KNIFE RIVER
CORPORATION
AN MDU RESOURCES COMPANY

PO Box 5568
Bismarck, ND 58506-5568
Street Address:
1150 West Century Avenue
Bismarck, ND 58506

May 14, 2014

Mr. James R. Deutsch
Director, Reclamation Division
Public Service Commission
600 E Boulevard Ave, Dept 408
Bismarck, ND 58505-0480

Re: Bond Release Application No. 7 (BR-7) - KRGC-8101
Response to Deficiencies identified by PSC in letter dated January 22, 2014

Dear Mr. Deutsch:

Pursuant to your Agency's letter dated January 22, 2014 concerning Knife River Corporation's Bond Release Application No. 7 (BR-7) regarding permit KRGC-8101, Knife River offers the following responses, highlighted in yellow, pertaining to each identified deficiency.

General Item

1. Knife River has included data for Tract 3 in the S1/2 of Section 26 demonstrating revegetation success using a weighted hay and cropland production ratio. Individually, two years of data is provided for the cropland area but only one successful year is provided for the hayland portion of the tract. The most concerning issue regarding the data for this tract is that in 2007 the cropland was sampled on the outer edges of the disturbance as shown on Figure 7.1 rather than a completely random sampling pattern. The narrative attempts to justify this by indicating that the outside corridors are "representative strips" but representative strips must be approved by the Reclamation Division prior to use and, in this instance, it appears the selected representative strips simply avoid that portion of the tract that was an access road and has compacted subsoil. Therefore, the sampling locations are not representative of the entire tract. An additional year of sample data will be required from the entire tract before action on this application. Another alternative would be to remove this tract from this bond release application and include it in a future bond release request. (GAW/RLK)

Knife River has removed Tract 3 in the S1/2 of Section 26 from this bond release application. All revisions to the application materials reflective of the removal of Tract 3 are identified in the attached summary table.

Attachment 7 – Supporting Narrative

2. Follow-up to item No. 6: Please add a statement to the third paragraph of the introduction of Attachment 7 indicating 47.5 undisturbed acres are included with this bond release

application. The acreages discussed in the narrative will then be consistent with the bond release total of 650.4 acres stated in the first sentence of the introduction. (ZAB)

Knife River has added the suggested statement as requested.

3. Follow-up to item No. 18: In the reclamation success narrative for Tract 2 in the NE ¼ of Section 33, please include a brief discussion on yields measured on the tract or refer to the tables containing the yield information. Also, the application does not clearly describe revegetation establishment success on those portions of this tract subject to pre-1975 reclamation requirements. We have observed that the vegetation on the early law area is practically indistinguishable from the rest of the tract. However, please include a statement in the narrative that the areas are hayed and have adequate cover to control erosion, if that is the case. (RLK/GAW)

The narrative for Tract 2 has been revised as requested to include brief discussions regarding yields measured and satisfactory erosion control observations on the tract.

4. Follow-up to Item 23: Please revise the narrative discussing reclamation success for Tract 1 (Section 29) to include the acreage reclaimed in 2000 and the reason reclamation was delayed on this area. While the reclamation history indicates that the 19.6 acre Rd 33 area contained ponds that were reclaimed after the completion of reclamation on the remainder of Section 29, this is an important consideration for explaining and evaluating reclamation success with the yield information provided for Tract 1. Please clarify in the narrative that the required productivity standard for entire Tract 1 was met in 2006 (even though the Rd 33 tract was only in year six of the responsibility period), the east half of Tract 1 (including tract Rd 33) met the standard in 2008, and the entire tract met the standard in 2010. Also please remove the reference to previous regulations that allowed the use of sample data from year six of the liability period and the related narrative since the former regulations will not be used to demonstrate success for this tract. The application does not include three years of successful crop production for the entire tract as would be required for consideration under the former regulation. (RLK/DKM/GAW/JRD)

The narrative for Tract 1 has been revised as requested to include brief discussions of the acreage reclaimed in 2000, the reason reclamation was delayed on this area, and related revegetation success information.

Knife River Corporation appreciates your assistance in this matter. Please don't hesitate to contact me by telephone at (701) 530-1421 or by email at ned.pettit@kniferiver.com if you have any questions or require additional information.

Sincerely,

Edward M. "Ned" Pettit
Environmental Director

Enclosures

Knife River Corporation
Mine: Gascoyne Mine
Permit Number: KRGC-8101
Bond Release #7 – Response to Deficiencies Identified in PSC Letter dated January 22, 2014
Submittal Date: July 25, 2013 – November 26, 2013 – *May 14, 2014*

Bond Release #7 KRGC 8101 Narrative

Bond Release #7 releases 640.9 acres from reclamation bond at the Gascoyne Mine, Bowman County, North Dakota. Two copies of the following changes are included with this submittal.

Listing of Revised/New Information

Application Form (SFN 19813)	Replace page 1
Attachment #1	Replace Permit Area/Topo Map & Bond Release Tracts (Attachment 1)
Attachment #2	Replace Meets & Bounds for BR7 description and BR7 Tracts Map (Attachment 2)
Attachment #5	Replace Aerial Photograph (Attachment 5)
Attachment #7	Remove entire Supporting Narrative (pages 1-22), Allan Anderson Bond Release Consideration letter dated 6/9/12, and all exhibits (Exhibit 7.1, 7.2, 7.3 and 7.4-1 through 7.4-3). Replace with revised narrative (pages 1-14), Exhibit 7.1 (Soil Map Units and Hay Sampling Sites), Exhibit 7.2 (Tract Seed Mixes), Exhibit 7.3-1 (Respread Tracts & Depths – Tract 1) and Exhibit 7.3-2 (Respread Tracts and Depths – Tract 2).
Attachment #8	Replace Meets & Bounds after BR7 description and Permit Area Map After Bond Release 7 (Attachment 8)
Attachment #9	Replace Calculation of Bond Reduction Amount information and Bonding Update Map (Attachment 9.1)

INTRODUCTION

Bond Release #7 (BR7) of Permit KRGC-8101 includes ~~three~~two tracts totaling ~~650.4~~640.9 acres in Township 131 North, Range 99 West, Bowman County, North Dakota. The tracts are located in sections 29~~,~~ and 33 ~~and 26~~ as shown on Attachment 1. Records show that the Gascoyne Mine was started in 1952 by the Helm brothers. Knife River Coal Mining Company stopped mining coal in August of 1995 and sold all remaining surface interests to GMHR in November, 2012.

Almost all of the bond release area that has been regraded was included in bond release No. 3, a stage two partial bond release. The only exclusion area is located in the SE¼ of Section 29 and identified as 16.9-acre tract Rd 33 on Exhibit 7.~~2~~1 (included at the end of this narrative). Here, sites involved with ponds 28, 29, and 30 were reclaimed later on. Final grade for this tract was approved on July 11, 1997. Removal of the pond embankments in 2000 was followed by respreading of 0.6 feet of topsoil and 1.4 feet of subsoil, which was completed on October 13, 2000.

For the disturbed acres covered by this application (BR7), all four stages of bond release (backfilling and grading, soil respreading, vegetation establishment, and demonstrating revegetation success) is requested for the 16.9 acre exclusion area identified above that remains under 100% bond. Third and fourth stage bond release is requested for ~~586.0~~576.5 acres which, as described above, were previously included in a partial bond release (BR3). BR7 also includes 47.5 undisturbed acres.

LAND USE and OWNERSHIP

The surface owners of the bond release tracts are Steve Reimer (Tract I)~~,~~ and Robert Perkins (Tract II)~~, and Allan Andersen (Tract III)~~. This information is shown below and on Attachment 6 – Ownership Map. The post-mining land uses included in this bond release are cropland/hayland for Reimer and most of the Perkins ownership, and developed water resource for the pond 23 area of Perkins (13.2 ac)~~, and cropland for Andersen~~.

Location/Acres	Surface Owners	Coal Owners
Sec. 29 (559.2 ac)	Steve Reimer	B. Reimer – J.H. Jagim- Mineral Trust
NE1/4, Sec. 33 (81.7 ac)	Robert W. Perkins	Robert W. Perkins
~~S1/2, Sec. 26 (9.5 ac)~~	~~Allan Andersen~~	~~Knife River Corporation - USA~~

HISTORICAL AND FUTURE USE

The acreage of this bond release application was utilized ~~both~~ for mining activities (i.e. coal was removed from both Tracts 1 and 2)~~ and for activities in support of mining activities (the former haul road in Tract 3)~~. Our records show that mining started at this location in the early 1950's. This area was utilized during active mining and reclamation operations during closure of the mine from approximately 1980 to 2002.

The reclaimed tracts that are part of this bond release are shown ~~i~~on Exhibit~~s~~ 7.1~~ and 7.2~~ at the end of this narrative. Seeding dates are also shown on these exhibits. Seed mix composition is detailed in Exhibit 7.~~2~~3, also included at the end of this narrative. Note that the responsibility period initiation dates on the annual map differ from the dates on the exhibits for four tract areas – Rd 3 (two sites), part of Rd 13, and Rd 14. The annual map dates represent seeding dates for temporary cover crops and not the perennial land use seed mix that initiated the period of responsibility for the performance bond.

The bond release tracts covered by BR7 do not, nor have they contributed suspended solids to any stream flow outside of the permit area in excess of that allowed by NDAC 69-05.2-16-04. The 2005 *Hydrologic Assessment* supplement to mining permits KRGC-8101 and KRGC-8404 concluded that surface mining activities at the Gascoyne Mine have had little impact on the quantity and quality of the surface and groundwater. The Post mining Hydrologic Assessment was approved by the North Dakota Public Service Commission on July 19, 2005. No pre-existing ground water resources (wells or springs) were disturbed by the mining process; therefore, Knife River Corporation did not replace any pre-mine ground water resources within the proposed bond release tracts.

There are surface water features included in this bond release area, specifically Pond 23W and Pond 23E. These features, collectively considered Pond 23, have enhanced their respective watersheds. Pond 23 is located in the NE ¼ of Section 33. The pond functions as it was originally designed, providing stormwater control and waterfowl habitat. A good stand of wetland grasses have established over the years.

Attachment 1 – Permit Area/Topo Map & Bond Release Tracts shows the BR7 tracts, the existing final topography, and the acres mined within each track. Tract I, located in Section 29, was disturbed by coal mining activities between 1976 and 1995, and ultimately reclaimed as cropland/hayland. Leveling and seeding occurred continuously from 1983 through 2000. Portions of the Township road located along the east side of Section 29 that were affected by mining activities are shown on Exhibit 7.34-1. Tract II, located in Section 33, was actively mined between 1975 and 1990, also being reclaimed as cropland/hayland from 1988 through 2002. ~~Tract III, located in Section 26, was used as a haul road associated with a materials stockpile area and was originally ripped and seeded as cropland/hayland in 1999.~~

RECLAMATION HISTORY

The reclaimed tracts that are part of this bond release are shown ion Exhibits 7.1 ~~and 7.2~~. Almost all of the bond release area that has been regraded was included in bond release No. 3, a stage two partial bond release that contains information on final topography, final grade approvals, and respread depths. The only exclusion area is located in the SE¼ of Section 29 and identified as 16.9-acre tract Rd 33 on Exhibit 7.21. Here, sites involved with ponds 28, 29, and 30 were reclaimed after completion of reclamation of the remainder of the Reimer area. Final grade for this tract was approved on July 11, 1997. Removal of the pond embankments in 2000 was followed by respreading of 0.6 feet of topsoil and 1.4 feet of subsoil, which was completed on October 13, 2000. Seeding dates are shown on Exhibits 7.1 ~~and 7.2~~. Seed mix composition is detailed in Exhibit 7.23 and topsoil/subsoil respread depths are detailed on Exhibits 7.34-1 through 7.34-23. Note that the responsibility period initiation dates on the annual map differ from the dates on the exhibits for four tract areas – Rd 3 (two sites), part of Rd 13, and Rd 14. The annual map dates for these tracts represent seeding dates for temporary cover crops and not the perennial land use seed mix that initiated the period of responsibility for the performance bond. The final seeding performed to establish the vegetation appropriate to the land use in all of the bond release area occurred in 2002 on the land under Perkins ownership, satisfying the 10-year period of responsibility on all tracts.

~~Cropland~~

~~The lone reclaimed tract dedicated to a postmining land use of cropland is a former stockpile access road in the S½ of Section 26, identified as tract BI 23 on Exhibits 7.1 and 7.2 and Tract 3 on other exhibits. The only disturbance here involved removal of the topsoil material. Respreading of the access road occurred in 1999 when the windrowed soil on the periphery was rolled back onto the travel corridor. The portion of the tract located in the SW¼ of Section 26 was immediately incorporated into the cropping routine employed on the surrounding crop field. Continuous cropping of the durum type spring wheat has been standard practice in this field. Ben durum was grown in the comparison years of 2007, 2009, and 2010. Urea nitrogen fertilizer was applied at 150 pounds per acre each of the cropping years. Weed control was accomplished with a pre-emergent burndown via application of Roundup followed by an application of herbicides to eliminate competitors such as wild oats. In an effort to improve crop production in the road corridor, the cropping portion of the corridor was scarified by a motor grader in 2008. More recently, new growth was burned down with Roundup in the spring of 2011 as the seminal effort in converting this tract to a hayland use. Alfalfa was seeded that fall, but establishment in 2012 was poor and reseeding was performed in the spring of 2013. The portion in the SE¼ of Section 26 that has persisted in the tamegrass and alfalfa stand since day one of reclamation has been idled on an annual basis since it's inception. Bond release No. 3 contains additional information regarding final grade and respreading data.~~

Hayland

The bond release area contains two reclaimed areas – land in Section 29 under Reimer ownership (Tract 1) and land in the NE¼ of Section 33 under Perkins ownership (Tract 2) – that have a postmining land use of hayland. Mining of the Reimer acreage began along the west edge of the section, near Gascoyne Lake, in late 1976. Coal removal in this tract was brought to an end in mid-1995, when all coal removal at the mine ceased due to contract termination. Approval of final grade parcels began about 6 years after coal removal initiation. Numerous final grade approvals were obtained, with the final grade approval occurring in July of 1997.

Cropland was the initial postmining land use selected for the Reimer area in Section 29. Reclaimed tracts were initially seeded with a "pre-cropland" seed mix usually consisting of several tamegrasses and alfalfa, sometimes after a small grain cover crop or in conjunction with a nurse crop such as oats. A grain drill was the seeding implement of choice for all such tracts throughout the bond release area. Seeding of tracts prior to 1998 was usually preceded by application and incorporation of granular fertilizer to achieve actual #/ac rates of Nitrogen ranging from 18 to 24 #/acre and Phosphorus at 58 to 60 #/acre on most tracts, but as low as 17 #/acre on a few. The reclaimed tracts were first put to a cropland use when several early reclaimed tracts, namely tracts Rd 2, 3, 4, and 5, were converted to an annual cropping regime in 1990. In 1998, tracts Rd 6, 8-11, 13, and 15 were incorporated into the cropping program. Tract Rd 17 was added into the mix a couple of years later, followed by tract Rd 27 in 2005. At this point, the majority of the reclaimed area in roughly the west half of Section 29 was being cropped.

The configuration of the Reimer cropping area remained static until 2009, when the cropped areas were converted to hayland via seeding of alfalfa by the landowner. This was followed by an overseeding of tamegrasses in the spring of 2010. Haying of the majority of the Reimer reclaimed acreage, with the exception of areas left for reasons such as the beneficiation of upland gamebirds, has occurred since 2009. Reclaimed tracts Rd 3, 12, 14, and 28 have generally been idled, agronomically speaking, following the successful seeding of the pre-cropland seed mix. In 2012, the landowner installed an electrifiable high-tensile strength fence around the area that was being cropped and/or hayed, including undisturbed tracts adjoining the county road lying on the east side. The fence will presumably allow for grazing by livestock. Noxious weeds have not been an issue on the reclaimed areas; however, control efforts have been carried out in the vicinity of the Russian olive population west of tract Rd 4 in most years. Canada thistle has found favorable niches here and has been treated with Curtail or closely related herbicides. Small, thin populations of leafy spurge are scattered throughout a broader area, generally outside of the Russian olive community. This noxious weed has been treated with Roundup except in locations where Tordon application was deemed appropriate.

The reclaimed area in the NE¼ of Section 33 was mined from early 1979 through late 1986. Final grade approval spanned the time period of September 1980 through August of 1997 and respreading occurred from October 1987 through October of 2000. Fertilizer application was identical to the early Reimer tracts, but tracts Yw 5, Yw 7, and higher tract numbers did not receive an application. As with the Reimer tracts, the establishment of vegetation was achieved by planting a tamegrass and legume seed mix. With the exception of tract Yw 5, all tracts (including pre-1975 disturbance areas) have been hayed in most years with said agronomic practice generally beginning the year after seeding.

EVALUATION OF RECLAMATION SUCCESS

Reclamation success will be evaluated in accordance with regulatory requirements in place at the time of disturbance. ~~The first of the three tracts subject to an evaluation of reclamation success is the former stockpile access road in Section 26, owned by Allan Andersen. All of this tract, which has been assigned a postmining land use of cropland, was disturbed after July 1, 1975 and therefore comes under quantitative standards elaborated in current regulations.~~ Mining-related disturbance after the 1975 date requires proof that vegetative yield has equaled or exceeded the production standard for any 2 years after year 6 of the period of responsibility according to current rules. The hayland occupying the Reimer ownership in Section 29 is the ~~second~~ first area under consideration. The original postmining land use of this area was cropland, but was changed to hayland in recent years in response to the landowner's stated preference. While small acreages had been devoted to stockpiles and much of a major haul road had been constructed prior to July 1, 1975, the entire reclaimed acreage is being held to the post-1975 requirements. The ~~third~~second area to be evaluated for reclamation success is the hayland in the NE¼ of Section 33, under the ownership of Robert W. "Bud" Perkins. Exhibit 7.12 shows that most of this area was disturbed after July 1, 1975. However, one fairly small area in the NW corner was disturbed prior to the initial reclamation law and another small area falls under the 1969 law disturbance category. The remainder of this property was disturbed under the 1973 law, which required salvaging and replacement of up to 2 feet of soil, seeding per the approved reclamation plan, and reclamation results satisfactory to the Public Service Commission. The 1973 disturbance areas were occupied by haul roads or soil stockpiles into the 1990's.

Methods for determining the production (yield) standards for all land uses and reclaimed tracts have been derived from the Public Service Commission's most recent edition of *Standards for Evaluation of Revegetation Success and Recommended procedures for Pre- and Postmining Vegetation Assessments* hereinafter referred to as the "vegetation document." The unadjusted cropland and hayland productivity standards were calculated by applying Natural Resources Conservation Service estimated yields to the acreage for each soil map unit shown within the entire reclaimed tract shown on Exhibits 7.1 and 7.2. The unadjusted standard is corrected for climatic vagaries using either correction method No.1, based on county data provided by the National Agricultural Statistics Service, or correction method No. 2, which employs a control area, as explained in the vegetation guidelines. However, in the case of the Reimer ownership in Section 29, a weighted production ratio approach is used for 2006 and 2007 in order to assess the combined contributions from cropland and hayland in each year. This approach and data have been reviewed and approved by Commission staff. Yield comparisons and sample data appear following the narrative.

The evaluation of reclamation success in Tract 3 in Section 26 is based on a comparison of yields on the access road to the standard which has been corrected for climatic variation by using a control area. Hand sampling of the cropland portion of the reclaimed access road and the associated control area occurred in 2007, 2009, and 2010. Sampling of 5 or 10-foot sections of the 12-inch wide planting rows resulted in 8,712 and 4,356 sampling units per acre respectively. To the extent possible, samples were systematically placed to achieve a homogenous distribution throughout each strip of Tract 3 and the entire control area. After reaching the general locale for the sample, final location of the sampling frame was somewhat randomly determined. As Exhibit 7.1 illustrates, sampling in the first 2 years occurring within the more productive 40-foot wide strips on the outside edges of the corridor. In a sense, the outside strips may be seen as representative sampling strips – an approved sampling method allowing use of data derived from strips occupying at least 10 percent of the reclaimed tract, as long as certain qualifications are met. The strips would seem to satisfy qualifications such as having a topography, soil respread depth, and age similar or identical to the remainder of the tract. They also occupy much more than 10 percent of the reclaimed area subject to quantitative standards. Further, they were perceived to generate yields more representative of reclaimed land under the same ownership that has already been released from bond. In contrast to previous years, sampling in 2010 was distributed throughout the corridor. The exhibit also shows that the control area was sampled with relatively homogeneous sample site distribution. Production in 2007 and 2010 exceeded the adjusted production standard, as table 4 illustrates. In 2009, cropland production on the reclaimed tract fell just short of the adjusted standard. However, data for that year was subjected to statistical analysis to determine if the reclaimed tract production might be statistically equivalent to the adjusted technical standard. The analysis successfully demonstrated statistical equivalence.

Hayland data from 2007 and 2010 is presented for that portion of the reclaimed tract in NE¼ of Section 26 that remains in a tamegrass/legume stand. Sampling sites for this and all other hayland are displayed on Exhibit 7.2. In this hayland sampling area, as well as the hayland sampling areas of tracts 1 and 2, sample sites were thoroughly distributed throughout the sampling area while representing the various revegetation tracts to the extent possible. After reaching the general locale for the sample, final location of the sampling frame was somewhat randomly determined. Hand-sampled yields in 2010 were victorious over the standard, adjusted using correction method No.1 for tame pastureland in the vegetation guidelines.

In addition to the direct comparisons for cropland and hayland, a comparison of yields in 2007 and 2010 using a weighted production ratio approach is also presented. Crop yields are based on the same datasets used in the direct comparisons. Beyond the data provided, it is useful to note that the adjoining reclaimed hayland in the S½ of Section 26 and SE¼ of Section 27, formerly under Knife River Corporation ownership, was successfully released from bond as part of bond release No. 5 after demonstrating that acceptable hayland yields were achieved in 2004 and 2005. In addition, landowner Allan Andersen has stated his full satisfaction with the reclaimed status and his desire that bond release be granted for the entire haul road corridor. His statement of support can be found at the end of the attachment.

Data for the Perkins property (Tract 2) in the NE¼ of Section 33 was secured in 2006 and 2007 by hand sampling of the hayland standing crop. In 2006, the reclaimed area yielded 1.57 tons/acre of forage, compared to a standard of 1.06 tons/acre. In 2007, the respective yields were 1.74 and 1.54 tons/acre. Sampling was restricted to areas disturbed after July 1, 1975. As in other areas, the standard was adjusted using correction method No. 1. A review of historic overhead aerial imagery reinforces that there are negligible differences in vegetative success between areas disturbed before and after the 1975 reclamation law. Interpretation of the

aerial imagery has been confirmed by occasional on-the-ground observations that have noted good erosion control on the pre-1975 areas under the annual haying regime.

In Section 29 (Tract 1), a weighted production ratio approach is used to demonstrate acceptability of the reclaimed yield in 2006 and 2007. ~~Although current regulations do not allow data collection until the seventh year of the liability period, data was collected in 2006 under previous/prevailing regulations which allowed sampling beginning in the sixth year. Thus, the 2006 data may not be applicable to the entire area if only current regulations are considered.~~ Crop yields were provided by the harvester, whereas hay yields were derived via hand sampling. The unadjusted cropland standard was adjusted for a continuous cropping scenario and corrected for climatic variation using county yield data (correction method No. 1). Table 3 of the Section 29 analysis reveals that the combined weighted yields of the 2006 wheat and hay crops exceeded the standard, but fell slightly short in 2007. In 2008, when only approximately the east half of the area was in a hayland use, and in 2010, comparisons use hay data alone. Data from these years demonstrate success on that portion of the area seeded in 2000, whereas 2006 and 2010 data demonstrate success on that portion of the area seeded prior to 2000. Reclaimed area hay yields based on hand sampling in these years bested the corrected technical standard, using correction method No.1, in direct comparisons for both years. The 19.6-acre tract seeded in 2000 included ponds that were not reclaimed until roughly 2 years had elapsed following completion of seeding on the remainder of the reclaimed area. As a result, sampling in 2006 occurred in the sixth year of the liability period for this tract. As a summary of revegetation success, the entire reclaimed area met the standard in 2006 and 2010, and the east half of the reclaimed area (including the 19.6-acre tract) met the standard in 2008.

SUMMARY OF RECLAIMED YIELDS AND ADJUSTED YIELD STANDARDS

Year	Landowner	Crop	Acres	Weighted Production Ratio	Reclaimed Yield	Adjusted Yield Standard
~~2007~~	~~Andersen~~	~~Durum~~			~~26.5 bu/ac~~	~~21.0 bu/ac~~
~~2009~~	~~Andersen~~	~~Durum~~			~~26.5 bu/ac~~	~~27.4 bu/ac~~
~~2010~~	~~Andersen~~	~~Durum~~			~~34.8 bu/ac~~	~~32.1 bu/ac~~
~~2007~~	~~Andersen~~	~~Hay~~			~~1.74 t/ac~~	~~1.94 t/ac~~
~~2010~~	~~Andersen~~	~~Hay~~			~~2.53 t/ac~~	~~1.99 t/ac~~
~~2007~~	~~Andersen~~	~~Durum/Hay~~	~~4.6~~	~~5.11~~		
~~2010~~	~~Andersen~~	~~Durum/Hay~~	~~4.6~~	~~5.33~~		
2006	Perkins	Hay			1.57 t/ac	1.06 t/ac
2007	Perkins	Hay			1.74 t/ac	1.54 t/ac
2006	Reimer	HRSW/Hay	455.7	595.6		
2007	Reimer	HRSW/Hay	455.7	450.2		
2008	Reimer	Hay			1.00 t/ac	0.94 t/ac
2010	Reimer	Hay			2.16 t/ac	1.42 t/ac

Developed Water Resources - Pond 23

Pond #23, located in section 33 was originally designed to (1) control surface water runoff from a drainage area consisting of approximately 860 acres, and (2) provide storage for accumulated groundwater pumped from the yellow pit. After mining, the pond remained in place as a permanent impoundment, functioning as it was originally designed to provide stormwater control and waterfowl habitat. Pond #23 was designed to handle a 50-year/6-hour event and includes an open channel spillway draining easterly from the impoundment which receives flows from two (12" and 30") CMP culverts. This pond has established wetland grasses and is an asset to the land use for this tract.

The eastern and western chambers of Pond 23 are hydraulically connected by an equalizing culvert. The equalizing culvert, which was replaced in 2010, continues to function as designed (as evidenced by several recent inspections and surveyed water elevation data) despite a modest accumulation of sediment near the pipe outlet and exceptionally high precipitation that has resulted in elevated pool levels that disallow further pipe access/inspection but that remain well within the pond's containment capacity.

A permanent impoundment management agreement for Pond 23 is included on the following pages.

EVALUATION OF CROPLAND REVEGETATION SUCCESS FOR THE S½ OF SECTION 26 ANDERSEN OWNERSHIP - TRACT 3

TABLE 1. S26 ANDERSEN UNADJUSTED TECHNICAL STANDARD FOR RECLAIMED CROPLAND

Soil Map Unit	Acres	PI	PI Yield	Weighted Production
Shambo B	4.0	80	25.6	102.4
Vebar fsl B	0.6	57	18.2	10.9
Total	4.6			113.3
Unadjusted Standard (bu/ac)				24.6

TABLE 2. S26 ANDERSEN TECHNICAL STANDARD FOR CROPLAND CONTROL AREA

Soil Map Unit	Acres	PI	Yield	Production
Shambo B	1.8	80	25.6	46.1
Unadjusted Standard (bu/ac)				25.6

TABLE 3. S26 ANDERSEN CORRECTION FACTOR CALCULATION

Year	Crop	Actual Control Area Yield	Control Area Standard	Corr. Factor
2007	Durum	21.8	25.6	0.852
2009	Durum	28.5	25.6	1.113
2010	Durum	33.4	25.6	1.305

TABLE 4. S26 ANDERSEN RECLAIMED TRACT PRODUCTION COMPARISONS

Year	Crop	Production (bu/ac)	Unadjusted Standard	Corr. Factor	Adjusted Standard
2007	Durum	**26.5**	24.6	0.852	**21.0**
2009	Durum	**26.5**	24.6	1.113	**27.4**
2010	Durum	**34.8**	24.6	1.305	**32.1**

STATISTICAL ANALYSIS -2009 Reclaimed Area Actual Yield vs. Adjusted Standard

	Actual Rreclaimed Area Yield	Adjusted Standard
Mean	26.5	27.4
Sample Size	30	
df	29	
Sq Root of Sample	5.5	
Variance	32.0	
Std. Deviation	5.7	

Calculated t $= \dfrac{|26.5-27.4|}{5.7/\sqrt{30}} = \dfrac{0.9}{1.0} =$ **0.871**

Table t for 29 df: 1.311

EVALUATION OF HAYLAND REVEGETATION SUCCESS FOR THE S½ OF SECTION 26, ANDERSEN OWNERSHIP - TRACT 3

Table 1. S26 ANDERSEN UNADJUSTED TECHNICAL STANDARD FOR RECLAIMED HAYLAND

Soil Map Unit	Suitability Group	NRCS Median Yield (t/ac)	Map Unit Acres	Suitability Group Acres	Weighted Yield (tons)	Unadjusted Standard (t/ac)
Shambo	A1	1.50	4.0	4.0	6.00	
Vebar	F3	1.05	0.6	0.6	0.63	
Total				4.6	6.63	
						1.44

Table 2. S26 ANDERSEN HAYLAND YIELD COMPARISONS

Year	Long-Term Average	County Yield	Climatic Correction Factor	Unadjusted Standard	Adjusted Standard	Reclaimed Area Yield
	~~ t/ac ~~~			~~~~~~ t/ac ~~~~~~		
2007	1.33	1.79	1.35	1.44	**1.94**	**1.74**
2010	1.34	1.85	1.38	1.44	**1.99**	**2.53**

Correction factors based on county alfalfa hay data, 15-year long term yield

STATISTICAL ANALYSIS - 2007 Reclaimed Area Actual Yield vs. Adjusted Standard

	Actual Rreclaimed Area Yield	Adjusted Standard
Mean	1.74	1.94
Sample Size	38	
df	37	
Sq Root of Sample	6.2	
Variance	0.48	
Std. Deviation	0.69	

$$\text{Calculated } t = \frac{|1.74 - 1.94|}{0.69/\sqrt{38}} = \frac{0.20}{0.11} = 1.780$$

Table t for 37 df: 1.305

EVALUATION OF REVEGETATION SUCCESS FOR THE S½ OF SECTION 26, ANDERSEN OWNERSHIP - TRACT 3
~ WEIGHTED PRODUCTION RATIO APPROACH ~

TABLE 1. S26 ANDERSEN UNADJUSTED TECHNICAL STANDARDS FOR RECLAIMED CROPLAND AND HAYLAND

		CROPLAND			HAYLAND		
Soil Map Unit	Acres	PI	PI Yield	Wheat Weighted Yield	Suit. Group	Median Yield	Weighted Yield
Shambo B	4.0	80	25.6	102.4	A1	1.50	6.00
Vebar fsl	0.6	57	18.2	10.9	F3	1.05	0.63
Total	4.6			113.3			6.63
Unadjusted Standard (bu/ac, t/ac)				**24.6**			**1.44**

TABLE 2. S26 ANDERSEN TECHNICAL STANDARD FOR CROPLAND CONTROL AREA

Soil Map Unit	Acres	PI	PI Yield	Weighted Yield
Shambo B	5.0	80	25.6	128.0
Standard (bu/ac)				**25.6**

TABLE 3. S26 ANDERSEN CORRECTION FACTOR CALCULATION

Year	Crop	Actual County Yield	Long Term County Hay Yield	Control Area Std.	Actual Control Area Yield	Corr. Factor
2007	Durum	--		25.6	21.8	0.852
	Hay	1.79	1.33	--		1.346
2010	Durum	--		25.6	33.4	1.305
	Hay	1.85	1.34			1.381

TABLE 4. S26 ANDERSEN RECLAIMED TRACT PRODUCTION COMPARISONS USING WEIGHTED PRODUCTION RATIOS

Year	Crop	Rec. Pro.	Unadjusted Standard	Correction Factor	Adjusted Standard	Pro. Ratio	Acres	Weighted Pro. Ratio
2007	Wheat	26.5	24.6	0.852	21.0	1.26	2.7	3.40
	Hay	1.74	1.44	1.346	1.94	0.90	1.9	1.71
							4.6	**5.11**
2010	Durum	34.8	24.6	1.305	32.1	1.08	2.7	2.92
	Hay	2.53	1.44	1.381	1.99	1.27	1.9	2.41
							4.6	**5.33**

Correction factor for wheat crop derived using control area

Correction factor for hay crop based on county alfalfa hay data, 15-year long term yield

EVALUATION OF HAYLAND REVEGETATION SUCCESS FOR THE NE¼ OF SECTION 33 PERKINS OWNERSHIP - TRACT 2

Table 1. NE33 PERKINS UNADJUSTED TECHNICAL STANDARD FOR RECLAIMED HAYLAND

Soil Map Unit	Suitability Group	NRCS Median Yield (t/ac)	Map Unit Acres	Suitability Group Acres	Weighted Yield (tons)	Unadjusted Standard (t/ac)
Amor	F2	1.20	14.1	14.1	16.9	
Brandenburg (<25%)	B2	0.65	0.8	0.8	0.5	
Cabba	H4	0.43	31.1	31.1	13.4	
Grail (<3%)	A3	2.10	5.4	5.4	11.3	
Heil	G3	0.90	10.6	10.6	9.5	
McKenzie (non-saline)	C1	1.90	3.2	3.2	6.1	
Regent	F2	1.20	2.0	2.0	2.4	
Searing	A1	1.50	9.6	9.6	14.4	
Shambo	A1	1.50	35.0	35.0	52.5	
			111.8	111.8	127.1	1.14

Table 2. NE33 PERKINS HAYLAND YIELD COMPARISONS

	Long-Term Average	County Yield	Climatic Correction Factor	Unadjusted Standard	Adjusted Standard	Reclaimed Area Yield
Year	~~~ t/ac ~~~			~~~~~~ t/ac ~~~~~~		
2006	1.28	1.19	0.93	1.14	**1.06**	**1.57**
2007	1.33	1.79	1.35	1.14	**1.54**	**1.74**

Correction factors based on county alfalfa hay data, 15-year long term yield)

EVALUATION OF REVEGETATION SUCCESS FOR SECTION 29, REIMER OWNERSHIP - TRACT 1
~~ WEIGHTED PRODUCTION RATIO AND STRAIGHT COMPARISON APPROACHES ~~

TABLE 1. SECTION 29 REIMER UNADJUSTED TECHNICAL STANDARDS FOR RECLAIMED CROPLAND AND HAYLAND

		CROPLAND			HAYLAND		
Soil Map Unit	Acres	PI	PI Yield	Weighted Yield	Suit. Group	Median Yield	Weighted Yield
Amor I B	126.5	76	24.3	3076.5	F2	1.20	151.80
Belfield-Daglum A							
- Belfield A	6.3	75	24.0	151.2	F1	1.05	6.62
- Daglum A	4.2	45	14.4	60.5	G1	0.90	3.78
Cabba B/C	49.3	34	10.9	536.4	H4	0.43	21.20
Cabba, stony B/C	5.0	17	5.4	27.2	H4	0.43	2.15
Daglum A	5.7	45	14.4	82.1	G1	0.90	5.13
Daglum-Belfield A							
- Daglum I A	3.7	45	14.4	53.3	G1	0.90	3.33
- Belfield I A	2.5	75	24.0	60.0	F1	1.05	2.63
Daglum I B	40.3	43	13.8	554.5	G1	0.90	36.27
Grail A	4.1	100	32.0	131.2	A3	2.10	8.61
Heil A	17.8	35	11.2	199.4	G3	0.90	16.02
Lowe A	4.0	40	12.8	51.2	H6	0.95	3.80
Reeder B	54.7	80	25.6	1400.3	F2	1.20	65.64
Rhoades B	52.7	28	9.0	472.2	G2	0.55	28.99
Saline Land/Seep	1.3	20	6.4	8.3	G4	1.20	1.56
Savage-Belfield B							
- Savage B	14.3	85	27.2	389.0	A4	1.35	19.31
- Belfield B	9.5	71	22.7	215.8	F1	1.05	9.98
Sen B	1.0	76	24.3	24.3	F2	1.20	1.20
Shambo A	8.0	85	27.2	217.6	A1	1.50	12.00
Shambo B	44.8	80	25.6	1146.9	A1	1.50	67.20
Total	455.7			8857.8			467.19
Unadjusted Standard (bu/ac or t/ac)				**19.4**			**1.03**

TABLE 2. SECTION 29 REIMER CORRECTION FACTOR CALCULATION

Year	Crop	Actual County Yield	Long Term County Hay Yield	Adjusted County Wheat Yd.	Benchmark County Wheat Yd.	Corr. Factor
2006	HRSW	21.9	--	17.6	21.0	0.836
	Hay	1.19	1.28	--	--	0.930
2007	HRSW	27.8	--	23.4	21.0	1.114
	Hay	1.79	1.33	--	--	1.346
2008	Hay	1.20	1.31	--	--	0.916
2010	Hay	1.85	1.34	--	--	1.381

TABLE 3. SECTION 29 REIMER RECLAIMED TRACT PRODUCTION COMPARISONS USING WEIGHTED PRODUCTION RATIOS AND STRAIGHT COMPARISONS

Year	Crop	Pro. (bu/ac, t/ac)	Unadjusted Standard	Correction Factor	Adjusted Standard	Pro. Ratio	Acres	Weighted Production Ratio
2006	HRSW	9.7	19.4	0.836	16.2	0.60	207.7	124.26
	Hay	1.82	1.03	0.930	0.96	1.90	248.0	471.36
							455.7	**595.61**
2007	HRSW	9.8	19.4	1.114	21.6	0.45	207.7	94.19
	Hay	1.99	1.03	1.346	1.39	1.44	248.0	356.01
							455.7	**450.20**
2008	Hay	**1.00**	1.03	0.916	**0.94**			
2010	Hay	**2.16**	1.03	1.381	**1.42**			

Table Notes

Table 1: Lowe substituted for Marsh soil map unit.

Table 2: Correction factor for wheat crop based on method No. 1 (county continuous cropping data)

Correction factor for hay crop based on method No. 1 (county alfalfa hay data, 15-year long term period)

Data from 2006 and 2010 represents areas seeded prior to 2000, data from 2008 and 2010 represents the 2000 seeding area.

2007 Andersen S26 Cleaned Grain Yields		
Reclaimed Area - Wheat		Sampled 7/27-28/07
Sample	**Wheat**	**Yield (bu/ac)[1]**
1	141.1	22.6
2	105.7	16.9
3	128.0	20.5
4	152.8	24.5
5	200.3	32.1
6	129.6	20.7
7	120.2	19.2
8	200.7	32.1
9	188.9	30.2
10	214.5	34.3
11	135.3	21.7
12	169.4	27.1
13	161.5	25.8
14	224.1	35.9
15	155.7	24.9
16	111.3	17.8
17	181.9	29.1
18	158.6	25.4
19	124.4	19.9
20	205.3	32.9
21	130.7	20.9
22	180.3	28.9
23	195.8	31.3
24	161.1	25.8
25	134.1	21.5
26	128.9	20.6
27	201.6	32.3
28	220.3	35.3
29	204.2	32.7
30	196.2	31.4
Mean	165.4	26.5

Calculation of sample adequacy where $n=t^2 s^2/d^2$

$t^2_{(.90,29)}$	1.720
s^2	32.6
d^2	7.0
n	8.0

[1] where bu/ac = g/453.6*4356/60

2007 S26 Control Area Cleaned Grain Yields		
Wheat		Sampled 7/25/07
Sample	**Wheat**	**Yield (bu/ac)[1]**
1	134.0	21.4
2	191.4	30.6
3	99.8	16.0
4	100.6	16.1
5	85.1	13.6
6	159.6	25.5
7	121.1	19.4
8	104.4	16.7
9	151.3	24.2
10	186.5	29.8
11	163.4	26.2
12	188.8	30.2
13	121.5	19.4
14	129.9	20.8
15	133.8	21.4
16	107.4	17.2
17	123.0	19.7
18	122.8	19.7
19	206.8	33.1
20	150.4	24.1
21	172.7	27.6
22	95.6	15.3
23	129.8	20.8
24	172.0	27.5
25	119.7	19.2
26	162.5	26.0
27	78.2	12.5
28	141.0	22.6
29	102.2	16.4
30	124.2	19.9
Mean	136.0	21.8

Calculation of sample adequacy where $n=t^2 s^2/d^2$

$t^2_{(.90,29)}$	1.720
s^2	29.1
d^2	4.7
n	10.5

[1] where bu/ac = g/453.6*4356/60

2009 Andersen S26 Cleaned Grain Yields		
Reclaimed Area - Durum		Sampled 8/25/09
Sample	**Grams**	**Yield (bu/ac)[1]**
1	122.9	39.3
2	64.5	20.6
3	99.2	31.8
4	72.8	23.3
5	101.0	32.3
6	66.1	21.2
7	79.0	25.3
8	73.6	23.6
9	77.5	24.8
10	80.7	25.8
11	55.4	17.7
12	108.8	34.8
13	86.3	27.6
14	87.3	27.9
15	113.0	36.2
16	87.3	27.9
17	109.1	34.9
18	48.7	15.6
19	82.2	26.3
20	68.6	22.0
21	102.2	32.7
22	93.2	29.8
23	78.4	25.1
24	81.3	26.0
25	94.1	30.1
26	68.3	21.9
27	71.1	22.8
28	66.6	21.3
29	83.9	26.9
30	64.8	20.7
Mean	82.9	26.5

Calculation of sample adequacy where $n=t^2 s^2/d^2$

$t^2_{(.90,29)}$	1.720
s^2	32.0
d^2	7.0
n	7.8

[1] where bu/ac = g/453.6*8712/60

2009 S26 Control Area Cleaned Grain Yields		
Durum		Sampled 8/24/09
Sample	**Grams**	**Yield (bu/ac)[1]**
1	107.7	34.5
2	95.6	30.6
3	89.2	28.6
4	91.4	29.3
5	51.4	16.5
6	114.8	36.7
7	105.0	33.6
8	117.4	37.6
9	45.6	14.6
10	90.1	28.8
11	67.6	21.6
12	73.7	23.6
13	113.9	36.5
14	89.3	28.6
15	123.8	39.6
16	78.9	25.3
17	90.5	29.0
18	124.2	39.8
19	89.6	28.7
20	79.0	25.3
21	76.0	24.3
22	79.2	25.4
23	109.4	35.0
24	108.2	34.6
25	76.2	24.4
26	59.8	19.1
27	71.1	22.8
28	86.4	27.7
29	88.4	28.3
30	78.0	25.0
Mean	89.0	28.5

Calculation of sample adequacy where $n=t^2 s^2/d^2$

$t^2_{(.90,29)}$	1.720
s^2	42.1
d^2	8.1
n	8.9

[1] where bu/ac = g/453.6*8712/60

2010 Andersen S26 Cleaned Grain Yields		
Reclaimed Area - Durum		Sampled 8/23-24/10
Sample	**Grams**	**Yield (bu/ac)[1]**
1	114.8	36.7
2	49.7	15.9
3	90.0	28.8
4	63.2	20.2
5	140.3	44.9
6	101.2	32.4
7	124.5	39.9
8	59.8	19.1
9	128.9	41.3
10	111.9	35.8
11	49.1	15.7
12	82.8	26.5
13	189.9	60.8
14	75.6	24.2
15	122.7	39.3
16	142.3	45.6
17	43.7	14.0
18	158.7	50.8
19	125.7	40.2
20	79.7	25.5
21	154.4	49.4
22	106.0	33.9
~~*23*~~	~~39.6~~	~~12.7~~
24	131.0	41.9
25	132.6	42.4
26	75.8	24.3
27	192.4	61.6
28	84.1	26.9
29	134.6	43.1
30	95.6	30.6
31	171.5	54.9
32	87.9	28.1
33	69.0	22.1
34	159.9	51.2
35	153.7	49.2
36	39.0	12.5
37	126.2	40.4
38	126.6	40.5
39	101.1	32.4
Mean	108.6	34.8

Calculation of sample adequacy where $n=t^2 s^2/d^2$

$t^2_{(.90,38)}$	1.701
s^2	174.6
d^2	12.1
n	24.6

[1] where bu/ac = g/453.6*8712/60

2010 S26 Control Area Cleaned Grain Yields		
Durum		Sampled 8/24/10
Sample	**Grams**	**Yield (bu/ac)[1]**
1	92.0	29.4
2	97.3	31.1
3	118.5	37.9
4	83.0	26.6
5	83.9	26.9
6	164.7	52.7
7	100.1	32.0
8	111.7	35.8
9	137.7	44.1
10	104.5	33.5
11	79.5	25.4
12	90.6	29.0
13	144.0	46.1
14	93.6	30.0
15	101.7	32.6
16	90.5	29.0
17	87.2	27.9
18	121.7	39.0
19	105.8	33.9
20	124.6	39.9
21	84.7	27.1
22	99.7	31.9
~~*23*~~	~~76.9~~	~~24.6~~
24	101.4	32.5
25	88.3	28.3
26	112.3	35.9
27	74.1	23.7
28	125.9	40.3
29	117.5	37.6
30	115.0	36.8
Mean	104.3	33.4

Calculation of sample adequacy where $n=t^2 s^2/d^2$

$t^2_{(.90,29)}$	1.720
s^2	45.8
d^2	11.1
n	7.1

[1] where bu/ac = g/453.6*8712/60

2007 Andersen S26 Dry Weight Hayland Yields					
					Sampled 7/9-10/07
Sample	Grasses and Others (g)	Alfalfa (g)	Total Weight (g)	Total Weight (#/ac)[1]	Total Weight (t/ac)
1	66.1	5.4	71.5	2552.6	1.28
2	53.1	0.0	53.1	1895.7	0.95
3	104.5	69.5	174.0	6211.8	3.11
4	67.6	15.2	82.8	2956.0	1.48
5	76.9	0.0	76.9	2745.3	1.37
6	43.0	0.9	43.9	1567.2	0.78
7	50.3	55.9	106.2	3791.3	1.90
8	47.8	49.3	97.1	3466.5	1.73
9	36.1	0.0	36.1	1288.8	0.64
10	93.1	54.1	147.2	5255.0	2.63
11	55.6	1.2	56.8	2027.8	1.01
12	68.8	14.7	83.5	2981.0	1.49
13	71.7	3.7	75.4	2691.8	1.35
14	67.9	0.0	67.9	2424.0	1.21
15	60.1	56.9	117.0	4176.9	2.09
16	73.5	35.9	109.4	3905.6	1.95
17	69.2	23.1	92.3	3295.1	1.65
18	29.5	23.6	53.1	1895.7	0.95
19	64.0	4.9	68.9	2459.7	1.23
20	67.6	0.0	67.6	2413.3	1.21
21	72.8	24.5	97.3	3473.6	1.74
22	65.5	46.7	112.2	4005.5	2.00
23	51.8	39.3	91.1	3252.3	1.63
24	48.7	35.6	84.3	3009.5	1.50
25	81.4	66.1	147.5	5265.8	2.63
26	61.4	128.9	190.3	6793.7	3.40
27	50.9	100.0	150.9	5387.1	2.69
28	84.9	82.4	167.3	5972.6	2.99
29	72.0	76.0	148.0	5283.6	2.64
30	51.7	78.4	130.1	4644.6	2.32
31	75.8	31.9	107.7	3844.9	1.92
32	27.6	29.2	56.8	2027.8	1.01
33	82.1	0.0	82.1	2931.0	1.47
34	52.3	54.8	107.1	3823.5	1.91
35	31.4	27.6	59.0	2106.3	1.05
36	57.6	75.2	132.8	4741.0	2.37
37	56.4	0.0	56.4	2013.5	1.01
38	99.5	0.0	99.5	3552.2	1.78
Mean	62.9	34.5	97.4	3477.1	1.74

[1] where #/ac = g/0.25m^2 x 35.7

Calculation of sample adequacy where $n=t^2 s^2 / d^2$

$t^2_{(.90,37)}$	1.703
s^2	0.48
d^2	0.03
Samples required	26.8

2010 Andersen S26 Dry Weight Hayland Yields					
					Sampled 7/19-21/10
Sample	Grasses and Others (g)	Alfalfa (g)	Total Weight (g)	Total Weight (#/ac)[1]	Total Weight (t/ac)
1	54.4	143.9	198.3	7079.3	3.54
2	67.4	0.2	67.6	2413.3	1.21
3	63.1	30.2	93.3	3330.8	1.67
4	67.5	51.8	119.3	4259.0	2.13
5	96.1	93.9	190.0	6783.0	3.39
6	74.2	82.5	156.7	5594.2	2.80
7	79.2	0.0	79.2	2827.4	1.41
8	70.8	1.4	72.2	2577.5	1.29
9	108.5	61.8	170.3	6079.7	3.04
10	82.7	6.9	89.6	3198.7	1.60
11	91.5	50.5	142.0	5069.4	2.53
12	63.1	30.7	93.8	3348.7	1.67
13	97.0	15.8	112.8	4027.0	2.01
14	60.8	122.1	182.9	6529.5	3.26
15	69.6	84.6	154.2	5504.9	2.75
16	74.4	51.9	126.3	4508.9	2.25
17	111.5	84.7	196.2	7004.3	3.50
18	85.6	75.9	161.5	5765.6	2.88
19	112.3	21.4	133.7	4773.1	2.39
20	93.5	6.4	99.9	3566.4	1.78
21	89.9	114.8	204.7	7307.8	3.65
22	107.4	71.2	178.6	6376.0	3.19
23	110.0	58.7	168.7	6022.6	3.01
24	98.4	94.5	192.9	6886.5	3.44
25	96.6	18.5	115.1	4109.1	2.05
26	74.4	111.6	186.0	6640.2	3.32
27	110.9	20.7	131.6	4698.1	2.35
28	118.2	28.4	146.6	5233.6	2.62
Mean	86.8	54.8	141.6	5054.1	2.53

[1] where #/ac = g/0.25m^2 x 35.7

Calculation of sample adequacy where $n=t^2 s^2 / d^2$

$t^2_{(.90,27)}$	1.726
s^2	0.57
d^2	0.06
Samples required	15.4

2006 Perkins (NE33) Dry Weight Hayland Yields					
					Sampled 6/26/06
Sample	Grasses and Others (g)	Alfalfa (g)	Total Weight (g)	Total Weight (#/ac)[1]	Total Weight (t/ac)
1	64.0	0.0	64.0	2284.8	1.14
2	120.4	11.0	131.4	4691.0	2.35
3	26.5	73.2	99.7	3559.3	1.78
4	65.5	11.3	76.8	2741.8	1.37
5	64.1	45.8	109.9	3923.4	1.96
6	53.8	15.1	68.9	2459.7	1.23
7	42.8	43.2	86.0	3070.2	1.54
8	57.9	38.5	96.4	3441.5	1.72
9	72.9	10.3	83.2	2970.2	1.49
10	42.7	30.5	73.2	2613.2	1.31
11	16.1	59.4	75.5	2695.4	1.35
12	64.5	25.5	90.0	3213.0	1.61
13	80.5	11.5	92.0	3284.4	1.64
Mean	59.4	28.9	88.2	3149.8	1.57
[1] where #/ac = g/0.25m^2 x 35.7					
Calculation of sample adequacy where $n=t^2 s^2 / d^2$					
$t^2_{(.90,12)}$	1.839				
s^2	0.11				
d^2	0.02				
Samples required	8.0				

2007 Perkins (NE33) Dry Weight Hayland Yields					
					Sampled 6/22-23/07
Sample	Grasses and Others (g)	Alfalfa (g)	Total Weight (g)	Total Weight (#/ac)[1]	Total Weight (t/ac)
1	39.0	39.0	78.0	2784.6	1.39
2	72.6	72.6	145.2	5183.6	2.59
3	54.5	54.5	109.0	3891.3	1.95
4	48.3	48.3	96.6	3448.6	1.72
5	40.9	9.8	50.7	1810.0	0.90
6	74.5	72.9	147.4	5262.2	2.63
7	73.3	62.9	136.2	4862.3	2.43
8	61.3	19.7	81.0	2891.7	1.45
9	37.6	58.3	95.9	3423.6	1.71
10	44.3	58.8	103.1	3680.7	1.84
11	29.3	43.3	72.6	2591.8	1.30
12	75.3	33.6	108.9	3887.7	1.94
13	75.1	22.6	97.7	3487.9	1.74
14	58.1	12.8	70.9	2531.1	1.27
15	70.9	4.1	75.0	2677.5	1.34
16	87.9	19.1	107.0	3819.9	1.91
17	74.2	12.4	86.6	3091.6	1.55
18	39.6	21.5	61.1	2181.3	1.09
19	104.8	45.7	150.5	5372.9	2.69
20	79.6	95.1	174.7	6236.8	3.12
21	87.2	71.2	158.4	5654.9	2.83
22	59.3	11.6	70.9	2531.1	1.27
23	46.1	1.6	47.7	1702.9	0.85
24	57.9	0.0	57.9	2067.0	1.03
25	59.1	0.0	59.1	2109.9	1.05
26	52.4	71.2	123.6	4412.5	2.21
27	68.0	16.4	84.4	3013.1	1.51
28	52.4	39.7	92.1	3288.0	1.64
29	58.7	33.0	91.7	3273.7	1.64
Mean	61.5	36.3	97.7	3488.6	1.74

[1] where #/ac = g/0.25m^2 x 35.7

Calculation of sample adequacy where $n=t^2 s^2 / d^2$

$t^2_{(.90,28)}$	1.723
s^2	0.37
d^2	0.03
Samples required	20.9

2006 Reimer (Sec. 29) Dry Weight Hayland Yields					
					Sampled 6/26/06
Sample	**Grasses and Others (g)**	**Alfalfa (g)**	**Total Weight (g)**	**Total Weight (#/ac)[1]**	**Total Weight (t/ac)**
1	71.9	45.4	117.3	4187.6	2.09
2	67.9	33.7	101.6	3627.1	1.81
3	13.4	75.2	88.6	3163.0	1.58
4	79.3	0.0	79.3	2831.0	1.42
5	79.4	10.9	90.3	3223.7	1.61
6	56.9	41.5	98.4	3512.9	1.76
7	45.0	15.8	60.8	2170.6	1.09
8	60.9	41.4	102.3	3652.1	1.83
9	49.7	81.0	130.7	4666.0	2.33
10	54.6	63.5	118.1	4216.2	2.11
11	71.4	48.8	120.2	4291.1	2.15
12	61.0	58.0	119.0	4248.3	2.12
Mean	59.3	42.9	102.2	3649.1	1.82

[1] where #/ac = g/0.25m^2 x 35.7

Calculation of sample adequacy where $n=t^2 s^2 / d^2$

$t^2_{(.90,11)}$	1.859
s^2	0.13
d^2	0.03
Samples required	7.2

2007 Reimer (Sec. 29) Dry Weight Hayland Yields					
					Sampled 6/27-28/07
Sample	Grasses and Others (g)	Alfalfa (g)	Total Weight (g)	Total Weight (#/ac)[1]	Total Weight (t/ac)
1	74.9	35.6	110.5	3944.9	1.97
2	45.5	27.6	73.1	2609.7	1.30
3	65.6	42.5	108.1	3859.2	1.93
4	91.7	27.6	119.3	4259.0	2.13
5	86.8	29.8	116.6	4162.6	2.08
6	40.3	60.3	100.6	3591.4	1.80
7	53.9	14.4	68.3	2438.3	1.22
8	95.8	0.0	95.8	3420.1	1.71
9	30.6	69.0	99.6	3555.7	1.78
10	56.4	0.0	56.4	2013.5	1.01
11	57.2	58.3	115.5	4123.4	2.06
12	74.2	69.0	143.2	5112.2	2.56
13	39.1	133.6	172.7	6165.4	3.08
14	69.2	111.8	181.0	6461.7	3.23
15	91.3	51.3	142.6	5090.8	2.55
16	82.8	74.8	157.6	5626.3	2.81
17	31.7	89.2	120.9	4316.1	2.16
18	79.0	62.0	141.0	5033.7	2.52
19	44.8	35.4	80.2	2863.1	1.43
20	45.0	0.0	45.0	1606.5	0.80
21	60.2	0.0	60.2	2149.1	1.07
22	52.9	91.8	144.7	5165.8	2.58
23	69.3	0.0	69.3	2474.0	1.24
24	52.1	60.4	112.5	4016.3	2.01
25	71.9	64.2	136.1	4858.8	2.43
26	56.9	91.5	148.4	5297.9	2.65
27	57.5	32.9	90.4	3227.3	1.61
28	75.2	49.6	124.8	4455.4	2.23
29	70.0	48.0	118.0	4212.6	2.11
30	63.5	32.6	96.1	3430.8	1.72
Mean	62.8	49.0	111.7	3984.7	1.99

[1] where #/ac = g/0.25m^2 x 35.7

Calculation of sample adequacy where $n=t^2 s^2 / d^2$

$t^2_{(.90,29)}$	1.720
s^2	0.38
d^2	0.04
Samples required	16.4

2008 Reimer (Sec. 29) Dry Weight Hayland Yields					
					Sampled 6/23-24/08
Sample	Grasses and Others (g)	Alfalfa (g)	Total Weight (g)	Total Weight (#/ac)[1]	Total Weight (t/ac)
1	36.5	14.9	51.4	1835.0	0.92
2	41.2	23.2	64.4	2299.1	1.15
3	27.9	10.2	38.1	1360.2	0.68
4	35.2	11.4	46.6	1663.6	0.83
5	41.6	29.1	70.7	2524.0	1.26
6	33.8	38.1	71.9	2566.8	1.28
7	33.4	16.1	49.5	1767.2	0.88
8	45.1	28.7	73.8	2634.7	1.32
9	36.4	9.5	45.9	1638.6	0.82
10	31.7	10.0	41.7	1488.7	0.74
11	44.3	30.1	74.4	2656.1	1.33
12	28.5	19.1	47.6	1699.3	0.85
13	46.5	30.8	77.3	2759.6	1.38
14	3.6	40.4	44.0	1570.8	0.79
15	35.0	29.5	64.5	2302.7	1.15
16	35.7	48.0	83.7	2988.1	1.49
17	44.1	18.5	62.6	2234.8	1.12
18	25.8	0.0	25.8	921.1	0.46
19	27.8	53.8	81.6	2913.1	1.46
20	34.8	15.1	49.9	1781.4	0.89
21	39.5	2.5	42.0	1499.4	0.75
22	30.6	11.2	41.8	1492.3	0.75
23	30.1	19.7	49.8	1777.9	0.89
24	41.1	36.4	77.5	2766.8	1.38
25	32.9	30.5	63.4	2263.4	1.13
26	17.0	9.3	26.3	938.9	0.47
27	44.3	26.0	70.3	2509.7	1.25
28	36.6	0.0	36.6	1306.6	0.65
29	62.0	0.0	62.0	2213.4	1.11
30	46.1	0.0	46.1	1645.8	0.82
Mean	36.5	18.8	55.2	2000.6	1.00

[1] where #/ac = g/0.25m^2 x 35.7

Calculation of sample adequacy where $n=t^2 s^2 / d^2$

$t^2_{(.90,29)}$	1.720
s^2	0.08
d^2	0.01
Samples required	14.5

2010 Reimer (Sec. 29) Dry Weight Hayland Yields					
					Sampled 6/24-29
Sample	Grasses and Others (g)	Alfalfa (g)	Total Weight (g)	Total Weight (#/ac)[1]	Total Weight (t/ac)
1	17.1	104.6	121.7	4344.7	2.17
2	3.9	85.1	89.0	3177.3	1.59
3	0.0	129.3	129.3	4616.0	2.31
4	0.0	124.3	124.3	4437.5	2.22
5	0.0	136.1	136.1	4858.8	2.43
6	1.3	82.9	84.2	3005.9	1.50
7	6.4	62.1	68.5	2445.5	1.22
8	4.5	71.7	76.2	2720.3	1.36
9	6.7	113.4	120.1	4287.6	2.14
10	6.4	142.7	149.1	5322.9	2.66
11	1.4	132.7	134.1	4787.4	2.39
12	16.4	35.2	51.6	1842.1	0.92
13	23.7	48.0	71.7	2559.7	1.28
14	9.0	125.6	134.6	4805.2	2.40
15	2.5	133.4	135.9	4851.6	2.43
16	4.9	72.1	77.0	2748.9	1.37
17	66.2	40.3	106.5	3802.1	1.90
18	59.4	51.4	110.8	3955.6	1.98
19	79.1	51.4	130.5	4658.9	2.33
20	79.2	39.7	118.9	4244.7	2.12
21	84.3	31.6	115.9	4137.6	2.07
22	59.5	59.5	119.0	4248.3	2.12
23	107.5	69.9	177.4	6333.2	3.17
24	71.7	34.9	106.6	3805.6	1.90
25	64.1	97.3	161.4	5762.0	2.88
26	82.2	59.9	142.1	5073.0	2.54
27	2.8	107.4	110.2	3934.1	1.97
28	57.4	109.4	166.8	5954.8	2.98
29	68.2	39.0	107.2	3827.0	1.91
30	48.1	15.7	63.8	2277.7	1.14
31	69.2	0.0	69.2	2470.4	1.24
32	97.5	124.7	222.2	7932.5	3.97
33	33.8	58.7	92.5	3302.3	1.65
34	105.2	128.2	233.4	8332.4	4.17
35	76.0	90.3	166.3	5936.9	2.97
36	116.7	30.8	147.5	5265.8	2.63
37	7.6	126.1	133.7	4773.1	2.39
38	101.0	58.4	159.4	5690.6	2.85
39	59.7	37.0	96.7	3452.2	1.73
40	1.0	85.1	86.1	3073.8	1.54
Mean	42.5	78.6	121.2	4326.4	2.16

[1] where #/ac = g/0.25m^2 x 35.7

Calculation of sample adequacy where $n=t^2 s^2 / d^2$

$t^2_{(.90,39)}$	1.699
s^2	0.51
d^2	0.05
Samples required	18.4

PERMANENT IMPOUNDMENT MANAGEMENT GUIDELINES

Location: NE¼ of Section 33, T.131N., R.99 W., Gascoyne Mine

Knife River Impoundment ID: 23

Landowner: Robert Perkins

The state of North Dakota requires that we obtain an agreement from the landowner to follow recommended sound management principles for permanent impoundments after release of performance bond. This agreement is necessary to allow bond release at the stage of vegetation establishment or final bond release.

While permanent impoundments are designed under strict guidelines to insure good performance for many years, periodic inspection and implementation of necessary maintenance are important. The following guidelines are based on Natural Resources Conservation Service (NRCS) recommendations. These and other reasonable operation and management practices should help to insure a properly functioning impoundment well into the future.

1. Woody plants on the embankment should be destroyed with herbicides or other means which will not affect the integrity of the embankment. Weeds which inhibit the growth of grasses should be controlled with herbicides or mowing. Fertilization and mowing of the embankment, including the emergency spillway, will encourage a dense grass sod and promote erosion control.

2. Animals which burrow into the embankment should be controlled. Grazing of the embankment should be controlled so that it does not promote erosion.

3. Any spillway inlet should be cleared of obstructions such as branches or vegetation stems which may impede the flow of water. Snow which accumulates in spillways and ice blockage of pipes should be removed if it will create flow problems.

4. Erosion in spillways or around pipe openings can be remedied through reshaping of the soil surface and seeding with appropriate plant species. If deep holes develop around pipes, the integrity of the embankment may be in question and immediate attention should be given to this problem.

5. Corrugated pipe or other man-made materials used to conduct water should be inspected periodically to insure that they are not leaking.

If questions arise regarding these management principles, the local NRCS office can provide assistance.

I have reviewed and understand the guidelines for management of permanent impoundments.

Robert Perkins — Robert Perkins

4-25-17 — Date