <u>105</u></td> <td>x 3 = <u>315</u></td> </tr> <tr> <td>FACU species <u>2</u></td> <td>x 4 = <u>8</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>157</u></td> <td>(A) <u>408</u> (B)</td> </tr> </tbody> </table> Prevalence Index = B/A = <u>2.59</u>	Total % Cover of:	Multiply by:	OBL species <u>15</u>	x 1 = <u>15</u>	FACW species <u>35</u>	x 2 = <u>70</u>	FAC species <u>105</u>	x 3 = <u>315</u>	FACU species <u>2</u>	x 4 = <u>8</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>157</u>	(A) <u>408</u> (B)
Total % Cover of:	Multiply by:																	
OBL species <u>15</u>	x 1 = <u>15</u>																	
FACW species <u>35</u>	x 2 = <u>70</u>																	
FAC species <u>105</u>	x 3 = <u>315</u>																	
FACU species <u>2</u>	x 4 = <u>8</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>157</u>	(A) <u>408</u> (B)																	
1. <u>Picea mariana</u>	<u>10</u>	Yes	FACW															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
Total Cover: <u>10</u> 50% of total cover: <u>5</u> 20% of total cover: <u>2</u>																		
Sapling/Shrub Stratum																		
1. <u>Alnus viridis</u>	<u>25</u>	Yes	FAC	Hydrophytic Vegetation Indicators: Yes Dominance Test is >50% Yes Prevalence Index is ≤3.0 _____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) _____ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.														
2. <u>Picea mariana</u>	<u>10</u>	Yes	FACW															
3. <u>Dasiphora fruticosa</u>	<u>10</u>	_____	FAC															
4. <u>Betula nana</u>	<u>10</u>	_____	FAC															
5. <u>Vaccinium uliginosum</u>	<u>5</u>	_____	FAC															
6. <u>Ledum groenlandicum</u>	<u>5</u>	_____	FAC															
Total Cover: <u>65</u> 50% of total cover: <u>32.5</u> 20% of total cover: <u>13</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>25</u>	Yes	FAC															
2. <u>Deschampsia caespitosa</u>	<u>25</u>	Yes	FAC															
3. <u>Sanguisorba canadensis</u>	<u>10</u>	_____	FACW															
4. <u>Equisetum fluviatile</u>	<u>10</u>	_____	OBL															
5. <u>Carex laeviculmis</u>	<u>5</u>	_____	FACW															
6. <u>Carex echinata</u>	<u>5</u>	_____	OBL															
7. <u>Geocaulon lividum</u>	<u>1</u>	_____	FACU															
8. <u>Mertensia paniculata</u>	<u>1</u>	_____	FACU															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>82</u> 50% of total cover: <u>41</u> 20% of total cover: <u>16.4</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____																		
% Cover of Wetland Bryophytes <u>10</u> Total Cover of Bryophytes <u>10</u> (Where applicable)																		
Remarks:																		

Sampling Point: DP-7

HYDROLOGY

US Army Corps of Engineers

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeAmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014

Applicant/Owner: _____ Sampling Point: DP-8

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Convex Slope (%): _____

Subregion: Southcentral Lat: N 61.0987 Long: W 149.7210 Datum: NAD83

Soil Map Unit Name: 412—Deception-Estelle-Kichatna complex, 20 to 45 percent slopes NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes _____	No <u>X</u>	
Wetland Hydrology Present?	Yes _____	No <u>X</u>	
Remarks: Site is located on a small knob along a south-facing mountain slope within open spruce-birch forest and bluejoint-herb meadow downslope. The location is slightly upslope of a major topographic break that runs east-west along the property, with the area further downslope to the south becoming dense black spruce forest and wet.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>3</u> (A) Total Number of Dominant Species Across All Strata: <u>5</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>60</u> (A/B) Prevalence Index worksheet: <table border="0"> <tr> <td>Total % Cover of:</td> <td>Multiply by:</td> </tr> <tr> <td>OBL species _____</td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species <u>26</u></td> <td>x 2 = <u>52</u></td> </tr> <tr> <td>FAC species <u>60</u></td> <td>x 3 = <u>180</u></td> </tr> <tr> <td>FACU species <u>103</u></td> <td>x 4 = <u>412</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>189</u></td> <td>(A) <u>644</u> (B)</td> </tr> </table> Prevalence Index = B/A = <u>3.40</u>	Total % Cover of:	Multiply by:	OBL species _____	x 1 = <u>0</u>	FACW species <u>26</u>	x 2 = <u>52</u>	FAC species <u>60</u>	x 3 = <u>180</u>	FACU species <u>103</u>	x 4 = <u>412</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>189</u>	(A) <u>644</u> (B)
Total % Cover of:	Multiply by:																	
OBL species _____	x 1 = <u>0</u>																	
FACW species <u>26</u>	x 2 = <u>52</u>																	
FAC species <u>60</u>	x 3 = <u>180</u>																	
FACU species <u>103</u>	x 4 = <u>412</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>189</u>	(A) <u>644</u> (B)																	
1. <u>Betula papyrifera (Southcentral)</u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Picea glauca</u>	<u>1</u>	_____	<u>FACU</u>															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
Total Cover: <u>26</u> 50% of total cover: <u>13</u> 20% of total cover: <u>5.2</u>																		
Sapling/Shrub Stratum																		
1. <u>Cornus canadensis</u>	<u>75</u>	<u>Yes</u>	<u>FACU</u>															
2. <u>Alnus viridis</u>	<u>10</u>	_____	<u>FAC</u>															
3. <u>Vaccinium vitis-idaea</u>	<u>10</u>	_____	<u>FAC</u>															
4. <u>Oplopanax horridus</u>	<u>5</u>	_____	<u>FACU</u>															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
Total Cover: <u>100</u> 50% of total cover: <u>50</u> 20% of total cover: <u>20</u>																		
Herb Stratum																		
1. <u>Sanguisorba canadensis</u>	<u>25</u>	<u>Yes</u>	<u>FACW</u>															
2. <u>Geocaulon lividum</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>															
3. <u>Calamagrostis canadensis</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>															
4. <u>Rhinanthus minor</u>	<u>5</u>	_____	<u>FACU</u>															
5. <u>Equisetum arvense</u>	<u>5</u>	_____	<u>FAC</u>															
6. <u>Phleum pratense</u>	<u>5</u>	_____	<u>FACU</u>															
7. <u>Heracleum maximum</u>	<u>1</u>	_____	<u>FACU</u>															
8. <u>Mertensia paniculata</u>	<u>1</u>	_____	<u>FACU</u>															
9. <u>Carex mertensii</u>	<u>1</u>	_____	<u>FACW</u>															
10. _____	_____	_____	_____															
Total Cover: <u>63</u> 50% of total cover: <u>31</u> 20% of total cover: <u>12.6</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____ % Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>5</u> (Where applicable)																		
Hydrophytic Vegetation Present? Yes <u>X</u> No _____																		
Remarks:																		

SOIL

Sampling Point: DP-8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+5-0	black 10YR2/1	50					silt, roots, wood debris and decomposed plant matter	
	dk red brn 5YR3/4	50						
0-5	black 10YR2/1	50					silt loam w/ gravel; many fine roots; dry	
	v dk gray 10YR3/1	50						
5-23	v pale brn 10YR7/3	50					silt loam w/ gravel & cobbles, dry; massive; firm	
	brown 10YR5/3	50						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:	Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Thick Dark Surface (A12)		
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.	
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.	
<input type="checkbox"/> Alaska Gleyed Pores (A15)		

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The lower portion of the profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The washed-out coloration of the lower profile is likely from remnant ash layers that leached down through underlying brown silt loam soil. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:	Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient) <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Surface Soil Cracks (B6)	<input type="checkbox"/> Water-stained Leaves (B9) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Salt Deposits (C5) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <u>X</u>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).	

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmour Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014
 Applicant/Owner: _____ Sampling Point: DP-9
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Convex Slope (%): _____
 Subregion: Southcentral Lat: N 61.0996 Long: W 149.7245 Datum: NAD83
 Soil Map Unit Name: 426—Jacobsen-Disappears-Doroshin complex. 3 to 7 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is exposed with trees and high shrubs absent.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>2</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50</u> (A/B)
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
Total Cover: <u>0</u> 50% of total cover: <u>0</u> 20% of total cover: <u>0</u>				Prevalence Index worksheet: Total % Cover of: OBL species _____ x 1 = <u>0</u> FACW species _____ x 2 = <u>0</u> FAC species <u>105</u> x 3 = <u>315</u> FACU species <u>31</u> x 4 = <u>124</u> UPL species _____ x 5 = <u>0</u> Column Totals: <u>136</u> (A) <u>439</u> (B) Prevalence Index = B/A = <u>3.22</u>
Sapling/Shrub Stratum 1. <u>Rubus idaeus</u> <u>25</u> <u>Yes</u> <u>FACU</u> 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ Total Cover: <u>25</u> 50% of total cover: <u>12.5</u> 20% of total cover: <u>5</u>				
Herb Stratum 1. <u>Calamagrostis canadensis</u> <u>100</u> <u>Yes</u> <u>FAC</u> 2. <u>Equisetum sylvaticum</u> <u>5</u> <u>_____</u> <u>FAC</u> 3. <u>Heracleum maximum</u> <u>5</u> <u>_____</u> <u>FACU</u> 4. <u>Gymnocarpium dryopteris</u> <u>1</u> <u>_____</u> <u>FACU</u> 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____ Total Cover: <u>111</u> 50% of total cover: <u>55.5</u> 20% of total cover: <u>22.2</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____ % Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)				
Hydrophytic Vegetation Indicators: <u>No</u> Dominance Test is >50% <u>No</u> Prevalence Index is ≤3.0 _____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) _____ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.				
Hydrophytic Vegetation Present? Yes _____ No <u>X</u>				
Remarks:				

SOIL

Sampling Point: DP-9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+1-0	dk gray brn 10YR4/2	100					silt, roots, wood debris and decomposed plant matter	
0-7	black 10YR2/1	50					silt loam w/ cobbles; few med roots; dry	
	v dk gray 10YR3/1	50						
7-31	pale brn 10YR6/3	10					silt loam w/ gravel & cobbles, dry; massive; firm	
	yel brown 10YR6/3	90						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present):		Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Type: <u>None</u>	Depth (inches): _____	

Remarks: The lower portion of the profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The washed-out coloration of the lower profile is likely from remnant ash layers that leached down through underlying brown silt loam soil. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations:		Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Surface Water Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____	Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____	
Saturation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____ (includes capillary fringe)		

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmon Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014
 Applicant/Owner: _____ Sampling Point: DP-10
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Convex Slope (%): _____
 Subregion: Southcentral Lat: N 61.1000 Long: W 149.7256 Datum: NAD83
 Soil Map Unit Name: 426—Jacobsen-Disappear-Doroshin complex. 3 to 7 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes _____	No <u>X</u>	
Wetland Hydrology Present?	Yes _____	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is partially exposed with trees and high shrubs occurring at the edge of the plot.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>3</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>66.6</u> (A/B) Prevalence Index worksheet: Total % Cover of: OBL species _____ x 1 = <u>0</u> FACW species _____ x 2 = <u>0</u> FAC species <u>115</u> x 3 = <u>345</u> FACU species <u>31</u> x 4 = <u>124</u> UPL species _____ x 5 = <u>0</u> Column Totals: <u>146</u> (A) <u>469</u> (B) Prevalence Index = B/A = <u>3.21</u>
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
Total Cover: <u>0</u> 50% of total cover: <u>0</u> 20% of total cover: <u>0</u>				
Sapling/Shrub Stratum				
1. <u>Rubus idaeus</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	
2. <u>Alnus viridis</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
Total Cover: <u>35</u> 50% of total cover: <u>17.5</u> 20% of total cover: <u>7</u>				
Herb Stratum				
1. <u>Calamagrostis canadensis</u>	<u>100</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Equisetum sylvaticum</u>	<u>5</u>	_____	<u>FAC</u>	
3. <u>Heracleum maximum</u>	<u>5</u>	_____	<u>FACU</u>	
4. <u>Gymnocarpium dryopteris</u>	<u>1</u>	_____	<u>FACU</u>	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: <u>111</u> 50% of total cover: <u>55.5</u> 20% of total cover: <u>22.2</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)				
Hydrophytic Vegetation Indicators: Yes Dominance Test is >50% No Prevalence Index is ≤3.0 _____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) _____ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.				
Hydrophytic Vegetation Present? Yes <u>X</u> No _____				
Remarks:				

SOIL

Sampling Point: DP-10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+2-0	dk gray brn 10YR4/2	100					silt, roots, wood debris and decomposed plant matter	
0-10	y pale brn 10YR7/2	20					ash and silt loam; many fine, med roots; dry	
	yel brown 10YR6/3	80						
7-31	pale brn 10YR6/3	10					silt loam w/ gravel & cobbles, dry; massive; firm	
	yel brown 10YR6/3	90						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder Underlying Layer	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue		
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 8/26/2014
 Applicant/Owner: _____ Sampling Point: DP-11
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Convex Slope (%): _____
 Subregion: Southcentral Lat: N 61.1010 Long: W 149.7251 Datum: NAD83
 Soil Map Unit Name: 426—Jacobsen-Disappear-Doroshin complex, 3 to 7 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is partially exposed with trees and high shrubs occurring at the edge of the plot.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>4</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50</u> (A/B) Prevalence Index worksheet: Total % Cover of: OBL species _____ x 1 = <u>0</u> FACW species _____ x 2 = <u>0</u> FAC species <u>115</u> x 3 = <u>345</u> FACU species <u>41</u> x 4 = <u>164</u> UPL species _____ x 5 = <u>0</u> Column Totals: <u>156</u> (A) <u>509</u> (B) Prevalence Index = B/A = <u>3.26</u>
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
Total Cover: <u>0</u> 50% of total cover: <u>0</u> 20% of total cover: <u>0</u>				
Sapling/Shrub Stratum				
1. <u>Rubus idaeus</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	Hydrophytic Vegetation Indicators: <u>No</u> Dominance Test is >50% <u>No</u> Prevalence Index is ≤3.0 _____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) _____ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
2. <u>Alnus viridis</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>	
3. <u>Sorbus scopulina</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
Total Cover: <u>45</u> 50% of total cover: <u>23</u> 20% of total cover: <u>9</u>				
Herb Stratum				
1. <u>Calamagrostis canadensis</u>	<u>100</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Equisetum sylvaticum</u>	<u>5</u>	_____	<u>FAC</u>	
3. <u>Heracleum maximum</u>	<u>5</u>	_____	<u>FACU</u>	
4. <u>Gymnocarpium dryopteris</u>	<u>1</u>	_____	<u>FACU</u>	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: <u>111</u> 50% of total cover: <u>56</u> 20% of total cover: <u>22</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)				
Hydrophytic Vegetation Present? Yes _____ No <u>X</u>				
Remarks:				

SOIL

Sampling Point: DP-11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+2-0	black 10YR2/1	50					wood debris and decomposed plant material	
	dk red brn 5YR3/4	50						
0-8	black 10YR2/1	50					charcol, ash, and silt loam; many fine, med roots; dry	
	white 10YR 81	20						
	v pale brn 10YR7/2	20						
8-25	pale brn 10YR6/3	10					silt loam w/ gravel & cobbles, dry; massive; firm	
	yel brown 10YR6/3	90						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/3/2014
 Applicant/Owner: _____ Sampling Point: DP-12
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Concave Slope (%): _____
 Subregion: Southcentral Lat: N 61.1002 Long: W 149.7213 Datum: NAD83
 Soil Map Unit Name: 427—Jacobsen-Disappear-Doroshin complex, 7 to 12 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in closed shrub-scrub of alder and red elder.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Alnus viridis</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>	
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: <u>6</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
Total Cover: <u>10</u>				Total % Cover of:
50% of total cover: <u>5</u> 20% of total cover: <u>2</u>				OBL species _____ x 1 = <u>0</u>
Sapling/Shrub Stratum				FACW species _____ x 2 = <u>0</u>
1. <u>Alnus viridis</u>	<u>75</u>	<u>Yes</u>	<u>FAC</u>	FAC species <u>140</u> x 3 = <u>420</u>
2. <u>Sorbus scopulina</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	FACU species <u>81</u> x 4 = <u>324</u>
3. <u>Ribes triste</u>	<u>5</u>	_____	<u>FAC</u>	UPL species _____ x 5 = <u>0</u>
4. _____	_____	_____	_____	Column Totals: <u>221</u> (A) <u>744</u> (B)
5. _____	_____	_____	_____	Prevalence Index = B/A = <u>3.36</u>
6. _____	_____	_____	_____	Hydrophytic Vegetation Indicators:
Total Cover: <u>105</u>				<u>No</u> Dominance Test is >50%
50% of total cover: <u>53</u> 20% of total cover: <u>21</u>				<u>No</u> Prevalence Index is ≤3.0
Herb Stratum				____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
1. <u>Calamagrostis canadensis</u>	<u>50</u>	<u>Yes</u>	<u>FAC</u>	____ Problematic Hydrophytic Vegetation ¹ (Explain)
2. <u>Mertensia paniculata</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
3. <u>Mertensia paniculata</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>	
4. <u>Chamerion angustifolium</u>	<u>10</u>	_____	<u>FACU</u>	
5. <u>Urtica dioica</u>	<u>10</u>	_____	<u>FACU</u>	
6. <u>Gymnocarpium dryopteris</u>	<u>1</u>	_____	<u>FACU</u>	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: <u>106</u>				
50% of total cover: <u>53</u> 20% of total cover: <u>21</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u>		% Bare Ground _____		Hydrophytic Vegetation Present? Yes _____ No <u>X</u>
% Cover of Wetland Bryophytes <u>0</u>	Total Cover of Bryophytes <u>0</u>			
(Where applicable)				
Remarks:				

SOIL

Sampling Point: DP-12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+10- +4	dk gray brn 10YR4/2	100					silt, roots, wood debris and decomposed plant matter	
+4-0	black 10YR2/1	50					silt loam, many fine roots, dry	
	v dk gray 10YR3/1	50						
0-11	dk gray brn 10YR4/2	100					gravelly silt loam; few med roots; dry	
11-17	v pale brn 10YR7/3	50					silt loam w/ gravel & cobbles, dry; loose	
	brown 10YR5/3	50						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations:		Wetland Hydrology Present? Yes _____ No <u>X</u>
Surface Water Present?	Yes _____ No <u>X</u> Depth (inches): _____	
Water Table Present?	Yes _____ No <u>X</u> Depth (inches): _____	
Saturation Present? (includes capillary fringe)	Yes _____ No <u>X</u> Depth (inches): _____	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 3, 2014 was above normal with 9.08 inches since June 1st, compared to the normal of 6.37 inches, resulting in an excess of 2.71 inches. Since January 1st, the total was 12.31 inches, compared to the normal of 9.61 inches, resulting in an excess of 2.7 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeAnnoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/3/2014
 Applicant/Owner: _____ Sampling Point: DP-13
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Convex Slope (%): _____
 Subregion: Southcentral Lat: N 61.0989 Long: W 149.7192 Datum: NAD83
 Soil Map Unit Name: 427—Jacobsen-Disappear-Doroshin complex. 7 to 12 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open spruce forest and dense alder shrub growth. Much of the spruce has been beetle-killed and blown down, opening up the canopy for shrubs and herbs to colonize the area.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>4</u> (A) Total Number of Dominant Species Across All Strata: <u>8</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>50</u> (A/B)														
1. <u>Picea mariana</u>	<u>25</u>	<u>Yes</u>	<u>FACW</u>															
2. <u>Alnus viridis</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____	Prevalence Index worksheet: <table border="0"> <tr> <td>Total % Cover of:</td> <td>Multiply by:</td> </tr> <tr> <td>OBL species _____</td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species <u>75</u></td> <td>x 2 = <u>150</u></td> </tr> <tr> <td>FAC species <u>35</u></td> <td>x 3 = <u>105</u></td> </tr> <tr> <td>FACU species <u>104</u></td> <td>x 4 = <u>416</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>214</u></td> <td>(A) <u>671</u> (B)</td> </tr> </table> Prevalence Index = B/A = <u>3.13</u>	Total % Cover of:	Multiply by:	OBL species _____	x 1 = <u>0</u>	FACW species <u>75</u>	x 2 = <u>150</u>	FAC species <u>35</u>	x 3 = <u>105</u>	FACU species <u>104</u>	x 4 = <u>416</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>214</u>	(A) <u>671</u> (B)
Total % Cover of:	Multiply by:																	
OBL species _____	x 1 = <u>0</u>																	
FACW species <u>75</u>	x 2 = <u>150</u>																	
FAC species <u>35</u>	x 3 = <u>105</u>																	
FACU species <u>104</u>	x 4 = <u>416</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>214</u>	(A) <u>671</u> (B)																	
Total Cover: <u>35</u> 50% of total cover: <u>18</u> 20% of total cover: <u>7</u>																		
Sapling/Shrub Stratum																		
1. <u>Alnus viridis</u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Rosa acicularis</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>															
3. <u>Rubus idaeus</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>															
4. <u>Oplopanax horridus</u>	<u>5</u>	_____	<u>FACU</u>															
5. <u>Cornus canadensis</u>	<u>5</u>	_____	<u>FACU</u>															
6. _____	_____	_____	_____															
Total Cover: <u>70</u> 50% of total cover: <u>35</u> 20% of total cover: <u>14</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>50</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Mertensia paniculata</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>															
3. <u>Heracleum maximum</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>															
4. <u>Chamerion angustifolium</u>	<u>10</u>	_____	<u>FACU</u>															
5. <u>Urtica dioica</u>	<u>10</u>	_____	<u>FACU</u>															
6. <u>Gymnocarpium dryopteris</u>	<u>1</u>	_____	<u>FACU</u>															
7. <u>Mertensia paniculata</u>	<u>1</u>	_____	<u>FACU</u>															
8. <u>Geranium erianthum</u>	<u>1</u>	_____	<u>FACU</u>															
9. <u>Chamerion angustifolium</u>	<u>1</u>	_____	<u>FACU</u>															
10. _____	_____	_____	_____															
Total Cover: <u>109</u> 50% of total cover: <u>55</u> 20% of total cover: <u>22</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____ % Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)																		
Hydrophytic Vegetation Indicators: <u>No</u> Dominance Test is >50% <u>No</u> Prevalence Index is ≤3.0 _____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) _____ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.																		
Hydrophytic Vegetation Present? Yes _____ No <u>X</u>																		
Remarks: _____																		

SOIL

Sampling Point: DP-13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (Inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+8 -0	black 10YR2/1	50					silt, roots, wood debris and decomposed plant matter	
	dk red brn 5YR3/4	50						
+4-0	black 10YR2/1	50					silt loam, many fine roots, dry	
	v dk gray 10YR3/1	50						
0-11	black 10YR2/1	100					silt loam; few med roots; dry; greasy when wetted	
11-14	black 10YR2/1	80					silt loam and ash; dry	
	white 10YR 8/1	20						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder Underlying Layer	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue		
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 3, 2014 was above normal with 9.08 inches since June 1st, compared to the normal of 6.37 inches, resulting in an excess of 2.71 inches. Since January 1st, the total was 12.31 inches, compared to the normal of 9.61 inches, resulting in an excess of 2.7 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmon Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/3/2014

Applicant/Owner: _____ Sampling Point: DP-15

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Convex Slope (%): _____

Subregion: Southcentral Lat: N 61.0989 Long: W 149.7249 Datum: NAD83

Soil Map Unit Name: 412—Deception-Estelle-Kichatna complex, 20 to 45 percent slopes NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is exposed with trees and high shrubs absent.			

VEGETATION – Use scientific names of plants. List all species in the plot.

<u>Tree Stratum</u>	<u>Absolute % Cover</u>	<u>Dominant Species?</u>	<u>Indicator Status</u>	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>4</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>25</u> (A/B) Prevalence Index worksheet: <table> <tr> <td>Total % Cover of:</td> <td>Multiply by:</td> </tr> <tr> <td>OBL species _____</td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species _____</td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>105</u></td> <td>x 3 = <u>315</u></td> </tr> <tr> <td>FACU species <u>51</u></td> <td>x 4 = <u>204</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>156</u></td> <td>(A) <u>519</u> (B)</td> </tr> </table> Prevalence Index = B/A = <u>3.32</u>	Total % Cover of:	Multiply by:	OBL species _____	x 1 = <u>0</u>	FACW species _____	x 2 = <u>0</u>	FAC species <u>105</u>	x 3 = <u>315</u>	FACU species <u>51</u>	x 4 = <u>204</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>156</u>	(A) <u>519</u> (B)
Total % Cover of:	Multiply by:																	
OBL species _____	x 1 = <u>0</u>																	
FACW species _____	x 2 = <u>0</u>																	
FAC species <u>105</u>	x 3 = <u>315</u>																	
FACU species <u>51</u>	x 4 = <u>204</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>156</u>	(A) <u>519</u> (B)																	
1. _____	_____	_____	_____															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
Total Cover: <u>0</u>																		
50% of total cover: <u>0</u> 20% of total cover: <u>0</u>																		
Sapling/Shrub Stratum																		
1. <u>Rubus idaeus</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>															
2. <u>Sorbus scopulina</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>															
3. <u>Rubus idaeus</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>															
4. _____	_____	_____	_____															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
Total Cover: <u>45</u>																		
50% of total cover: <u>23</u> 20% of total cover: <u>9</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>100</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Equisetum sylvaticum</u>	<u>5</u>	_____	<u>FAC</u>															
3. <u>Heracleum maximum</u>	<u>5</u>	_____	<u>FACU</u>															
4. <u>Gymnocarpium dryopteris</u>	<u>1</u>	_____	<u>FACU</u>															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
7. _____	_____	_____	_____															
8. _____	_____	_____	_____															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>111</u>																		
50% of total cover: <u>56</u> 20% of total cover: <u>22</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____																		
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u>																		
(Where applicable)																		
Hydrophytic Vegetation Present? Yes _____ No <u>X</u>																		
Remarks:																		

SOIL

Sampling Point: DP-15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)							
Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
+2-0	dk gray brn 10YR4/2	100					silt, roots, and decomposed plant matter
0-8	black 10YR2/1	50					silt loam, many fine roots, dry
	v dk gray 10YR3/1	50					
8-29	brown 10YR5/3	50					silt loam w/ gravel & cobbles, dry; massive; loose
	yel brown 10YR5/6	50					
>29							cobbles and gravel, compacted, dry

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:	Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Thick Dark Surface (A12)		
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.	
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.	
<input type="checkbox"/> Alaska Gleyed Pores (A15)		

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 3, 2014 was above normal with 9.08 inches since June 1st, compared to the normal of 6.37 inches, resulting in an excess of 2.71 inches. Since January 1st, the total was 12.31 inches, compared to the normal of 9.61 inches, resulting in an excess of 2.7 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmon Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/3/2014
 Applicant/Owner: _____ Sampling Point: DP-16
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Concave Slope (%): _____
 Subregion: Southcentral Lat: N 61.0989 Long: W 149.7270 Datum: NAD83
 Soil Map Unit Name: 412—Deception-Estelle-Kichatna complex. 20 to 45 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is exposed with trees and high shrubs absent.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>4</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>25</u> (A/B) Prevalence Index worksheet: <table border="0"> <tr> <td>Total % Cover of:</td> <td>Multiply by:</td> </tr> <tr> <td>OBL species _____</td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species _____</td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>125</u></td> <td>x 3 = <u>375</u></td> </tr> <tr> <td>FACU species <u>59</u></td> <td>x 4 = <u>236</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>184</u></td> <td>(A) <u>611</u> (B)</td> </tr> </table> Prevalence Index = B/A = <u>3.32</u>	Total % Cover of:	Multiply by:	OBL species _____	x 1 = <u>0</u>	FACW species _____	x 2 = <u>0</u>	FAC species <u>125</u>	x 3 = <u>375</u>	FACU species <u>59</u>	x 4 = <u>236</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>184</u>	(A) <u>611</u> (B)
Total % Cover of:	Multiply by:																	
OBL species _____	x 1 = <u>0</u>																	
FACW species _____	x 2 = <u>0</u>																	
FAC species <u>125</u>	x 3 = <u>375</u>																	
FACU species <u>59</u>	x 4 = <u>236</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>184</u>	(A) <u>611</u> (B)																	
1. _____	_____	_____	_____															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
Total Cover: <u>0</u> 50% of total cover: <u>0</u> 20% of total cover: <u>0</u>																		
Sapling/Shrub Stratum																		
1. <u>Rubus idaeus</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>															
2. <u>Sorbus scopulina</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>															
3. <u>Rubus idaeus</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>															
4. _____	_____	_____	_____															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
Total Cover: <u>45</u> 50% of total cover: <u>23</u> 20% of total cover: <u>9</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>100</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Athyrium filix-femina</u>	<u>25</u>	_____	<u>FAC</u>															
3. <u>Heracleum maximum</u>	<u>10</u>	_____	<u>FACU</u>															
4. <u>Gymnocarpium dryopteris</u>	<u>1</u>	_____	<u>FACU</u>															
5. <u>Mertensia paniculata</u>	<u>1</u>	_____	<u>FACU</u>															
6. <u>Chamerion angustifolium</u>	<u>1</u>	_____	<u>FACU</u>															
7. <u>Equisetum sylvaticum</u>	<u>1</u>	_____	<u>FAC</u>															
8. _____	_____	_____	_____															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>139</u> 50% of total cover: <u>70</u> 20% of total cover: <u>28</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____ % Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)																		
Hydrophytic Vegetation Present? Yes _____ No <u>X</u>																		
Remarks: _____																		

SOIL

Sampling Point: DP-16

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)							
Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
+1-0	dk gray brn 10YR4/2	100					silt, roots, and decomposed plant matter
0-12	grav brn 10YR5/2 v dk gray 10YR3/1	50 50					silty gravel, many fine/med roots, dry
12-19	grav brn 10YR5/2 gray 10YR6/1	80 20					gravel and small cobble, few med roots, moist (not saturated)
19-29	gray 10YR6/1 lt gray 10YR7/1	20 80					cobbles and gravel, compacted, saturated

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder Underlying Layer	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue		
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The presence of depleted (lt gray) soil is indicative of hydric conditions below 12-in. depth, which is too deep to qualify the soil profile as hydric. The absence of redox indicators and lack of soil moisture in the upper 12-in. during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes <u>X</u> No _____ Depth (inches): <u>19</u> (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Saturation at 19-in. depth is below the threshold for wetland hydrology, especially supported by the abundance of accumulated precipitation at the time of the investigation. Cumulative total precipitation on September 3, 2014 was above normal with 9.08 inches since June 1st, compared to the normal of 6.37 inches, resulting in an excess of 2.71 inches. Since January 1st, the total was 12.31 inches, compared to the normal of 9.61 inches, resulting in an excess of 2.7 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/4/2014

Applicant/Owner: _____ Sampling Point: DP-17

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Concave Slope (%): _____

Subregion: Southcentral Lat: N 61.0986 Long: W 149.7153 Datum: NAD83

Soil Map Unit Name: 427—Jacobsen-Disappear-Doroshin complex, 7 to 12 percent slopes NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in closed shrub-scrub of red elder and alder.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Alnus viridis</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>	
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: <u>5</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>60</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
Total Cover: <u>10</u>				Total % Cover of:
50% of total cover: <u>5</u> 20% of total cover: <u>2</u>				Multiply by:
Sapling/Shrub Stratum				OBL species x 1 = <u>0</u>
1. <u>Sorbus scopulina</u>	<u>75</u>	<u>Yes</u>	<u>FACU</u>	FACW species x 2 = <u>0</u>
2. <u>Alnus viridis</u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>	FAC species <u>60</u> x 3 = <u>180</u>
3. _____	_____	_____	_____	FACU species <u>137</u> x 4 = <u>548</u>
4. _____	_____	_____	_____	UPL species x 5 = <u>0</u>
5. _____	_____	_____	_____	Column Totals: <u>197</u> (A) <u>728</u> (B)
6. _____	_____	_____	_____	Prevalence Index = B/A = <u>3.69</u>
Total Cover: <u>100</u>				Hydrophytic Vegetation Indicators:
50% of total cover: <u>50</u> 20% of total cover: <u>20</u>				<u>Yes</u> Dominance Test is >50%
Herb Stratum				<u>No</u> Prevalence Index is ≤3.0
1. <u>Urtica dioica</u>	<u>50</u>	<u>Yes</u>	<u>FACU</u>	____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
2. <u>Calamagrostis canadensis</u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>	____ Problematic Hydrophytic Vegetation ¹ (Explain)
3. <u>Chamerion angustifolium</u>	<u>10</u>	_____	<u>FACU</u>	
4. <u>Mertensia paniculata</u>	<u>1</u>	_____	<u>FACU</u>	
5. <u>Streptopus amplexifolius</u>	<u>1</u>	_____	<u>FACU</u>	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: <u>87</u>				
50% of total cover: <u>44</u> 20% of total cover: <u>17</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				Hydrophytic Vegetation Present? Yes <u>X</u> No _____
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)				
Remarks:				

SOIL

Sampling Point: DP-17

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+10 -0	black 10YR2/1	50					silt, roots, wood debris and decomposed plant matter	
	dk gray brn 10YR4/2	50						
0-23	gray brn 10YR5/2	50					silt loam and decomposed plant material; few med roots; dry	
	yel brown 10YR6/3	50						
23-34	yel brown 10YR6/3	80					silt loam; few med roots; dry	
	dk gray brn 10YR4/2	20						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The lower portion of the profile correlates with the mapped unit for adjacent areas, Deception-Estelle-Kichatna complex. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:		
Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 4, 2014 was above normal with 9.63 inches since June 1st, compared to the normal of 6.47 inches, resulting in an excess of 3.16 inches. Since January 1st, the total was 12.86 inches, compared to the normal of 9.71 inches, resulting in an excess of 3.15 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).		

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/4/2014

Applicant/Owner: _____ Sampling Point: DP-18

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Convex Slope (%): _____

Subregion: Southcentral Lat: N 61.0985 Long: W 149.7166 Datum: NAD83

Soil Map Unit Name: 412—Deception-Estelle-Kichatna complex, 20 to 45 percent slopes NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes _____	No <u>X</u>	
Wetland Hydrology Present?	Yes _____	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is exposed with trees and high shrubs absent.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A) Total Number of Dominant Species Across All Strata: <u>1</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B) Prevalence Index worksheet: <table> <tr> <td>Total % Cover of:</td> <td>Multiply by:</td> </tr> <tr> <td>OBL species _____</td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species _____</td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>126</u></td> <td>x 3 = <u>378</u></td> </tr> <tr> <td>FACU species <u>13</u></td> <td>x 4 = <u>52</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>139</u></td> <td>(A) <u>430</u> (B)</td> </tr> </table> Prevalence Index = B/A = <u>3.09</u>	Total % Cover of:	Multiply by:	OBL species _____	x 1 = <u>0</u>	FACW species _____	x 2 = <u>0</u>	FAC species <u>126</u>	x 3 = <u>378</u>	FACU species <u>13</u>	x 4 = <u>52</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>139</u>	(A) <u>430</u> (B)
Total % Cover of:	Multiply by:																	
OBL species _____	x 1 = <u>0</u>																	
FACW species _____	x 2 = <u>0</u>																	
FAC species <u>126</u>	x 3 = <u>378</u>																	
FACU species <u>13</u>	x 4 = <u>52</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>139</u>	(A) <u>430</u> (B)																	
1. _____	_____	_____	_____															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
Total Cover: <u>0</u>																		
50% of total cover: <u>0</u> 20% of total cover: <u>0</u>																		
Sapling/Shrub Stratum																		
1. _____	_____	_____	_____															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
Total Cover: <u>0</u>																		
50% of total cover: <u>0</u> 20% of total cover: <u>0</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>100</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Athyrium filix-femina</u>	<u>25</u>	_____	<u>FAC</u>															
3. <u>Heracleum maximum</u>	<u>10</u>	_____	<u>FACU</u>															
4. <u>Gymnocarpium dryopteris</u>	<u>1</u>	_____	<u>FACU</u>															
5. <u>Mertensia paniculata</u>	<u>1</u>	_____	<u>FACU</u>															
6. <u>Chamerion angustifolium</u>	<u>1</u>	_____	<u>FACU</u>															
7. <u>Equisetum sylvaticum</u>	<u>1</u>	_____	<u>FAC</u>															
8. _____	_____	_____	_____															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>139</u>																		
50% of total cover: <u>70</u> 20% of total cover: <u>28</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____																		
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)																		
Hydrophytic Vegetation Present? Yes <u>X</u> No _____ Remarks:																		

SOIL

Sampling Point: DP-18

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+2 -0	dk gray brn 10YR4/2	100					silt loam; many fine/med roots; wood debris and decomposed plant matter	
0-10	dk vel brn 10YR4/4	50					silt loam; many fine/med roots; dry	
	dk gray brn 10YR4/2	50						
10-23	vel brown 10YR6/3	60					sandy silt loam; dry	
	gray brn 10YR5/2	20						
	dk gray brn 10YR4/2	20						
23-35	brown 10YR5/3	50					sandy silt loam; dry; massive; loose	
	yel brown 10YR5/6	50						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 4, 2014 was above normal with 9.63 inches since June 1st, compared to the normal of 6.47 inches, resulting in an excess of 3.16 inches. Since January 1st, the total was 12.86 inches, compared to the normal of 9.71 inches, resulting in an excess of 3.15 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmon Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/4/2014

Applicant/Owner: Sampling Point: DP-19

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Concave Slope (%):

Subregion: Southcentral Lat: N 61.0980 Long: W 149.7177 Datum: NAD83

Soil Map Unit Name: 412—Deception-Estelle-Kichatna complex, 20 to 45 percent slopes NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation, Soil, or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is partially exposed with trees and high shrubs occurring at the edge of the plot.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <i>Betula papyrifera</i> (Southcentral)	25	Yes	FAC	
2. <i>Picea glauca</i>	10	Yes	FACU	Total Number of Dominant Species Across All Strata: 6 (B)
3. _____				Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)
4. _____				Prevalence Index worksheet:
Total Cover: 35				Total % Cover of:
50% of total cover: 18 20% of total cover: 7				OBL species x 1 = 0
Sapling/Shrub Stratum				FACW species x 2 = 20
1. <i>Alnus viridis</i>	25	Yes	FAC	FAC species x 3 = 225
2. <i>Rosa acicularis</i>	25	Yes	FACU	FACU species x 4 = 348
3. <i>Cornus canadensis</i>	25	Yes	FACU	UPL species x 5 = 0
4. <i>Oplopanax horridus</i>	5		FACU	Column Totals: 172 (A) 593 (B)
5. _____				Prevalence Index = B/A = 3.44
6. _____				Hydrophytic Vegetation Indicators:
Total Cover: 80				No Dominance Test is >50%
50% of total cover: 40 20% of total cover: 16				No Prevalence Index is ≤3.0
Herb Stratum				Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
1. <i>Calamagrostis canadensis</i>	25	Yes	FAC	Problematic Hydrophytic Vegetation ¹ (Explain)
2. <i>Dryopteris expansa</i>	10		FACU	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
3. <i>Heracleum maximum</i>	10		FACU	
4. <i>Sanguisorba canadensis</i>	10		FACW	
5. <i>Mertensia paniculata</i>	1		FACU	
6. <i>Chamerion angustifolium</i>	1		FACU	
7. _____				
8. _____				
9. _____				
10. _____				
Total Cover: 57				Hydrophytic Vegetation Present? Yes No <u>X</u>
50% of total cover: 29 20% of total cover: 11				
Plot size (radius, or length x width) 30-ft diameter % Bare Ground				
% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 0				
(Where applicable)				
Remarks:				

SOIL

Sampling Point: DP-19

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+7 -0	black 10YR2/1	100					organic soil (silt, roots, wood debris and decomposed plant matter); not saturated; many fine/med roots; greasy when wetted	
0-14	black 10YR2/1	50					silt loam w/fine sand; dry	
	dk gray bm 10YR4/2	50						
14-23	lt brn gray 10YR6/2	80					silt loam w/fine sand; dry	
	gray brn 10YR5/2	20						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder Underlying Layer	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue		
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The surficial organic, black soil indicates potential hydric conditions but does not extend to depth and is not saturated. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 4, 2014 was above normal with 9.63 inches since June 1st, compared to the normal of 6.47 inches, resulting in an excess of 3.16 inches. Since January 1st, the total was 12.86 inches, compared to the normal of 9.71 inches, resulting in an excess of 3.15 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmon Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/4/2014
 Applicant/Owner: _____ Sampling Point: DP-20
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Concave Slope (%): _____
 Subregion: Southcentral Lat: N 61.0981 Long: W 149.7192 Datum: NAD83
 Soil Map Unit Name: 412—Deception-Estelle-Kichatna complex, 20 to 45 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes _____	No <u>X</u>	
Wetland Hydrology Present?	Yes _____	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is partially exposed with trees and high shrubs occurring at the edge of the plot.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <i>Betula papyrifera</i> (Southcentral)	25	Yes	FAC	
2. <i>Picea mariana</i>	10	Yes	FACW	Total Number of Dominant Species Across All Strata: <u>6</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>67</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
Total Cover: <u>35</u>				Total % Cover of:
50% of total cover: <u>18</u> 20% of total cover: <u>7</u>				OBL species _____ x 1 = <u>0</u>
Sapling/Shrub Stratum				FACW species <u>20</u> x 2 = <u>40</u>
1. <i>Alnus viridis</i>	25	Yes	FAC	FAC species <u>75</u> x 3 = <u>225</u>
2. <i>Rosa acicularis</i>	25	Yes	FACU	FACU species <u>77</u> x 4 = <u>308</u>
3. <i>Cornus canadensis</i>	25	Yes	FACU	UPL species _____ x 5 = <u>0</u>
4. <i>Oplopanax horridus</i>	5	_____	FACU	Column Totals: <u>172</u> (A) <u>573</u> (B)
5. _____	_____	_____	_____	Prevalence Index = B/A = <u>3.33</u>
6. _____	_____	_____	_____	Hydrophytic Vegetation Indicators:
Total Cover: <u>80</u>				Yes Dominance Test is >50%
50% of total cover: <u>40</u> 20% of total cover: <u>16</u>				No Prevalence Index is ≤3.0
Herb Stratum				Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
1. <i>Calamagrostis canadensis</i>	25	Yes	FAC	Problematic Hydrophytic Vegetation ¹ (Explain)
2. <i>Dryopteris expansa</i>	10	_____	FACU	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
3. <i>Heracleum maximum</i>	10	_____	FACU	
4. <i>Sanguisorba canadensis</i>	10	_____	FACW	Hydrophytic Vegetation Present? Yes <u>X</u> No _____
5. <i>Mertensia paniculata</i>	1	_____	FACU	
6. <i>Chamerion angustifolium</i>	1	_____	FACU	Remarks:
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: <u>57</u>				
50% of total cover: <u>29</u> 20% of total cover: <u>11</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u>				
(Where applicable)				

SOIL

Sampling Point: DP-20

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+2-0	dk yel brn 10YR4/6	50					silt, roots, and decomposed plant matter	
	dk red brn 5YR3/4	50						
0-6	dk yel brn 10YR4/4	50					silt loam; many fine/med roots; dry	
	dk gray brn 10YR4/2	50						
6-18	gray brn 10YR5/2	50					gravel and small cobble; few med roots; dry	
	gray 10YR6/1	50						
18-30	brown 10YR5/3	50					gravelly silt loam; dry; massive: loose	
	yel brown 10YR5/6	50						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:			Indicators for Problematic Hydric Soils ³ :		
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder			
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer			
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)			
<input type="checkbox"/> Thick Dark Surface (A12)					
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.				
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.				
<input type="checkbox"/> Alaska Gleyed Pores (A15)					

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The lower portion of the profile correlates with the mapped unit for this location, Deception-Estelle-Kichatna complex. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 4, 2014 was above normal with 9.63 inches since June 1st, compared to the normal of 6.47 inches, resulting in an excess of 3.16 inches. Since January 1st, the total was 12.86 inches, compared to the normal of 9.71 inches, resulting in an excess of 3.15 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/8/2014

Applicant/Owner: _____ Sampling Point: DP-21

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Concave Slope (%): _____

Subregion: Southcentral Lat: N 61.0983 Long: W 149.7286 Datum: NAD83

Soil Map Unit Name: 438—Moose River-Niklasen complex, occasionally flooded, 0 to 3 percent NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____
Hydric Soil Present?	Yes <u>X</u>	No _____	
Wetland Hydrology Present?	Yes <u>X</u>	No _____	
Remarks: Site is located at the base of a south-facing mountain slope in closed black spruce trees and alder scrub. Springs emerge from the slope to the north and form small streams that flow only a short distance before re-entering the ground.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Picea mariana</u>	<u>25</u>	<u>Yes</u>	<u>FACW</u>	
2. <u>Alnus viridis</u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>	Total Number of Dominant Species Across All Strata: <u>5</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
Total Cover: <u>50</u>				Total % Cover of:
50% of total cover: <u>25</u> 20% of total cover: <u>10</u>				OBL species <u>25</u> x 1 = <u>25</u>
Sapling/Shrub Stratum				FACW species <u>25</u> x 2 = <u>50</u>
1. <u>Alnus viridis</u>	<u>50</u>	<u>Yes</u>	<u>FAC</u>	FAC species <u>150</u> x 3 = <u>450</u>
2. _____	_____	_____	_____	FACU species _____ x 4 = <u>0</u>
3. _____	_____	_____	_____	UPL species _____ x 5 = <u>0</u>
4. _____	_____	_____	_____	Column Totals: <u>200</u> (A) <u>525</u> (B)
5. _____	_____	_____	_____	Prevalence Index = B/A = <u>2.62</u>
6. _____	_____	_____	_____	Hydrophytic Vegetation Indicators:
Total Cover: <u>50</u>				<u>Yes</u> Dominance Test is >50%
50% of total cover: <u>25</u> 20% of total cover: <u>10</u>				<u>Yes</u> Prevalence Index is ≤3.0
Herb Stratum				____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
1. <u>Calamagrostis canadensis</u>	<u>75</u>	<u>Yes</u>	<u>FAC</u>	____ Problematic Hydrophytic Vegetation ¹ (Explain)
2. <u>Equisetum fluviatile</u>	<u>25</u>	<u>Yes</u>	<u>OBL</u>	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
3. _____	_____	_____	_____	Hydrophytic Vegetation Present? Yes <u>X</u> No _____
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: <u>100</u>				
50% of total cover: <u>50</u> 20% of total cover: <u>20</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)				
Remarks:				

Sampling Point: DP-21

HYDROLOGY

US Army Corps of Engineers

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/8/2014
 Applicant/Owner: _____ Sampling Point: DP-22
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Concave Slope (%): _____
 Subregion: Southcentral Lat: N 61.0986 Long: W 149.7290 Datum: NAD83
 Soil Map Unit Name: 412—Deception-Estelle-Kichatna complex, 20 to 45 percent slopes NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes _____	No <u>X</u>	
Wetland Hydrology Present?	Yes _____	No <u>X</u>	
Remarks: Site is located at the base of a south-facing mountain slope in open bluejoint reed grass-herb meadow. The site is exposed with a few high shrubs present.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A) Total Number of Dominant Species Across All Strata: <u>3</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>67</u> (A/B) Prevalence Index worksheet: <table border="0"> <tr> <td>Total % Cover of:</td> <td>Multiply by:</td> </tr> <tr> <td>OBL species _____</td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species _____</td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>136</u></td> <td>x 3 = <u>408</u></td> </tr> <tr> <td>FACU species <u>23</u></td> <td>x 4 = <u>92</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>159</u></td> <td>(A) <u>500</u> (B)</td> </tr> </table> Prevalence Index = B/A = <u>3.14</u>	Total % Cover of:	Multiply by:	OBL species _____	x 1 = <u>0</u>	FACW species _____	x 2 = <u>0</u>	FAC species <u>136</u>	x 3 = <u>408</u>	FACU species <u>23</u>	x 4 = <u>92</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>159</u>	(A) <u>500</u> (B)
Total % Cover of:	Multiply by:																	
OBL species _____	x 1 = <u>0</u>																	
FACW species _____	x 2 = <u>0</u>																	
FAC species <u>136</u>	x 3 = <u>408</u>																	
FACU species <u>23</u>	x 4 = <u>92</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>159</u>	(A) <u>500</u> (B)																	
1. _____	_____	_____	_____															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
Total Cover: <u>0</u> 50% of total cover: <u>0</u> 20% of total cover: <u>0</u>																		
Sapling/Shrub Stratum																		
1. <u>Sorbus scopulina</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>															
2. <u>Alnus viridis</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
Total Cover: <u>20</u> 50% of total cover: <u>10</u> 20% of total cover: <u>4</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>100</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Athyrium filix-femina</u>	<u>25</u>	_____	<u>FAC</u>															
3. <u>Heracleum maximum</u>	<u>10</u>	_____	<u>FACU</u>															
4. <u>Gymnocarpium dryopteris</u>	<u>1</u>	_____	<u>FACU</u>															
5. <u>Mertensia paniculata</u>	<u>1</u>	_____	<u>FACU</u>															
6. <u>Chamerion angustifolium</u>	<u>1</u>	_____	<u>FACU</u>															
7. <u>Equisetum sylvaticum</u>	<u>1</u>	_____	<u>FAC</u>															
8. _____	_____	_____	_____															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>139</u> 50% of total cover: <u>70</u> 20% of total cover: <u>28</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____																		
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)																		
Remarks: _____																		

SOIL

Sampling Point: DP-22

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)							
Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
+7- +5	dk yel brn 10YR4/6	50					silt, roots, and decomposed plant matter
	dk red brn 5YR3/4	50					
+5 -0	black 10YR2/1	100					organic soil (silt, roots, wood debris and decomposed plant matter); not saturated; many fine/med roots; greasy when wetted
0-19	lt brn grav 10YR6/2	80					silt loam w/fine sand; dry
	gray brn 10YR5/2	20					
19-23	dk gray brn 10YR4/2	80					gravelly silt loam; moist; massive; loose
	gray brn 10YR5/2	20					

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The surficial organic, black soil indicates potential hydric conditions but does not extend to depth and is not saturated. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 8, 2014 was above normal with 10.06 inches since June 1st, compared to the normal of 6.88 inches, resulting in an excess of 3.18 inches. Since January 1st, the total was 13.29 inches, compared to the normal of 10.12 inches, resulting in an excess of 3.17 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW

Project/Site: corner of Upper DeArmoun Rd and Canyon Rd Borough/City: Anchorage Sampling Date: 9/8/2014

Applicant/Owner: _____ Sampling Point: DP-23

Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope

Local relief (concave, convex, none): Concave Slope (%): _____

Subregion: Southcentral Lat: N 61.0983 Long: W 149.7280 Datum: NAD83

Soil Map Unit Name: 438—Moose River-Niklason complex, occasionally flooded, 0 to 3 percent NWI classification: None Indicated

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____
Hydric Soil Present?	Yes <u>X</u>	No _____	
Wetland Hydrology Present?	Yes <u>X</u>	No _____	
Remarks: Site is located at the base of a south-facing mountain slope in closed black spruce trees and alder scrub. Springs emerge from the slope to the north and form small streams that flow only a short distance before re-entering the ground.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>4</u> (A) Total Number of Dominant Species Across All Strata: <u>4</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B) Prevalence Index worksheet: <table border="0"> <tr> <td>Total % Cover of:</td> <td>Multiply by:</td> </tr> <tr> <td>OBL species <u>25</u></td> <td>x 1 = <u>25</u></td> </tr> <tr> <td>FACW species _____</td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>135</u></td> <td>x 3 = <u>405</u></td> </tr> <tr> <td>FACU species <u>1</u></td> <td>x 4 = <u>4</u></td> </tr> <tr> <td>UPL species _____</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>161</u></td> <td>(A) <u>434</u> (B)</td> </tr> </table> Prevalence Index = B/A = <u>2.69</u>	Total % Cover of:	Multiply by:	OBL species <u>25</u>	x 1 = <u>25</u>	FACW species _____	x 2 = <u>0</u>	FAC species <u>135</u>	x 3 = <u>405</u>	FACU species <u>1</u>	x 4 = <u>4</u>	UPL species _____	x 5 = <u>0</u>	Column Totals: <u>161</u>	(A) <u>434</u> (B)
Total % Cover of:	Multiply by:																	
OBL species <u>25</u>	x 1 = <u>25</u>																	
FACW species _____	x 2 = <u>0</u>																	
FAC species <u>135</u>	x 3 = <u>405</u>																	
FACU species <u>1</u>	x 4 = <u>4</u>																	
UPL species _____	x 5 = <u>0</u>																	
Column Totals: <u>161</u>	(A) <u>434</u> (B)																	
1. <u>Alnus viridis</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
Total Cover: <u>10</u> 50% of total cover: <u>5</u> 20% of total cover: <u>2</u>																		
Sapling/Shrub Stratum																		
1. <u>Alnus viridis</u>	<u>50</u>	<u>Yes</u>	<u>FAC</u>	Hydrophytic Vegetation Indicators: <u>Yes</u> Dominance Test is >50% <u>Yes</u> Prevalence Index is ≤3.0 _____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) _____ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.														
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
7. _____	_____	_____	_____															
8. _____	_____	_____	_____															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>50</u> 50% of total cover: <u>25</u> 20% of total cover: <u>10</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>75</u>	<u>Yes</u>	<u>FAC</u>	Hydrophytic Vegetation Present? Yes <u>X</u> No _____														
2. <u>Equisetum fluviatile</u>	<u>25</u>	<u>Yes</u>	<u>OBL</u>															
3. <u>Heracleum maximum</u>	<u>1</u>	_____	<u>FACU</u>															
4. _____	_____	_____	_____															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
7. _____	_____	_____	_____															
8. _____	_____	_____	_____															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>101</u> 50% of total cover: <u>51</u> 20% of total cover: <u>20</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____																		
% Cover of Wetland Bryophytes <u>10</u> Total Cover of Bryophytes <u>10</u> (Where applicable)																		
Remarks:																		

Sampling Point: DP-23

HYDROLOGY

US Army Corps of Engineers

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmon Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/8/2014
 Applicant/Owner: _____ Sampling Point: DP-24
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Concave Slope (%): _____
 Subregion: Southcentral Lat: N 61.0983 Long: W 149.7263 Datum: NAD83
 Soil Map Unit Name: 438—Moose River-Niklason complex, occasionally flooded, 0 to 3 percent NWI classification: PSS1/4B
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <u>X</u>	No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____
Hydric Soil Present?	Yes <u>X</u>	No _____	
Wetland Hydrology Present?	Yes <u>X</u>	No _____	
Remarks: Site is located at the base of a south-facing mountain slope in closed black spruce trees and alder scrub. Springs emerge from the slope to the north and form small streams that flow only a short distance before re-entering the ground.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>5</u> (A) Total Number of Dominant Species Across All Strata: <u>5</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B) Prevalence Index worksheet: <table border="1"> <thead> <tr> <th>Total % Cover of:</th> <th>Multiply by:</th> </tr> </thead> <tbody> <tr> <td>OBL species</td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species <u>10</u></td> <td>x 2 = <u>20</u></td> </tr> <tr> <td>FAC species <u>145</u></td> <td>x 3 = <u>435</u></td> </tr> <tr> <td>FACU species <u>10</u></td> <td>x 4 = <u>40</u></td> </tr> <tr> <td>UPL species</td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>165</u></td> <td>(A) <u>495</u> (B)</td> </tr> </tbody> </table> Prevalence Index = B/A = <u>3</u>	Total % Cover of:	Multiply by:	OBL species	x 1 = <u>0</u>	FACW species <u>10</u>	x 2 = <u>20</u>	FAC species <u>145</u>	x 3 = <u>435</u>	FACU species <u>10</u>	x 4 = <u>40</u>	UPL species	x 5 = <u>0</u>	Column Totals: <u>165</u>	(A) <u>495</u> (B)
Total % Cover of:	Multiply by:																	
OBL species	x 1 = <u>0</u>																	
FACW species <u>10</u>	x 2 = <u>20</u>																	
FAC species <u>145</u>	x 3 = <u>435</u>																	
FACU species <u>10</u>	x 4 = <u>40</u>																	
UPL species	x 5 = <u>0</u>																	
Column Totals: <u>165</u>	(A) <u>495</u> (B)																	
1. <u>Alnus viridis</u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Betula papyrifera (Southcentral)</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>															
3. <u>Picea mariana</u>	<u>10</u>	<u>Yes</u>	<u>FACW</u>															
4. _____	_____	_____	_____															
Total Cover: <u>45</u>																		
50% of total cover: <u>23</u> 20% of total cover: <u>9</u>																		
Sapling/Shrub Stratum																		
1. <u>Alnus viridis</u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>															
2. _____	_____	_____	_____															
3. _____	_____	_____	_____															
4. _____	_____	_____	_____															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
Total Cover: <u>25</u>																		
50% of total cover: <u>13</u> 20% of total cover: <u>5</u>																		
Herb Stratum																		
1. <u>Calamagrostis canadensis</u>	<u>75</u>	<u>Yes</u>	<u>FAC</u>															
2. <u>Athyrium filix-femina</u>	<u>10</u>	_____	<u>FAC</u>															
3. <u>Heracleum maximum</u>	<u>10</u>	_____	<u>FACU</u>															
4. _____	_____	_____	_____															
5. _____	_____	_____	_____															
6. _____	_____	_____	_____															
7. _____	_____	_____	_____															
8. _____	_____	_____	_____															
9. _____	_____	_____	_____															
10. _____	_____	_____	_____															
Total Cover: <u>95</u>																		
50% of total cover: <u>48</u> 20% of total cover: <u>19</u>																		
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____																		
% Cover of Wetland Bryophytes <u>5</u> Total Cover of Bryophytes <u>5</u> (Where applicable)																		
Hydrophytic Vegetation Present? Yes <u>X</u> No _____ Hydrophytic Vegetation Indicators: <u>Yes</u> Dominance Test is >50% <u>No</u> Prevalence Index is ≤3.0 _____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) _____ Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.																		
Remarks: _____																		

SOIL

Sampling Point: DP-24

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features		Type ¹	Loc ²	Texture	Remarks
	Color (moist)	%	Color (moist)	%				
+8-0	black 10YR2/1	50					muck and plant debris, roots; saturated; greasy;	
	dk yel brn 10YR4/4	50						
0-3	dk vel brn 10YR4/4	50					silt loam; several med roots; saturated	
	dk gray brn 10YR4/2	50						
3-25	lt gray N7/1	50					silty clay loam w/fine sand; plastic; massive; oxidized root channels; moist (saturated at 22-in. depth)	
	lt brn gray 10YR6/2	50						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input checked="" type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present):		Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Type: <u>Compacted soil</u>	Depth (inches): <u>12</u>	

Remarks: The soil profile generally correlates with the mapped soil unit for the location, Moose River-Niklason complex. The presence of gleyed soil with oxidized root channels qualifies as Alaska Gleyed hydric soil. This is an area of groundwater discharge, small springs emerge from the slope and form streams that flow a short distance then seep back into the ground, providing a permanent source of soil moisture resulting in the observed hydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	<input checked="" type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input checked="" type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Salt Deposits (C5)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Geomorphic Position (D2)	<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Microtopographic Relief (D4)	<input type="checkbox"/> FAC-Neutral Test (D5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)		
<input type="checkbox"/> Algal Mat or Crust (B4)			
<input type="checkbox"/> Iron Deposits (B5)			
<input type="checkbox"/> Surface Soil Cracks (B6)			

Field Observations:		Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Surface Water Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____	Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): _____	
Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>22</u>		

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No saturation w/in 12-inches but the presence of depleted soil along with the secondary indicators of oxidized root channels, and the obvious drainage patterns in the area support a wetland hydrology finding. Cumulative total precipitation on August 26, 2014 was above normal with 8.29 inches since June 1st, compared to the normal of 5.71 inches, resulting in an excess of 3.21 inches. Since January 1st, the total was 12.15 inches, compared to the normal of 8.95 inches, resulting in an excess of 3.2 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmoun Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/9/2014
 Applicant/Owner: _____ Sampling Point: DP-25
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Flat Slope (%): _____
 Subregion: Southcentral Lat: N 61.1011 Long: W 149.7206 Datum: NAD83
 Soil Map Unit Name: 414—Deception-Estelle-Kichatna complex, undulating and hilly NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <u>X</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>X</u>
Hydric Soil Present?	Yes	No <u>X</u>	
Wetland Hydrology Present?	Yes	No <u>X</u>	
Remarks: Site is located on a south-facing mountain slope in open spruce-birch forest and dense alder shrub growth. Much of the spruce has been beetle-killed and blown down, resulting in an open canopy.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Picea mariana</u>	<u>25</u>	<u>Yes</u>	<u>FACW</u>	
2. <u>Betula papyrifera (Southcentral)</u>	<u>5</u>		<u>FAC</u>	Total Number of Dominant Species Across All Strata: <u>6</u> (B)
3. _____				Percent of Dominant Species That Are OBL, FACW, or FAC: <u>33</u> (A/B)
4. _____				Prevalence Index worksheet:
Total Cover: <u>30</u>				Total % Cover of: _____ Multiply by: _____
50% of total cover: <u>15</u> 20% of total cover: <u>6</u>				OBL species _____ x 1 = <u>0</u>
Sapling/Shrub Stratum				FACW species <u>25</u> x 2 = <u>50</u>
1. <u>Sorbus scopulina</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	FAC species <u>40</u> x 3 = <u>120</u>
2. <u>Rosa acicularis</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	FACU species <u>110</u> x 4 = <u>440</u>
3. <u>Cornus canadensis</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	UPL species _____ x 5 = <u>0</u>
4. <u>Viburnum edule</u>	<u>10</u>		<u>FACU</u>	Column Totals: <u>175</u> (A) <u>610</u> (B)
5. <u>Alnus viridis</u>	<u>10</u>		<u>FAC</u>	Prevalence Index = B/A = <u>3.48</u>
6. _____				Hydrophytic Vegetation Indicators:
Total Cover: <u>95</u>				<u>No</u> Dominance Test is >50%
50% of total cover: <u>48</u> 20% of total cover: <u>19</u>				<u>No</u> Prevalence Index is ≤3.0
Herb Stratum				____ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
1. <u>Calamagrostis canadensis</u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>	____ Problematic Hydrophytic Vegetation ¹ (Explain)
2. <u>Gymnocarpium dryopteris</u>	<u>25</u>	<u>Yes</u>	<u>FACU</u>	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
Total Cover: <u>50</u>				Hydrophytic Vegetation Present? Yes _____ No <u>X</u>
50% of total cover: <u>25</u> 20% of total cover: <u>10</u>				
Plot size (radius, or length x width) <u>30-ft diameter</u> % Bare Ground _____				
% Cover of Wetland Bryophytes <u>0</u> Total Cover of Bryophytes <u>0</u> (Where applicable)				
Remarks:				

SOIL

Sampling Point: DP-25

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)									
Depth (inches)	Matrix		Redox Features				Texture	Remarks	
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²			
+9- +5	v dk gray brn 10YR3/2	50					silt, roots, wood debris and decomposed plant matter		
	black 10YR2/1	50							
+5-0	black 10YR2/1	50					organic soil, many fine roots; greasy when wetted; dry		
	v dk gray 10YR3/1	50							
0-10	dk gray brn 10YR4/2	100					silt loam and charcoal; dry		
10-17	v pale brn 10YR7/3	50							
	brown 10YR5/3	50							

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Underlying Layer	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The surficial organic, black soil indicates potential hydric conditions but does not extend to depth and is not saturated. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)	
Primary Indicators (any one indicator is sufficient)			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)	
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)	
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)	
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-Neutral Test (D5)	

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)		Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 9, 2014 was above normal with 10.30 inches since June 1st, compared to the normal of 6.90 inches, resulting in an excess of 3.40 inches. Since January 1st, the total was 13.53 inches, compared to the normal of 10.22 inches, resulting in an excess of 3.31 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

WETLAND DETERMINATION DATA FORM – Alaska Region

MOA Parcel 1707306000; SEC 25, T12N, R3W, SM; SW
 Project/Site: corner of Upper DeArmon Rd and Canyon Rd. Borough/City: Anchorage Sampling Date: 9/9/2014
 Applicant/Owner: Sampling Point: DP-26
 Investigator(s): Pat Athey Landform (hillside, terrace, hummocks, etc.): Mountain slope
 Local relief (concave, convex, none): Flat Slope (%):
 Subregion: Southcentral Lat: N 61.1008 Long: W 149.7192 Datum: NAD83
 Soil Map Unit Name: 414—Deception-Estelle-Kichatna complex, undulating and hilly NWI classification: None Indicated
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No (If no, explain in Remarks.)
 Are Vegetation, Soil, or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No
 Are Vegetation, Soil, or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Hydric Soil Present?	Yes	No <input checked="" type="checkbox"/>	
Wetland Hydrology Present?	Yes	No <input checked="" type="checkbox"/>	
Remarks: Site is located on a south-facing mountain slope in open spruce-birch forest and dense alder shrub growth. Much of the spruce has been beetle-killed and blown down, resulting in an open canopy.			

VEGETATION – Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <i>Picea mariana</i>	25	Yes	FACW	
2. <i>Picea glauca</i>	25	Yes	FACU	Total Number of Dominant Species Across All Strata: 9 (B)
3. <i>Betula papyrifera</i> (Southcentral)	10	Yes	FAC	Percent of Dominant Species That Are OBL, FACW, or FAC: 44 (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
Total Cover: 60				Total % Cover of: _____ Multiply by: _____
50% of total cover: 30 20% of total cover: 12				OBL species _____ x 1 = 0
Sapling/Shrub Stratum				FACW species 30 x 2 = 60
1. <i>Cornus canadensis</i>	50	Yes	FACU	FAC species 55 x 3 = 165
2. <i>Rosa acicularis</i>	10	Yes	FACU	FACU species 117 x 4 = 468
3. <i>Rubus idaeus</i>	10	Yes	FACU	UPL species _____ x 5 = 0
4. <i>Viburnum edule</i>	10	_____	FACU	Column Totals: 202 (A) 693 (B)
5. <i>Alnus viridis</i>	10	_____	FAC	Prevalence Index = B/A = 3.43
6. _____	_____	_____	_____	Hydrophytic Vegetation Indicators:
Total Cover: 90				No Dominance Test is >50%
50% of total cover: 45 20% of total cover: 18				No Prevalence Index is ≤3.0
Herb Stratum				Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
1. <i>Calamagrostis canadensis</i>	25	Yes	FAC	Problematic Hydrophytic Vegetation ¹ (Explain)
2. <i>Gymnocarpium dryopteris</i>	10	Yes	FACU	¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.
3. <i>Equisetum arvense</i>	10	Yes	FAC	
4. <i>Sanguisorba canadensis</i>	5	_____	FACW	
5. <i>Mertensia paniculata</i>	1	_____	FACU	
6. <i>Chamerion angustifolium</i>	1	_____	FACU	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
Total Cover: 52				Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/>
50% of total cover: 26 20% of total cover: 10				
Plot size (radius, or length x width) 30-ft diameter % Bare Ground _____				
% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 0 (Where applicable)				
Remarks:				

SOIL

Sampling Point: DP-26

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)							
Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
+10- +4	dk gray brn 10YR4/2	100				organic matter, fine roots, wood debris and decomposed plants	
+4-0	black 10YR2/1	50				organic soil; many fine roots; greasy when wetted; dry	
	v dk gray 10YR3/1	50					
0-11	black 10YR2/1	100				silt loam and charcoal; dry	
11-19	v pale brn 10YR7/3	50				silt loam w/ gravel & cobbles; dry; loose	
	brown 10YR5/3	50					

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol or Histel (A1)	<input type="checkbox"/> Alaska Color Change (TA4) ⁴	<input type="checkbox"/> Alaska Gleyed Without Hue 5Y or Redder Underlying Layer	
<input type="checkbox"/> Histel Epipedon (A2)	<input type="checkbox"/> Alaska Alpine Swales (TA5)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Alaska Redox With 2.5Y Hue		
<input type="checkbox"/> Thick Dark Surface (A12)			
<input type="checkbox"/> Alaska Gleyed (A13)	³ One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present.		
<input type="checkbox"/> Alaska Redox (A14)	⁴ Give details of color change in Remarks.		
<input type="checkbox"/> Alaska Gleyed Pores (A15)			

Restrictive Layer (if present): Type: <u>None</u> Depth (inches): _____	Hydric Soil Present? Yes _____ No <u>X</u>
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Remarks: The surficial organic, black soil indicates potential hydric conditions but does not extend to depth and is not saturated. The absence of redox indicators and lack of soil moisture during this wet season supports the finding of nonhydric soil.

HYDROLOGY

Wetland Hydrology Indicators:		Secondary Indicators (2 or more required)
Primary Indicators (any one indicator is sufficient)		
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Water-stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Drainage Patterns (B10)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Dry-Season Water Table (C2)	<input type="checkbox"/> Salt Deposits (C5)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Stunted or Stressed Plants (D1)
<input type="checkbox"/> Algal Mat or Crust (B4)		<input type="checkbox"/> Geomorphic Position (D2)
<input type="checkbox"/> Iron Deposits (B5)		<input type="checkbox"/> Shallow Aquitard (D3)
<input type="checkbox"/> Surface Soil Cracks (B6)		<input type="checkbox"/> Microtopographic Relief (D4)
		<input type="checkbox"/> FAC-Neutral Test (D5)

Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <u>X</u>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The site lacks characteristics of wetland hydrology despite the seasonally high cumulative precipitation in the region. Cumulative total precipitation on September 9, 2014 was above normal with 10.30 inches since June 1st, compared to the normal of 6.90 inches, resulting in an excess of 3.40 inches. Since January 1st, the total was 13.53 inches, compared to the normal of 10.22 inches, resulting in an excess of 3.31 inches. The site is within the Rabbit Creek-Frontal Turnagain Arm Watershed (HUC 1902040107); Rabbit Creek Subwatershed (HUC 190204010701).

Attachment 3 Photos

MOA Parcel 1707306000



DP-1



DP-1



DP-1



DP-2



DP-3



DP-3



DP-4



DP-4



DP-5



DP-6



DP-7



DP-8



DP-9



DP-9



DP-10



DP-10



DP-11



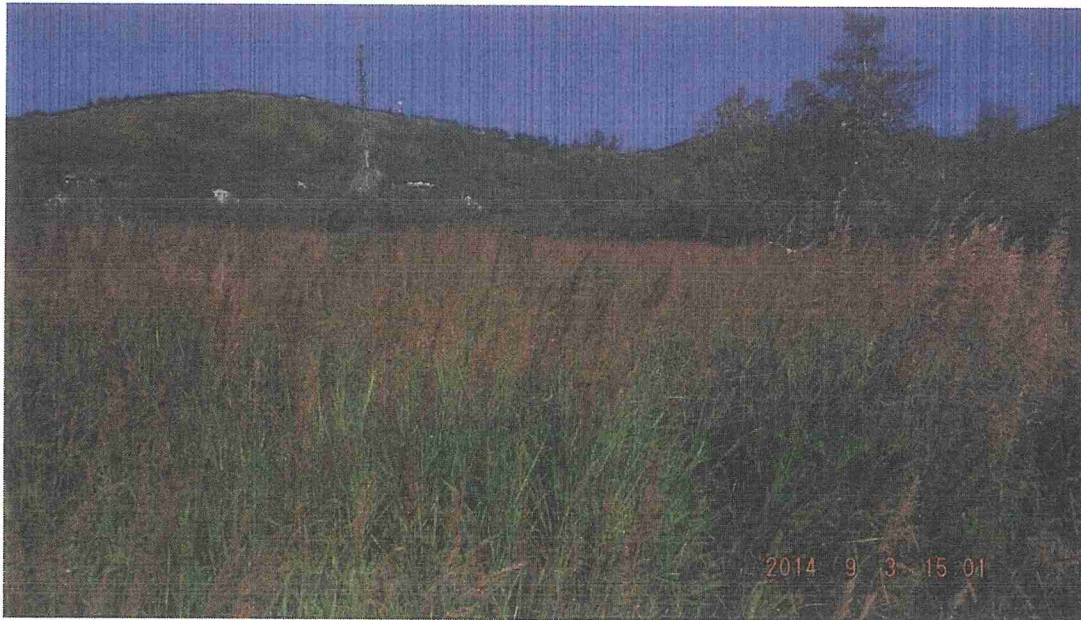
DP-11



DP-13



DP-15



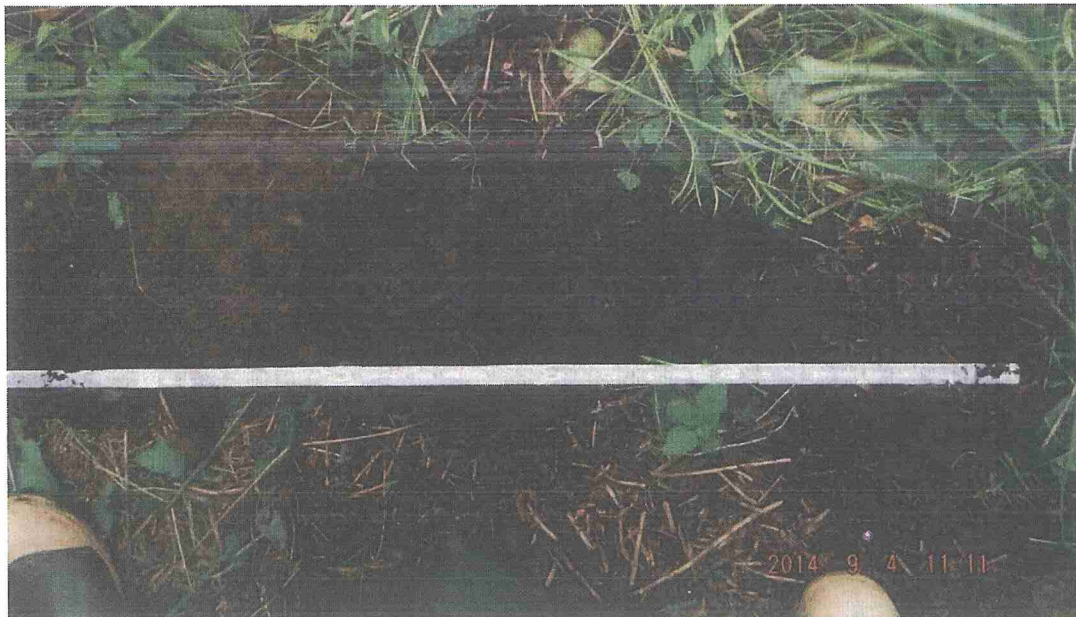
DP-15



DP-16



DP-16



DP-17



DP-18



DP-18



DP-19



DP-20



DP-21



DP-22



DP-22



DP-23



DP-24



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DP-26



DP-26