Preliminary Drainage Report  
ATD Job #2018-071  
Ronald Bakel  

A parcel of land, located in the Northeast Quarter (NE ¼) of Section 4, Township 4 North, Range 68 West, of the 6th Principal Meridian, County of Weld, State of Colorado

Ronald Bakel  
2740 Highway 60  
Weld County, Colorado

June 6, 2018

Prepared by Dan Campbell  
EIT 74322

"I hereby attest that this report for the Preliminary drainage design for Ronald Bakel was prepared by me, or under my direct supervision, in accordance with the provisions of the Weld County Storm Drainage Design Criteria for the responsible parties thereof. I understand that Weld County does not and shall not assume liability for drainage facilities designed by others."

Mark A. Taylor  
Registered Professional Engineer  
State of Colorado No. 46065
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I. General Location and Description

A. Location

1. The property (parcel number 106104100044) is located in the Northeast Quarter (NE ¼) of Section 4, Township 4 North, Range 68 West, of the 6th Principal Meridian, County of Weld, State of Colorado.

2. Historically, Weld County Road 7 was located on the East side of the property and has recently been realigned further West through the property. Weld County Road 7 now divides the property into two areas, with one area being West of the road and the other area being East of the road. The area of interest that is being developed is the portion of land on the East side of Weld County Road 7. The site is bordered by Highway 60 to the North. North of Highway 60 is Larimer County and South is Weld County. To the East of the site is the old Weld County Road 7, which has been vacated and is now a paved private road. To the South and to the West of the site is Weld County Road 7.

3. There are no major open channels, lakes, streams, irrigation or other water resource facilities within or adjacent to the proposed project site. Using the Weld County Property Portal website with the Lake-River-Canal layer turned on, an unnamed intermittent drainage channel was found near the property. The historic drainage channel is located near the Southeast corner of the site and runs in a Northeastern direction. Water in the drainage channel flows into an unnamed pond approximately two miles Northeast of the site. Water from the pond travels in a Northeast direction for approximately one mile until reaching Hillsboro Ditch. Water from Hillsboro Ditch flows in a Southeast direction until eventually reaching the Little Thompson River. If the Hillsboro Ditch was to exceed capacity near the area Northeast of the pond, the overflow water would travel East into the nearby Big Thompson River. After performing a site visit and reviewing satellite images, it is determined that the drainage channel does not exist adjacent to the site anymore. It is possible that stormwater runoff from the site could reach the drainage channel from the borrow ditch along Highway 60 East of the site.

4. North of the property past Highway 60 is a residential property owned by Martin and Melinda Horstmeyer. East of the property past the old Weld County Road 7 is a residential property owned by M & J Dairy, LLC. The site operates in the Dairy Farms industry within the Agricultural Production-Livestock and Animal Specialties sector. To the South of the property is an agricultural property owned by David and Nancy Larsen. West of the property past Weld County Road 7 is the other portion of property owned by Ronald Bakel.

5. The property is approximately 3,150 feet (0.60 miles) from Johnstown City Limits, which classifies the site as a non-urbanizing drainage area. According to the Weld County Property Portal website, the property is not located in an MS4 zone, therefore the MS4 permit standards do not need to be considered.

B. Description of Property

1. The area of the property that is being developed is ± 15.47 Acres. A land survey for the entire property has been performed by Geomark Surveying LLC. However, a separate topographic survey has not been performed for just the area of land being
developed on the East side of Weld County Road 7. An estimated area was achieved with the Weld County Property Portal website using the area measuring tool.

2. The existing ground cover is native non-irrigated prairie grass that is approximately three feet tall. According to the United States Department of Agriculture’s (USDA) WebSoil Survey website, the site is made up of approximately 80.5% Colby loam with 3 to 5 percent slopes and 19.5% Nunn clay loam with 1 to 3 percent slopes. The Nunn clay loam is located in the Northwest corner and also the East/Southeast area of the site.

3. There are no major open channels on or adjacent to the site.

4. The proposed construction for this site is for a packed gravel parking surface for storing recreational vehicles and boats. The owners expect approximately 40-60 parking spaces per acre. No new buildings or structures are proposed for the site. According to the planning/landscaping architecture plans supplied by Planscapes, the site may also include shipping/storage containers along the perimeter, please see attached document. A detention pond is proposed in the Northeastern portion of the site that will collect stormwater from the Northern half of the site. After performing a site visit, it has been determined that a second detention pond is likely required on the Southeastern portion of the site in order to maintain historical flow patterns. Stormwater runoff that reaches the Southeastern boundary of the site collects into the borrow ditch along the vacated Weld County Road 7. After the runoff flows into the borrow ditch, it appears to pond in this ditch until it over tops the vacated road and onto the dairy farm property. A second detention pond will help capture the stormwater with the goal of responsibly releasing the water in a way that doesn’t become a nuisance to the dairy farm property.

5. There are no irrigation facilities on this site or within 200 feet of the property.

6. Ground water at this site is assumed to be greater than 6.5 feet below the surface per USDA WebSoils Survey and should be verified during an on-site investigation. Vegetation that relies on ground water to be near the surface in order to survive was not present on the site, which is a good indication that ground water is not near the surface.

II. Drainage Basins and Sub-Basins

A. Major Basin Description

1. Weld County Public Works department has been contacted and they are doing research to determine if there is a master drainage plan for this area.

2. At a local scale the site is located in the Big Thompson Drainage Basin which flows into the South Platte Drainage Basin. The South Platte Drainage Basin includes much of the populated region of the Front Range extending outward to the Eastern plains of Colorado. The South Platte River Corridor has experienced a trend of increased urbanization in recent years.

3. The site is on FEMA FIRM map Panels 08123C1660E and 08123C1680E. The maps are effective as of January 20, 2016. The site is not located in or is affected by any published flood plain or floodway.
4. Alles Taylor & Duke, LLC will perform a topographic survey of the site as the project advances. On-site contours of one foot intervals will be created once the topographic survey is conducted.

B. Sub-Basin Description
1. Using the Weld County Property Portal website with the Topography layer turned on, the contours show a historic drainage pattern where runoff flows in a Northeasterly direction on the entire site. However, an on-site inspection revealed that the southern half of the site actually flows to the Southeastern area of the site. A second detention may be required as a result of the property drainage patterns. Stormwater runoff from the Northern half of the site flows in a Northeast direction until it reaches the borrow ditch along Highway 60. Stormwater runoff from the Southern half of the site flows in a Southeast direction to the property boundary and into the existing borrow ditch located along the vacated Weld County Road 7. After the runoff flows into the borrow ditch, it appears to pond in this ditch until it overtops the vacated road. Historic drainage for the adjacent properties all have similar patterns where stormwater flows in a Northeast direction until reaching the historic drainage channel and Hillsboro Ditch. None of the adjacent properties should contribute to additional stormwater runoff on the property.

2. Stormwater runoff from the Northern half of the site flows in a Northeast direction and ends up in the borrow ditch along Highway 60. Stormwater travels East along the borrow ditch away from the site. Further investigation will need to be conducted to see exactly where this stormwater ends up. An existing culvert may be in place that directs the stormwater to the North side of Highway 60 and eventually on a path to the Hillsboro Ditch. Stormwater runoff from the Southern half of the site flows in a Southeast direction to the property boundary. Further investigation will need to be conducted to see exactly where this stormwater ends up. At this point there does not appear to be a culvert that carries the stormwater under the vacated Weld County Road 7 on the East side of the site. Since there is no culvert, it is assumed that the stormwater overtops the vacated Weld County Road 7 and runs onto the M & J Dairy property.

III. Drainage Design Criteria
A. Development Criteria Reference and Constraints
1. There are no known affects from previous drainage studies on this site development and there are no foreseeable effects of the site on any drainage master plans.

2. A detention pond will be constructed on the Northeast portion of the site. Stormwater runoff from the Northern half of the site will flow into the detention pond and will be released into the borrow ditch along Highway 60. A possible constraint is that the depth of the borrow ditch will limit the detention pond depth design. The Southern half of the site will have constraints that need to be addressed. A second detention pond will most likely need to be constructed on the Southeastern portion of the site that will capture stormwater runoff from the Southern half of the site. The problem with this detention pond is that it is unclear where the stormwater is going to be
released. A solution will need to be achieved that results in stormwater runoff not flowing over the vacated Weld County Road 7 and onto the M & J Dairy property, this stormwater flow is likely considered a nuisance flow for the Dairy property.

B. Hydrological Criteria
1. A topographic survey has not been conducted yet for this site. A survey will provide the necessary data to perform accurate drainage design calculations. At this point, several assumptions have been made for the preliminary drainage calculations. The area of the site is assumed to be ± 15.47 Acres. The time of concentration for historical flow analysis is assumed to be 60 minutes. The time of concentration for developed flow analysis is assumed to be 40 minutes. Percent impervious for the developed site is assumed to be: 15% greenbelts/landscaping, 10% detention pond, and 75% packed gravel. The dimensions of the detention pond are assumed to be 225 feet by 127.5 feet, which gives total area of 28,687.5 square feet.

2. The Northern boundary of this site is approximately 1.5 miles from the Loveland City Limits. The rainfall data that will be used is the City of Loveland rainfall tables and IDF curves due to the proximity to the city limits. For historic flow analysis the rainfall intensity values are as follows: 5-yr: 1.4 in/hr, 10-yr: 1.7 in/hr, and 100-yr: 2.65 in/hr. For developed flow analysis the rainfall intensity values are as follows: 5-yr: 1.85 in/hr, 10-yr: 2.2 in/hr, and 100-yr: 3.55 in/hr.

3. The design storm recurrence intervals used in this drainage report are the five (5) year, ten (10) year, and one hundred (100) year storm events.

4. The method used to determine the storm runoff is the Rational Method. The site Percent Imperviousness has been determined from the equations given in the Urban Drainage and Flood Control (UDFC) Urban Storm Drainage Manual, Volume 1, chapter 6, Runoff, (Updated March 2017). An impervious percentage value of 2% was used for the historic flow analysis. A developed site imperviousness is determined to be 33%. The historic flow values for peak runoff are as follows: 5-yr: 2.17 CFS, 10-yr: 5.0 CFS, 100-yr: 15.99 CFS. The developed flow values for peak runoff are as follows: 5-yr: 7.73 CFS, 10-yr: 11.57 CFS, 100-yr: 27.46 CFS.

5. The Detention Discharge was determined using the Historic Five (5) Year rate for an undeveloped site. The historic 5-year rate was determined to be 0.140 CFS/Acre. The historic time of concentration was assumed to be 60 minutes, the developed time of concentration was assumed to be 40 minutes. The Modified FAA Method was utilized to determine the detention pond volume, the pond volume was determined to be 97,319 cubic feet. This volume includes the 9,062 cubic feet of Water Quality Capture Volume (WQCV).

C. Hydraulic Criteria
1. The detention pond is limited to a historic 5-year release rate per Weld County Engineering & Construction Criteria and is designed as such. The historic 5-year release rate is 0.14 CFS/Acre or 2.17 CFS for the developed site.

2. The proposed detention outlet type is a two-stage release. The first stage will be Water Quality Capture Volume (WQCV) which will be designed to release the 9,062 cubic feet in 40 hours. The second stage will be designed to release the rest of the
pond at the historic 5-year runoff rates to mitigate downstream flooding and to control the flows off site. The entire pond shall be released in 72 hours per Colorado State Legislation.

3. The detention pond outlet will be a restrictor plate designed to release the 5-year historic flows. Additional calculations will need to be conducted after the topographic survey is finished in order to properly design the WQCV release structure.

4. All criteria and calculation methods used in this report are presented in either Weld County Code or in compliance with Urban Storm Drainage Criteria Manuals Volumes I, II, and III dated June 2001 and revised in April 2008.

IV. Drainage Facility Design

A. General Concept

1. Historical drainage patterns will be utilized as much as possible for the development of the site. Stormwater runoff from the Northern half of the site flows in a Northeast direction and will end up in the first detention pond. Stormwater from the detention will be released in the borrow ditch along Highway 60. Stormwater travels East along the borrow ditch away from the site. Stormwater runoff from the Southern half of the site flows in a Southeast direction and will end up in the second detention pond. Further analysis will be needed to figure out exactly where the stormwater from the Southern detention pond is going to be released to. Since the detention ponds and release structures will limit flows from the site, there should be no conveyance issues downstream.

2. Any off-site flows will be directed though the site and will go through the pond and over the emergency overflow weir if the pond is full. Off-site flows will not be calculated into pond volume as the pond volume is designed for on-site flows only.

3. Included with this report is a Weld County property report for the parcel to be developed, the FEMA FIRM panel that the site in on, the Web Soil Surveys showing the soil type, hydrologic soil group, and basic construction information that may be useful for this development, and basic calculations showing pond volume calculations and rainstorm events.

4. The only anticipated hydraulic structures are the detention pond rundowns, outlet structures, and emergency overflow weir.

B. Specific Details

1. Maintenance will be manageable and routine for the detention pond. The sides for the detention pond will not be greater than 4:1 so traditional maintenance equipment will be adequate to ensure the pond is maintained. The detention pond will be oversized approximately 10% to account for sedimentation. Cleaning of the sedimentation build up should be performed every five to ten years.

V. Conclusions

A. Compliance with the Weld County CODE

1. The proposed Drainage plan will meet the Weld County Drainage Criteria.

B. Drainage Concept
1. This drainage design will mitigate site run-off from the higher storm events. The stormwater will be released at the historic 5-year rate so all storm events of the developed site will be released at lower rates than if the runoff were to be unregulated, diminishing downstream flows. The historic 5-year rate is 2.17 CFS compared to the developed rates of; 7.73 CFS for the 5-year event, 11.57 CFS for the 10-year event, and 27.46 CFS for the 100-year event.

2. There are no foreseeable influences of the proposed development on any Weld County Master Drainage Plan recommendations.

3. No irrigation companies or facilities are impacted by this new site development. The Dairy Farm East of the site may be impacted by the runoff from the Southern portion of the site. Communication and planning will need to be conducted to figure the best plan for that area.

VI. References
Weld County Addendum to the Urban Storm Drainage Criteria Manual, October 2006.
Urban Storm Drainage Web Site for Spreadsheet Models.
Weld County Property Portal Website, https://www.weldgov.com/departments/assessor
FEMA Flood Map Service Center Website, https://msc.fema.gov/portal/search

VII. Appendices
A. Hydrologic Computations
1. North of the property is a residential property. East of the property is a residential property owned by M & J Dairy, LLC. M & J Dairy, LLC operates in the Dairy Farms industry within the Agricultural Production-Livestock and Animal Specialties sector. To the South of the property is an agricultural property. West of the property is the other portion of property owned by Ronald Bakel, which is an agricultural property, separated by Weld County Road 7.

2. Storm runoff computations for different storm frequencies were calculated for the entire site and are attached to this report for reference.

3. Storm runoff computations for the entire historic and developed site were calculated and are attached for reference.

4. All computer calculations and inputs are attached for reference. These calculations include detention pond volume and storm runoff rates.

B. Hydraulic Computations
1. There are no foreseeable culverts that will be a part of the drainage design that need to be sized or installed.

2. The stormwater rundown will be sized when the rest of the release structure and grading and drainage is designed for the final design.

3. There are no foreseeable swales or channels that will be a part of the grading and drainage or drainage design that need to be sized.
4. Riprap will be along the downstream side of the emergency overflow weir and will be sized as part of the final design.

5. The preliminary minimum required pond volume is 97,319 cubic feet. The pond will be designed to hold about 107,050 cubic feet to allow for sedimentation during construction without using vital detention pond volume. The exact area the pond will take is yet to be determined and will be calculated during the final design.

6. Modified FAA Calculations and spreadsheets are attached for reference.
Account: R8947949

June 9, 2018

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Legal

PT NE4 4 4 68 LOT B REC EXEMPT RECX16-0120

Subdivision Block Lot Land Economic Area

0261 BERTHOUD

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