Milk River Project Ability-to-Pay Study

Milk River Project, North-Central Montana
Missouri Basin and Arkansas-Rio Grande-Texas Gulf Regions

U.S. Department of the Interior

September 2022

Mission Statements

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Cover photo – (Big Sky Blog, 2014).

BUREAU OF RECLAMATION
Technical Service Center, Denver, Colorado
Economic Analysis Group, 86-68270

Milk River Project Ability-to-Pay Study

Milk River Project, North-Central Montana
Missouri Basin and Arkansas-Rio Grande-Texas Gulf Regions

TODD GASTON Digitally signed by TODD GASTON
Date: 2022.09.07 22:14:25 -06'00'

Prepared by: Todd Gaston
Economist; Economic Analysis Group 86-68270

MUSTAPHA ALHASSAN Digitally signed by MUSTAPHA ALHASSAN
Date: 2022.09.08 05:19:32 -06'00'

Peer Review by: Mustapha Alhassan
Economist; Economic Analysis Group 86-68270

Contents

Page

1 Introduction **1**
1.1 Overview of Ability-to-Pay 1
1.2 Scope of this ATP Study 1
1.3 Milk River Project Background 1
2 Irrigation Ability-to-Pay Analysis **3**
2.1 Milk River Project-Irrigated Lands 4
2.2 Milk River Project Irrigation Diversions 7
2.3 Farm-Level Payment Capacity Analysis 8
2.3.1 Representative Farm Method 8
2.3.2 Representative Farm Size 9
2.3.3 Representative Farm Cropping Pattern 9
2.3.4 University Enterprise Budgets 12
2.3.5 Gross Farm Income 14
2.3.6 Farm Expenses 18
2.3.7 Payment Capacity Results 23
2.4 Evaluation of Irrigation Ability-to-Pay 24
2.4.1 Irrigation District Income 25
2.4.2 Irrigation District Expenses 30
2.5 Irrigation ATP Conclusions 32
3 M&I Ability-to-Pay Analysis **33**
3.1 Milk River Project M&I Contractors and Diversions 33
3.2 Ability-to-Pay for Water Service 35
3.3 Estimating the Ability-to-Pay Threshold 35
3.4 Household Ability-to-Pay 36
3.5 Water Payment Percentage Used to Represent ATP 38
3.6 Consideration of Economic Hardship in Evaluating ATP 38
3.7 Estimation of Household Ability to Pay 40
3.8 Summary of MRP Total M&I Ability to Pay 40
4 References **41**
Appendices **45**
Appendix A. FBT data and outputs for farm-level payment capacity analysis A-1
Appendix B. Poverty percentages for Montana communities B-1

Tables

Page

Table 2-1.—Milk River Project irrigators and irrigated lands totals 6
Table 2-2.—Contractors evaluated for irrigation ATP 7
Table 2-3.—Calculation of Milk River Project average farm size 9
Table 2-4.—Representative farm size and cropping pattern 12
Table 2-5.—Enterprise budgets used in this analysis 13
Table 2-6.—Yield (units per acre) for studied crops 17
Table 2-7.—Prices received (dollars per unit) for studied crops 17
Table 2-8.—Debt to asset ratios and interest rates for payment capacity studies conducted in FY2021 22
Table 2-9.—FBA summary results for modeled representative farm and calculation of payment capacity per acre 24
Table 2-10.—Summary of district financial statements used in ATP study 25
Table 2-11.—Calculation of Payment Capacity Income by contractor 27
Table 2-12.—Non-Operating Income calculations for MRP contractors 28
Table 2-13.—Calculation of District Income by contractor 30
Table 2-14.—District Expenses calculations for MRP contractors 31
Table 2-15.—Irrigation ATP Study results 32
Table 3-1.—Milk River Project M&I water diversions 34
Table 3-2.—Nondiscretionary expenditure modeling results (Dependent variable is log of necessary expenditure) 37
Table 3-3.—Estimated nondiscretionary expenditure (Dependent variable is log of necessary expenditure) 37
Table 3-4.—Estimated water payments as a percentage of discretionary income for estimating ATP 38

Figures

Page

Figure 1.—Montana Counties of Interest and Select Project Features. 5
Figure 2.—Cities evaluated for M&I ATP set within Montana counties of interest 34

1 Introduction

1.1 Overview of Ability-to-Pay

An ability-to-pay (ATP) study assesses the financial capability of contracting entities (contractors) to pay for existing or increased water charges and services provided by the US Bureau of Reclamation (Reclamation). The goal of an ability-to-pay study is to determine financial capability of the contractor for five years in the future. The five-year time horizon is based on Reclamation's policy to review ability to pay every five years for repayment and water service contracts entered into after March 25, 1994.

1.2 Scope of this ATP Study

The Milk River Project (MRP) contractors evaluated for ATP include eight irrigation districts that receive MRP water deliveries for commercial agricultural purposes and three cities that receive MRP water deliveries for municipal and industrial (M&I) purposes. For the purposes of this ATP study, the five-year period of analysis for estimating ATP for contractors is fiscal years 2022 through 2026. All results are estimated at a 2020 price level.

Irrigation districts are evaluated for ATP in accordance with Reclamation Manual, Directives and Standards, *Irrigation Ability-to-Pay Analyses*, PEC 11-01 (Reclamation, 2019b). Specific procedures and guidance for irrigation ATP studies is provided in Reclamation's *Technical Guidance for Irrigation Ability-to-Pay*, dated May 2004 (Reclamation, 2004a). M&I entities are evaluated for ATP in accordance with the PR&Gs (DOI, 2015) and other published literature. There is currently no Reclamation Manual, Directives and Standards specific to M&I ATP.

1.3 Milk River Project Background

The Milk River Project (MRP) is located in north-central Montana and furnishes water for the irrigation of over 140,000 acres of Project lands (Reclamation, 2018b). Principal Project features include:

- Fresno Storage Dam
- Lake Sherburne
- Nelson Storage Dam
- Dodson, Vandalia, St. Mary, Paradise, and Swift Current Diversion Dams
- Dodson Pumping Plant
- 200 miles of canals, 219 miles of laterals, and 295 miles of drains.

A water supply is furnished to project lands which are divided into the Chinook, Malta, and Glasgow Divisions and the Dodson Pumping Unit. The lands extend about 165 miles along the river from near Havre to a point 6 miles below Nashua, Montana.

The Project was conditionally approved by the Secretary of the Interior on March 14, 1903. The St. Mary Storage Unit was authorized March 25, 1905. Fresno Dam, constructed under the National Industrial Recovery Act, was approved by the President in August 1935, pursuant to the acts of June 25, 1910, and December 5, 1924. The Dodson Pumping Unit was approved by the President on March 17, 1944, under the Water Conservation and Utilization Act of August 11, 1939.

Construction of the St. Mary Storage Unit began on July 27, 1906. A treaty with Great Britain relating to the distribution between Canada and the United States of the waters of the St. Mary and Milk Rivers was signed on January 11, 1909. The Dodson Diversion Dam was completed in January 1910, and the first water delivered for irrigation in 1911. In 1915, the Nelson and Swift Current Dikes, and St. Mary Diversion Dam were completed. In 1917, the Vandalia Diversion Dam was put into operation, Lake Sherburne Dam was completed in 1921, and the Fresno Dam in 1939. The Dodson Pumping Plant was completed in 1946.

The storage works are operated by the Bureau of Reclamation. The distribution systems are operated by the Malta, Glasgow, and Dodson Irrigation Districts. The systems serving the Chinook Division, are operated by the Fort Belknap, Zurich, Harlem, Paradise Valley, and Alfalfa Valley Irrigation Districts (Reclamation, 2018c).

Benefits provided by the Project include irrigation water supply, M&I water supply, fish and wildlife enhancement, flood control, and recreation.

2 Irrigation Ability-to-Pay Analysis

An irrigation ATP study is completed subsequent to a payment capacity analysis that evaluates the farm income being generated by typical irrigators in the contracting district. Irrigation ATP is defined as the farm-level payment capacity aggregated to the entire irrigation district, minus district existing obligations, operations, maintenance, and replacement (OM&R) costs, power costs, and reserve fund requirements. If the contractor has documented sources of non-farm-related income, they may also be incorporated into the analysis. The derived ATP amount is sometimes referred to as the annual loan amortization capacity.

Irrigation ATP studies consider the district as a business entity that generates revenues and incurs expenses. On the revenue side of the ledger, the district (or business entity) generates income by collecting payments from water users within the district. These collections may take the form of water assessments, account charges, or tax levies collected by the county assessor. On the expense side, the district as a whole incurs operational expenses for the reservoirs, canals, laterals, and drains so that irrigation water may be delivered to individual farms. Districts also incur long-term debt obligations to the United States and/or other entities, thus incurring annual debt service for loans, bonds, etc.

In an ATP study, financial information is gathered to evaluate existing and projected sources of revenue and financial obligations of the district. This information comes from financial statements provided by the district. Although data on current and recent financial operations are collected, the goal of an ATP study is to determine financial capability of the district for five years into the future. The five-year time horizon is based on Reclamation's policy to review ATP every five years for repayment and water service contracts entered into after March 25, 1994.

The steps necessary to complete an ATP study include:

1. Completing a farm-level payment capacity analysis;
2. Aggregating the farm-level payment capacity results to district-level payment capacity (Payment Capacity Income); and
3. Analyzing the district-level financial reports such as the profit and loss statement and the district's balance sheet for district expenses and/or other income sources available.

Step 1—the payment capacity analysis—provides per-acre estimates of net farm revenues from crops grown in the district. The payment capacity analysis depends on primary and secondary data sources that allow the analysis to reflect local operating conditions such as cropping patterns, yields, operating costs, and farm-level revenues.

Steps 2 and 3 combine to form the ATP study. In Step 2, Payment Capacity Income (the district-level income available from lands served by the district) is computed by multiplying the per-acre payment capacity estimate by the number of acres assessed by the district. Payment Capacity Income is considered the primary source of income available to the district for an ATP study.

Step 3 evaluates the financial statements of the district. Non-farm sources of income available to the District (if any) and annual operating expenses are examined, as well as the availability of excess district-level reserve funds required for scheduled and emergency repairs and replacements. Generally, financial data for the most recent five years is used in an ATP study. All irrigation ATP results are estimated at a 2020 price level.

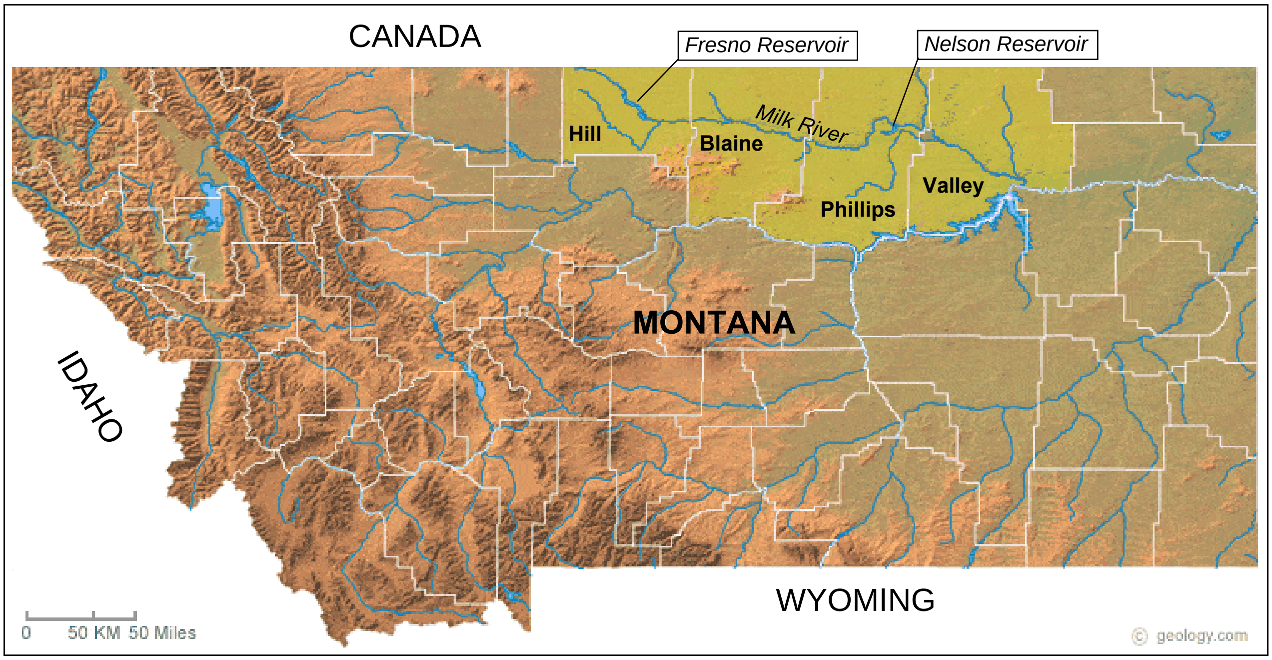
2.1 Milk River Project-Irrigated Lands

All lands that receive, or are eligible to receive, MRP irrigation water are henceforth referred to as MRP-irrigated lands. The entirety of MRP-irrigated lands falls within four north-central Montana counties, specifically (listed west to east): Hill County, Blaine County, Phillips County, and Valley County (see Figure 1 below).

The entities that irrigate commercial agricultural lands with MRP-delivered water can be classified into five general categories: (1) irrigation districts; (2) district pumpers; (3) river pumpers;
(4) private lands irrigators; and (5) Indian reservations. These entities are described below and further detailed in Table 2-1.

Irrigation districts are municipal entities that hold a contract with Reclamation to deliver Project water to their constituents. The eight irrigation districts receiving Project water total about 101,134 irrigated acres and make up approximately 72 percent of MRP-irrigated lands. The largest single irrigation district is Malta Irrigation District, at 44,844 acres of MRP-irrigated lands. All eight irrigation districts are party to the Milk River Joint Board of Control (JBOC)—a body consisting of representatives from the eight irrigation districts that works with Reclamation to develop annual operations and maintenance plans and in setting annual water allotments (Reclamation, 2012).

District pumpers are commercial irrigators with contracts through one of the eight irrigation districts for Project irrigation water. District pumpers make up 559 acres of MRP-irrigated lands, or about 0.04 percent of total MRP-irrigated lands. District pumpers are considered party to the JBOC, as the contracts are held through a JBOC irrigation district.



Source: Adaptation of Montana Physical Map (Geology.com, 2018)

Figure 1.—Montana Counties of Interest and Select Project Features.

River pumpers are private commercial farmers that hold a contract with directly with Reclamation for Project irrigation diversions to their farmlands (Phillips Co. Ext., 2018). There are about 150 river pumper contracts for the irrigation of approximately 8,336 acres of private farmland, or about six percent of total MRP-irrigated lands. River pumpers are not party to the JBOC.

Private land irrigators are private landholders that hold an individual water right with the state of Montana and fulfill this water right through pumping from the Milk River (Phillips Co. Ext., 2018). The Project enables for these water rights to be satisfied, and thus, the acreage irrigated by way of these water rights are included in MRP-irrigated lands for the purpose of this study. Approximately 25,000 acres are irrigated through these state-held water rights, making up about 18 percent of MRP-irrigated lands. Private land irrigators are not party to the JBOC.

Indian reservations are tribal entities that deliver Project water to constituent farmers. The sole Indian reservation receiving Project irrigation water is Fort Belknap Indian Reservation. Fort Belknap Indian Reservation is the senior water right holder for natural flow. This translates to an entitlement of one-seventh of the natural flows stored in Fresno Dam, as calculated through an accounting process. Fort Belknap Indian Reservation is not party to the JBOC.

Table 2-1.—Milk River Project irrigators and irrigated lands totals

Irrigator	Irrigated acres	Member of JBOC (Y/N)
IRRIGATION DISTRICTS*	101,134	
Malta ID	*44,844*	Y
Glasgow ID	*18,011*	Y
Harlem ID	*11,148*	Y
Paradise Valley ID	*8,315*	Y
Zurich	*7,664*	Y
Fort Belknap	*6,482*	Y
Alfalfa Valley	*3,664*	Y
Dodson Pumping Unit	*1,006*	Y
DISTRICT PUMPERS*	559	
Glasgow pumpers	*327*	Y
Malta pumpers	*232*	Y
RIVER PUMPERS	8,211	
~150 contracts with Reclamation	*8,211*	N
PRIVATE LAND IRRIGATORS	25,000	
Water rights held with State of Montana	*25,000*	N
INDIAN RESERVATIONS	5,500	
Fort Belknap Indian Reservation	*5,500*	N
Total JBOC MRP-irrigated lands	101,693	
Total non-JBOC MRP-irrigated lands	38,711	
Grand total MRP-irrigated lands	140,404	

Sources: primary source for MRP-irrigated acres is *Allocation of Operation, Maintenance and Replacement Expenses: Milk River Project* (Reclamation, 2005) and updates provided in email correspondence with Reclamation's MTAO (Reclamation, 2018b).

The eight irrigation districts and two affiliated district pumpers comprise approximately 72 percent of MRP-irrigated lands, and are the contracting entities evaluated for irrigation ATP. Lands irrigated by Malta pumpers are combined with Malta Irrigation District and evaluated as a single contractor. Likewise, lands irrigated by Glasgow pumpers are combined with Glagow Irrigation District and evaluated as a single contractor. The eight contractors evaluated for irrigation ATP and total assessed acres are listed in Table 2-2 by order of greatest to least acres. All contractors evaluated for ATP are party to the JBOC.

Table 2-2.—Contractors evaluated for irrigation ATP

Contractor	Acreage
Malta ID + Malta pumpers[a]	45,076
Glasgow ID+ Glasgow pumpers[a]	18,338
Harlem ID	11,148
Paradise Valley ID	8,315
Zurich	7,664
Fort Belknap	6,482
Alfalfa Valley	3,664
Dodson Pumping Unit	1,006

[a] Acreage associated with district pumpers is combined with the affiliated district and evaluated as a single contractor.

2.2 Milk River Project Irrigation Diversions

Reclamation defines water supply as irrigation-use in Reclamation Manual PEC P05 (Reclamation, 2014b) as water that is used to "…irrigate land primarily for the production of commercial agricultural crops or livestock, and domestic and other uses that are incidental thereto." As further described in PEC P05, irrigation use does not include uses such as "…watering golf courses; lawns and ornamental shrubbery used in residential and commercial landscaping, household gardens, parks and other recreational facilities; pasture for animals raised for personal purposes or for nonagricultural commercial purposes; cemeteries; and similar uses…" In addition, irrigation use does not include "…commercial agricultural uses that do not require irrigation, such as fish farms and livestock production in confined feeding or brooding operations…" (e.g., dairy farm operations).

A conversation with the JBOC Project Manager provided historical Project irrigation diversions data (JBOC, 2018a). Average annual Project irrigation diversions to JBOC member lands over the 11-year period 2007–2017 were 1.75 AF per acre. The JBOC Project Manager further explained that diversion allotments are set at beginning of the irrigation season, and that farmers generally don't go under their allotment. Diversions differ from deliveries in that between the river or dam outlet structure (point of *diversion*) and the farm gate (point of *delivery*), there may be losses due to seepage or other factors. No data was provided regarding the estimated water lost due to seepage or other factors.

All Project irrigation diversions are made from April through September (the irrigation season). There are no releases after October from St. Mary's Basin due to weather and lack of reliability (Reclamation, 2018a). Phillips County Extension clarifies that consistent irrigation diversions—and thus the primary irrigation season—is May 1 through September 15 (Phillips Co. Ext., 2018).

2.3 Farm-Level Payment Capacity Analysis

A farm-level payment capacity analysis estimates irrigation payment capacity for the commercial agricultural operations receiving project irrigation deliveries. Per Reclamation policy (Reclamation, 2019b), farm-level payment capacity is the estimated residual net farm income of irrigators generated from the production and sales of commercial crops that is available to pay for Reclamation project costs allocated to irrigation, after deducting on-farm production and investment expenses, as well as appropriate allowances for management, equity, and labor. Payment capacity is determined by estimating on-farm economic and financial conditions expected to occur in the next 5 years with the Federal project in place.

Irrigation payment capacity is determined using a *farm budget analysis* (FBA). The FBA models a farm or farms representative of the MRP-affected area subject to expected water supply conditions with the project in place. The FBA determines residual net farm income on a per-acre basis, considering farm revenues and production expenses, and excluding existing water charges. The FBA is conducted using Reclamation's *farm budget tool* (FBT), a software application developed by Reclamation. Summary tables are presented in the body of this report. Comprehensive FBT inputs and outputs are included as Appendix A of this report and details all revenues and expenses associated with the FBA.

Cropping pattern, farm size, irrigated acreage, and numerous other inputs and assumptions used in this irrigation ATP analysis were first researched and reported in the irrigation benefits technical report prepared in support of the 2019 Fresno Dam Safety of Dams study (Reclamation, 2019a). That irrigation benefits technical report is henceforth referred to as the *2019 IBTR*.

2.3.1 Representative Farm Method

Cropping pattern and farm size are major factors in determining irrigation payment capacity. Reclamation's technical guidance (Reclamation, 2004b) recommends that enough farm types be analyzed to reflect the kinds of farm organizations and enterprises influencing the payment capacity of the area as a whole. It is often not practical to complete farm budgets for all crops grown on project-irrigated lands. If certain crops are grown only on a small percentage of project-irrigated acres, they can be represented by a more extensively grown crop in the same general category of crops (e.g., forage, grain, orchard, vegetables, etc.).

If the typical Reclamation project irrigator also irrigates lands with water from non-Reclamation sources, those lands should be included. If irrigators integrate non-irrigated crops and pasture and/or livestock enterprises into their farm operation, the analysis should include the income and expenses of those enterprises. In summary, payment capacity should reflect returns to the entire operating unit.

MRP-irrigated lands all grow crops in the same general category, and therefore, a single representative farm is developed to represent the full-time farming operations (commercial agriculture) utilizing MRP water deliveries. All representative farm acres are modeled using an extensively grown crop or crops from the same general category. The representative farm therefore constitutes all MRP acres, while only a select number of extensively grown crops are modeled.

In summary, the results of the FBA for the single representative farm will serve as the basis for estimating Payment Capacity Income for all eight contractors evaluated for irrigation ATP.

2.3.2 Representative Farm Size

Per Reclamation guidelines (Reclamation, 2004b), the representative farm reflects full-time irrigated enterprises within the MRP area and is of adequate size to provide a fair return to land, labor, and capital. The PR&Gs recommend using a minimum farm size that provides reasonable full employment for the farm operator based on the amount of investment and management expected for the type of farm represented. Conversations with local agricultural experts confirmed that farm sizes and cropping patterns were relatively consistent amongst farms receiving Project irrigation diversions, regardless of county. Therefore, the representative farm size is based on the average farm size across Hill, Blaine, Phillips, and Valley counties.

Average county-level farm sizes were calculated using 2012 Census of Agriculture data obtained from the US Department of Agriculture's National Agricultural Statistics Service (USDA-NASS) (USDA-NASS, 2021). As displayed in Table 2-3, the average farm size across Hill, Blaine, Phillips, and Valley counties is 2,991 acres. This study rounds up from this average and assumes 3,000 agricultural acres for the modeled representative farm. An additional 150 acres of land is included as farmstead, roads, and waste acreage—which are assumed to be about 5 percent of agricultural acres—and are included in total farm size. A farm size of 3,150 acres meets the PR&Gs criteria for minimum farm size.

Table 2-3.—Calculation of Milk River Project average farm size

Montana counties With-Project lands	Farm acres	Number of farms	Average farm size (acres)
Hill	1,597,982	802	1,992
Blaine	2,204,248	546	4,037
Phillips	2,066,540	507	4,076
Valley	1,634,642	654	2,499
All counties	7,503,412	2,509	2,991

Source: 2012 Census of Agriculture (USDA-NASS, 2021)

2.3.3 Representative Farm Cropping Pattern

The cropping pattern for the representative farm models agricultural practices with the Project in its current state. Therefore, the representative farm cropping pattern reflects current and recent agricultural practices.

The representative farm cropping pattern is primarily based on previously published literature estimating Milk River Project irrigation benefits (Reclamation, 2003) and Milk River Project irrigation efficiency (Dalton, 1999). The cropping pattern was modified to reflect contemporary agricultural practices and farm sizes using the USDA-NASS online database and correspondence with agricultural experts familiar with local agricultural practices—including Montana State University Extension (MSU Extension) specialists and USDA Farm Service Agency (FSA) agents for Blaine, Phillips, and Valley counties. The representative farm is developed to represent all four MRP-affected counties (Hill, Blaine, Phillips, and Valley), and therefore cropping patterns and agricultural practices do not specifically reflect any one county, but rather a rounded central tendency across the four counties of interest.

The JBOC Project Manager explained that the average JBOC farm operation receiving Project water receives irrigation diversions for five to ten percent of their total farmland (JBOC, 2018a). Reclamation and JBOC data indicate that JBOC irrigators receive irrigation diversions for about 100,000 acres of land pursuant to approximately 600 contracts, making the average JBOC irrigation contract for about 170 acres—or approximately five percent of a 3,150-acre farm—which is consistent with the JBOC Project Manager's input. Therefore, this study assigns 200 irrigated acres to the representative farm, while the 2,800 non-irrigated agricultural acres are assigned to dryland farming. This is consistent with Reclamation's *Technical Guidance for Irrigation Payment Capacity*, which states: "If irrigators integrate non-irrigated crops and pasture and/or livestock enterprises into their farm operation, the analysis should include the income and expenses of those enterprises. In summary, payment capacity should reflect returns to the entire operating unit" (Reclamation, 2004b). The remaining 150 acres consists of farmstead, roads, and waste acreage—which are assumed to be about 5 percent of agricultural acres—and are included in total farm size in the farm budget.

The 200 acres of irrigated cropland include: 100 acres of irrigated alfalfa hay, 70 acres of irrigated feed barley, and 30 acres of irrigated pasture. The 2,800 dryland acres include: 1,350 acres of dryland pasture; 1,000 acres of dryland spring wheat; 300 acres of dryland feed barley; and 150 acres of dryland peas.

2.3.3.1 Representative Farm Irrigated Acreage

Irrigated feed barley is an annual crop in north-central Montana, while irrigated alfalfa hay and irrigated pasture are both perennial crops. Irrigated alfalfa hay in north-central Montana has a stand life of five years—one establishment year and four years of full production (Phillips Co. Ext., 2018). This study therefore assumes that in the typical year one-fifth of irrigated alfalfa hay acreage (20 acres) is in establishment, while four-fifths of irrigated alfalfa hay acreage (80 acres) is in full production.

Irrigated pasture in north-central Montana has a stand life of ten years—one establishment year and nine years in full production. This study therefore assumes that in the typical year one-tenth of irrigated pasture (three acres) is in establishment, while nine tenths (27 acres) is in full production.

2.3.3.2 Representative Farm Dryland Acreage

Dryland pasture is a perennial crop in north-central Montana, while dryland spring wheat, dryland feed barley, and dryland peas are all annual crops. Dryland pasture in north-central Montana is generally not actively managed and consists of approximately 75 percent native grasses (e.g., western wheatgrass, stipa grasses, and green needlegrass) and 25 percent tame grass species (e.g., crested wheatgrass, fescues, and orchardgrass) (Phillips Co. FSA, 2018). This study assumes that native grasses are not actively maintained (beyond grazing rotations), while tamegrass species are replanted every 10 years and actively maintained to a lesser degree than irrigated pasture (e.g., minimal fertilization and herbicides).

Dryland spring wheat in north-central Montana requires rotating cropland every third year into a fallow cycle. The With-Project condition representative farm therefore allocates one third of dryland wheat acreage (333 acres) to fallow, while the remaining two thirds of dryland wheat acreage (667 acres) is under cultivation. Yields and agricultural inputs are multiplied by a factor of two-thirds and fallowing preparation and maintenance costs are multiplied by a factor of one-third to accommodate the fallow cycle in the FBA.

Dryland feed barley is often rotated with dryland alfalfa, but this study does not explicitly account for such a rotation. Acreage cropped to dryland peas has trended up in recent years, and in Valley County has surpassed acreage cropped to dryland hay (Valley Co. FSA, 2018). This is reflected by the representative farm including 150 acres of dryland peas.

The cropping pattern for the modeled representative farm is displayed below in Table 2-4.

Table 2-4.—Representative farm size and cropping pattern

Crop studied	Representative farm acreage
IRRIGATED CROPS	
Irrigated alfalfa hay	100
1st year irrigated alfalfa hay	*20*
Full production irrigated alfalfa hay	*80*
Irrigated feed barley	70
Irrigated pasture (tame species)	30
1st year irrigated pasture	*3*
Full production irrigated pasture	*27*
DRYLAND CROPS	
Dryland pasture (native & tame)	1,350
Dryland spring wheat	1,000
Cropped dryland wheat acreage	*667*
Fallowed dryland wheat acreage	*333*
Dryland feed barley	300
Dryland peas	150
Sub-total[a]	3,000
Farmstead, roads, waste acreage[b]	150
Total farm size[c]	3,150

[a] Total agricultural acreage, including cropped and fallowed acres.

[b] Farmstead, roads, and waste acreage are assumed to be about 5 percent of agricultural acres and are included in total farm size in the FBA.

[c] Total farm size for representative farm modeled.

2.3.4 University Enterprise Budgets

Enterprise budgets from several universities are used to develop the farm budgets used in estimating farm-level payment capacity. These budgets provide the basis for farm size, fertilizers, chemicals, farming operations, etc. All enterprise budgets and their respective sources are listed in Table 2-5. Cultural details for each crop come from the respective university enterprise budget(s) unless otherwise noted.

Table 2-5.—Enterprise budgets used in this analysis

Crop/Year/Title	Source
Alfalfa Hay	
2008 Northwestern Nevada Alfalfa Hay Establishment, Production Costs and Returns	University of Nevada Cooperative Extension
2012 Sample Costs to Establish and Produce Alfalfa Hay – Intermountain Siskiyou County, Scott Valley [California] – Mixed Irrigation	University of California Cooperative Extension
2013 Costs and Returns Estimate – Northern Idaho: Alfalfa Establishment with Barley	University of Idaho CALS
2017 Costs and Returns Estimate – Eastern Idaho: Alfalfa Hay Establishment in Grain Stubble	University of Idaho CALS
2017 Costs and Returns Estimate – Eastern Idaho: Alfalfa Hay Production	University of Idaho CALS
Feed Barley	
2017 Costs and Returns Estimate – Eastern Idaho: Lower Rainfall Dryland Feed Barley	University of Idaho CALS
2017 Costs and Returns Estimate – Eastern Idaho: Spring Feed Barley	University of Idaho CALS
Pasture	
2007 Costs and Returns Estimate – Southcentral Idaho: Magic Valley Pasture	University of Idaho CALS
2008 Sample Costs to Establish and Produce Pasture – Irrigated in the Intermountain Region – Shasta, Lassen, and Modoc Counties	University of California Cooperative Extension
Spring Wheat	
2017 Costs and Returns Estimate – Eastern Idaho: Lower Rainfall Dryland Hard White Spring Wheat	University of Idaho CALS
Multiple Crops (including Alfalfa, Barley, Peas, and Wheat)	
2014 Projected Budgets for Irrigated Crops – Western North Dakota	North Dakota State Univ. Extension Service
2016 Enterprise Budgets – District 1 Wheat Rotations Under Conventional Tillage	University of Idaho CALS
2017 Projected 2017 Crop Budgets – North West North Dakota	North Dakota State Univ. Extension Service

The specific assumptions used in the representative farm budgets are discussed in subsequent sections of this report. These sections of the report explain how gross revenues are estimated, the variable and fixed expenses included, and returns to management and labor.

2.3.5 Gross Farm Income

Gross farm income for crops is calculated by multiplying the total units yielded by the price received per unit. In accordance with Reclamation Policy PEC 11-01, prices and yields used in this study reflect the typical farm production practices for modeled farm types in the study area and primary data is collected in cases where published data do not reflect typical conditions (Reclamation, 2019b).

2.3.5.1 Crop Yields

Reclamation's *Technical Guidance for Irrigation Payment Capacity* states that crop yields for payment capacity should be established at levels expected to be representative of the next five years of operation (Reclamation, 2004b). The primary source used for crop yields is USDA-NASS (USDA-NASS, 2021). Table 2-6 reports the five-year average of county-level yields for the studied crops for each MRP-affected county, the four-county average for each studied crop, and the value used in the FBA. The five-year range reported in Table 2-6 for each crop is the most recent five years where data is available for all four counties of interest. The four-county average is the average of the county-level five-year averages across the four counties of interest. Those instances where "value used" is not the four-county average are those crop yields that local agricultural experts suggested are not typical of Project area farms and they provided a more representative value. Details of the derivation of these yields follows.

2.3.5.1.1 Irrigated Alfalfa Yields

Irrigated alfalfa in north-central Montana generally produces two good cuttings per season, and sometimes a third, lesser cutting, near Labor Day (Phillips Co. FSA, 2018). Irrigated alfalfa hay yields reported by USDA-NASS for the four MRP-affected counties are the best available published data for use in this study. The most recent five years of available yield data for irrigated alfalfa hay for the four counties are 2004–2008 (USDA-NASS, 2021). The four-county average for irrigated alfalfa yields is 3.18 tons per acre. Area agricultural experts confirmed this as a representative value, and it is therefore the value used in the FBA.

As described above in Section 2.3.3.1, irrigated alfalfa hay in north-central Montana has a stand life of five years—one establishment year and four years of full production. Establishment year alfalfa hay is assumed to have a lower yield than the full production years. The yield differences between establishment and full production years are accounted for in the FBA.

2.3.5.1.2 Irrigated Feed Barley Yields

Irrigated feed barley in north-central Montana is planted in April and harvested in August (U. ID CALS, 2017e). Irrigated feed barley yields reported by USDA-NASS for the four MRP-affected counties are the best available published data for use in this study. There is no consecutive five-year period in the last 20 years with reported yield data for all four counties of interest. Therefore, the 10-year average (1999–2008) is used, as yield data is reported for three of the four counties throughout most of this range (USDA-NASS, 2021). The four-county average for irrigated feed barley yields is 62 bushels per acre.

Correspondence with the Valley County FSA Executive Director revealed 62 bushels per acre to be low and suggested 70 bushels per acre as more typical of irrigated feed barley yields in the Project area (Valley Co. FSA, 2018). The FBA therefore uses 70 bushels per acre for irrigated feed barley yield.

2.3.5.1.3 Irrigated Pasture Yields

The grazing season for MRP-irrigated pasture is limited to the primary irrigation season—May 1st through September 15th (Phillips Co. Ext., 2018). USDA-NASS does not report irrigated pasture yields. The irrigated pasture yield of 2.5 animal unit months (AUM) per acre used in this study is a conservative estimate based on regionally-specific literature and input from Phillips County MSU Extension.

The USDA Natural Resources Conservation Service (USDA-NRCS) publication *Unlocking the Power of Irrigated Pasture* suggests that sprinkler-irrigated pasture in Montana achieves yields between 2.6 and 3.9 AUMs per acre, while flood-irrigated pasture achieves yields between 1 and 3 AUMs per acre (USDA-NRCS, 2010). MRP-irrigated acreage uses a mix of flood, wheel-line, and center-pivot irrigation, thus 2.5 AUMs per acre is a reasonable assumption for irrigated pasture yield. 2.5 AUMs per acre was confirmed by Phillips County MSU Extension (Phillips Co. Ext., 2018) and it is therefore the value used in the FBA.

As described above in Section 2.3.3.1, irrigated pasture is a perennial crop with a stand life of ten years—one establishment year and nine years of full production. The yield differences between establishment and full production years are accounted for in the FBA.

2.3.5.1.4 Dryland Pasture Yields

The grazing season for dryland pasture in north-central Montana is May 1st through November 15th (Phillips Co. FSA, 2018). USDA-NASS does not report dryland pasture yields. The dryland pasture yield of 0.28 AUMs per acre used in this study is a conservative estimate based on regionally specific literature and input from multiple county FSA offices and Phillips County MSU Extension.

Correspondence with Phillips and Valley County FSA offices and Phillips County Extension indicates that approximately 75 percent of dryland pasture is native species (providing about 0.23 AUMs per acre) and 25 percent of dryland pasture is tame grass species (providing about 0.42 AUM per acre) (Phillips Co. FSA, 2018) (Valley Co. FSA, 2018) (Phillips Co. Ext., 2018). The weighted average across all Project area dryland pasture is therefore assumed to be 0.28 AUMs per acre (75% x 0.23 + 25% x 0.42 = 0.28 AUMs per acre). This input is corroborated in the USDA-NRCS publication *Montana Grazing Animal Unit Month (AUM) Estimator* (USDA-NRCS, 2008) and 0.28 AUMs per acre is therefore the value used in the FBA.

As described above in Section 2.3.3.2, dryland pasture is a perennial crop. It is assumed that the 75 percent of dryland pasture composed of native species is not actively maintained, but that 25 percent of dryland pasture composed of tame grass species has a stand life of ten years—one establishment year and nine years of full production. The yield differences between establishment and full production years for the tame grass species portion of dryland pasture are accounted for in the FBA.

2.3.5.1.5 Dryland Spring Wheat Yields

Dryland spring wheat in north-central Montana is planted in May and harvested in August (Phillips Co. Ext., 2018). Dryland spring wheat yields reported by USDA-NASS for the four MRP-affected counties are the best available published data for use in this study. The most recent five years of available yield data for dryland spring wheat for the four counties are 2002–2006 (USDA-NASS, 2021). The four-county average for dryland spring wheat yields is 25.0 bushels per acre.

Correspondence with the Valley County FSA Executive Director revealed this value to be low and suggested 30 bushels per acre as more typical of dryland spring wheat yields in the Project area (Valley Co. FSA, 2018). The FBA therefore uses 30 bushels per acre for dryland spring wheat yield. Accommodating the one-third of dryland spring wheat acreage in fallow in a given year, this yield is expressed as 20 bushels per acre (30 bushels per acre x 2/3 of spring wheat acreage in cultivation) in the FBA.

2.3.5.1.6 Dryland Feed Barley Yields

Dryland feed barley in north-central Montana is planted in May and harvested in August (U. ID CALS, 2016). Dryland feed barley yields reported by USDA-NASS for the four MRP-affected counties are the best available published data for use in this study. The most recent five years of available yield data for dryland feed barley for the four counties are 2002–2006 (USDA-NASS, 2021). The four-county average for dryland feed barley yields is 36 bushels per acre.

Correspondence with the Valley County FSA Executive Director revealed this value to be low and suggested 40 bushels per acre as more typical of dryland feed barley yields in the Project area (Valley Co. FSA, 2018). The FBA therefore uses 40 bushels per acre for dryland feed barley yield.

2.3.5.1.7 Dryland Pea Yields

Dryland peas in north-central Montana are planted by May 15 and harvested by the end of July or early August (Phillips Co. Ext., 2018). Dryland pea yields reported by USDA-NASS for the four MRP-affected counties are the best available published data for use in this study. The most recent five years of available yield data for dryland peas for the four counties are 2016–2021 (USDA-NASS, 2021). The four-county average for dryland pea yields is 16.2 hundredweights (CWT) per acre. Area agricultural experts confirmed this as a representative value, and it is therefore the value used in the FBA.

Table 2-6.—Yield (units per acre) for studied crops

Crop studied	Unit	5-year average by county (units/acre) Yrs. Used[a]	Blaine	Hill	Phillips	Valley	4-county avg.	Value Used[b] (units/acre)
IRRIGATED CROPS								
Irrigated alfalfa hay	Ton	2004–08	3.09	3.20	2.79	3.63	3.18	3.18
Irrigated barley (feed)[c]	BU	1999–2008	61	--	65	60	62	70
Irrigated pasture[d]	AUM	NA	--	--	--	--	--	2.5
DRYLAND CROPS								
Dryland pasture[d]	AUM	NA	--	--	--	--	--	0.28
Dryland spring wheat[e]	BU	2002–06	25.6	24.0	25.4	25.0	25.0	30
Dryland barley (feed)[f]	BU	2002–06	36	41	37	29	36	40
Dryland peas (dry, edible)	CWT	2016–20	18.1	14.5	15.5	16.8	16.2	16.2

[a] The 5 most recent consecutive years with reported yield data for all 4 counties. Barley required a 10-year average to populate an adequate data set (USDA-NASS, 2021).

[b] The yield value used in the FBA modeling. Unless otherwise noted, this is the 4-county average for the 5 years shown.

[c] Correspondence with the Valley County FSA Executive Director revealed 62 BU/acre to be low and suggested 70 BU/acre as more typical of irrigated feed barley yields in the Project area (Valley Co. FSA, 2018).

[d] USDA-NASS does not report pasture yields, thus yields for irrigated and dryland pasture yields were obtained through correspondence with local agricultural experts and relevant published literature (see sections 2.3.5.1.3 and 2.3.5.1.4 for details).

[e] Correspondence with the Valley County FSA Executive Director revealed 25 BU/acre to be low and suggested 30 BU/acre as more typical of dryland spring wheat yields in the Project area (Valley Co. FSA, 2018).

[f] Correspondence with the Valley County FSA Executive Director revealed 36 BU/acre to be low and suggested 40 BU/acre as more typical of dryland feed barley yields in the Project area (Valley Co. FSA, 2018).

2.3.5.2 Prices Received

Reclamation's standard procedure for prices received is to average the most recent five years of available data. It is preferable to use local or county prices received, but, in most cases, published data is not available at lower than the State level. Crop prices received for all crops included in the FBA are the five-year average (2016–2020) of state-level prices for Montana as reported by NASS (USDA-NASS, 2021). The metric used for pasture price received is the pasture rental rate AUM. All prices received used in this analysis are reported below in Table 2-7.

Table 2-7.—Prices received (dollars per unit) for studied crops

Crop studied	Unit	2016	2017	2018	2019	2020	5-yr avg.[a]
Alfalfa hay	Ton	$134.00	$142.00	$148.00	$143.00	$132.00	$139.80
Barley (feed)	BU	$2.49	$2.60	$3.51	$2.94	$3.46	$3.00
Pasture (rent per month)	AUM	$24.00	$24.50	$24.50	$24.50	$23.50	$24.20
Spring wheat	BU	$4.76	$6.21	$5.37	$4.81	$5.30	$5.30
Peas (dry, edible)	CWT	$10.50	$11.00	$9.56	$8.89	$8.87	$9.80

[a] 5-year average (2016-20) of price received per unit for the state of Montana as reported by USDA-NASS (USDA-NASS, 2021).

2.3.6 Farm Expenses

Expenses were taken from university enterprise budgets, discussions with JBOC, and others knowledgeable about Project agriculture.

All expenses except for real estate investment are indexed to 2020 dollars within the FBT. 2020 is the last year for which index and price data is available (USDA-NASS, 2021), and is therefore the base year set within the FBT and the year in which all results are reported. Comprehensive input data used to develop farm expenses is reported in Appendix A of this report. General farm expenses are discussed here.

2.3.6.1 Real Estate Investment

Real estate investment is included in the FBA to estimate interest cost on loans. Real estate investment values in a payment capacity study should reflect its current agricultural use value, which may differ from the market value. The real estate investment values used in the FBA are calculated as the five-year average (2016–2020) for non-irrigated cropland and pastureland value for the state of Montana, as reported by NASS (USDA-NASS, 2021).

USDA-NASS reports an irrigated cropland value for the state of Montana, which accounts for the costs of facilities and equipment for irrigating Montana cropland. Being a statewide average, this value lacks regional and irrigation system-type specificity. This analysis attains a higher level of specificity for irrigated acreage by using a non-irrigated cropland value as the real estate investment and subsequently including the irrigation equipment and facilities costs specific to MRP-irrigated lands. Irrigation system investment costs are discussed below in Section 2.3.6.3.1.

The five-year average value for Montana non-irrigated cropland is $828 per acre and is used as the real estate investment value for all modeled crop acreage except for dryland pasture. The five-year average value for Montana pastureland is $667 per acre and is used as the real estate investment value for the modeled dryland pasture acreage.

2.3.6.2 Buildings and Improvements

Annual investment and repair costs are included for buildings and improvements in the representative farm budgets. These costs include items such as fuel tanks, wells and pumps, shop buildings, and tools, etc.

Building investments on full-time farms in the area vary widely. This study includes a building/infrastructure complement for each representative farm based on the university enterprise budgets used in developing the farm (see Section 2.3.4 for further detail about university enterprise budgets). The representative farm includes a machine shed valued at $60,000 and a storage shed valued at $26,000 (both in 2010 dollars).

2.3.6.3 Irrigation Expenses

Irrigation expenses for the representative farm include irrigation system investment, operation, depreciation, and repair costs. These expenses are obtained from local sources and university enterprise budgets.

2.3.6.3.1 Irrigation System Investment Costs

Correspondence with the JBOC indicates that of the irrigated acres within JBOC membership about 15 percent are irrigated by center-pivot systems, 5 percent are irrigated by wheel-line systems, and the remaining 80 percent are flood-irrigated (JBOC, 2018b). For the purpose of this analysis, all MRP-irrigated acres are assumed to be irrigated by these methods in the same proportions. Thus, of the 200 irrigated acres included in the representative farm, 160 acres (80 percent) are flood-irrigated, 30 acres (15 percent) are irrigated by center-pivot, and 10 acres (5 percent) are irrigated by wheel-line.

Investment and repair costs for the irrigation systems are taken from university enterprise budgets. The wheel-line irrigation system is assumed to be $395 per acre (in 2012 dollars) with repair costs of two percent a year of the investment cost (UC Coop. Ext., 2012). The center-pivot irrigation system is assumed to be $625 per acre (in 2014 dollars) with repair costs of two percent a year of the investment cost (NDSU Ext. Service, 2014). Initial investment for the flood irrigation system is assumed to be $465 per acre (in 2011 dollars) with annual repair costs of $13.95 per acre for maintenance costs on ditches such as hauling dirt to fix washouts, broken head gates and machinery costs to weed the ditches (Reclamation, 2014a).

2.3.6.3.2 Irrigation Electricity Costs

The base power rate, load charges, and demand charges for all Project irrigation-related pumping were obtained from Big Flat Electric, the primary provider of power for agricultural use in the area (Big Flat Electric, 2021). The base power rate for all irrigation-related pumping is $0.077 per kilowatt-hour. The demand charge for up to 100 kw is $7.00 per kw and for over 100 kw's is $14.00 per kw. Lastly, the base charge is $58.00 per month during the five-month primary irrigation season (May through September).

Representative values for pumping lift (feet) and pumping pressure (PSI) for the area were obtained from university enterprise budgets. Pumping lift is assumed to be five feet across Project irrigated lands, for pumping surface water up out of storage cans. Pumping pressure for the wheel-line and center-pivot systems is assumed to be 70 PSI. There are no pumping costs associated with flood-irrigated or dryland acreage.

2.3.6.4 Machinery Costs

Information on cultural practices, machinery and equipment needed, time of use, new costs, depreciation, fuel, and repair costs were obtained from the respective university enterprise budget for each crop when possible (see Section 2.3.4). Supplemental sources used include the Pacific Northwest Extension Publication *Costs of Owning and Operating Farm Machinery in the Pacific Northwest: 2011* (Painter, 2011).

In accordance with Reclamation policy PEC 11-01, the investment value for power implements, non-power implements, and vehicles is adjusted to 60 percent of new purchase price to reflect a mix of new and used equipment (Reclamation, 2019b). Likewise, life hours (life miles in the case of vehicles) are adjusted to 60 percent of the hours or miles expected for new equipment. This adjustment has an impact on the calculation of taxes, interest on debt, insurance, and return-to-equity.

Fuel, oil, grease, and repair costs are calculated on a per hour basis for farm equipment and on a per mile basis for vehicles, and then multiplied by the total hours or miles the equipment is used to calculate the total maintenance cost.

2.3.6.5 Depreciation

Depreciation is calculated for machinery, vehicles, buildings, and improvements using the straight-line depreciation method. Buildings, vehicles, and machinery generally have maximum useful lives of 40 years, 10 years, and 25 years, respectively, although the equipment life in the analysis is usually less than the maximum useful life and varies based on annual use. Salvage value is set at 10 percent of the investment value for all equipment except for the center-pivot irrigation system, which is set at 20 percent of investment value (NDSU Ext. Service, 2014). There is no salvage value for buildings.

2.3.6.6 Crop Expenses

Crop expenses include custom work, herbicides, insect control, disease control, fertilizer, seed, and miscellaneous crop expenses. Custom work includes the application of chemicals and fertilizer, and custom harvest. Chemicals are used on the representative farms to control weeds, insects, and gophers. Seed costs are for the purchase of high-quality seed for maximum germination and production.

2.3.6.7 General Expenses

General expenses include expenses that are general and similar in nature for each budget, such as labor, utilities, and insurance costs.

2.3.6.7.1 Labor Distribution and Costs

Labor expense is derived from the hours of labor required to operate machinery and manual labor for irrigation. Total machinery labor is calculated by adding 10 percent to the power machinery use. The hours of power machinery use are driven by the non-power machine being pulled by the power machine. The addition of 10 percent of hours for the power machine provides an estimate of time for the operator of the machine for such things as greasing and fueling equipment, etc.

Hired labor is required if the operator and family labor is not sufficient to perform all the tasks that are required. Hired labor is estimated on a monthly basis. There is no hired labor required in this study due to the extensive use of custom work.

2.3.6.7.1.1 Wages

Wages are reported by the Bureau of Labor Statistics on a statewide basis. The five-year average (2016–2020) farm labor wage rate for Montana is $16.55 per hour. This is the rate used for hired labor and family labor. Skilled labor is figured at $22.11 per hour—the five-year average (2016–2020) for farm supervisors in Montana—and is used for operator labor. These rates were obtained from the U. S. Bureau of Labor Statistics website (BLS, 2021c).

2.3.6.7.1.2 Labor Distribution during the Year

Labor requirements are adapted from university enterprise budgets (see Section 2.3.4) and past FBAs. The labor requirements tend to be highest in the summer months when irrigated crops place heavy requirements on the available labor supply.

2.3.6.7.1.3 Social Security and Workers' Compensation

Social Security expenses are calculated only for hired labor. The social security rate is 15.30 percent, which is divided between the employer and employee, thus, the hired labor rate is 7.65 percent. The workers' compensation rate used in the FBA is 7.95 percent, the 2020 workers' compensation rate for Montana farm and ranch employees and drivers (Montana State Fund, 2021).

2.3.6.7.2 Telephone and Electricity for Farm Management

According to the US Department of Labor, the average annual telephone and electricity costs for self-employed workers in the United States for 2020 (the most recent data year available) is $1,541 and $1,695, respectively (BLS, 2021a). Reclamation assumes 25 percent of usage is attributed to farm business, so telephone and fixed electricity expenses for this study are calculated to be $385.25 and $423.75, respectively.

2.3.6.7.3 Taxes

Pertinent tax information was obtained from the Montana Department of Revenue (MTDOR). An email correspondence and documentation provided by MTDOR (2021) for tax years 2020 and 2021 indicate that the average assessed value for tillable irrigated land is $553 per acre, the average assessed value for non-tillable irrigated land and summer fallow is $276 per acre, and all acres are taxed at an average effective rate of 1.245 percent. For the purposes of this FBA, all irrigated crop and homestead acres are assigned a taxable value of $553, all dryland crop acres are assigned a taxable value of $276, and all acres are taxed at a rate of 1.245 percent.

The first $300,000 of farm equipment value is exempt from taxation and any value beyond this is taxed at a rate of 1.50 percent (MTDOR, 2021).

2.3.6.7.4 Insurance Costs

Liability insurance pays for personal injury and property damage that occurs on the property or is caused by the insured while off the property. A farmer in the area is usually insured for $1,000,000, which costs about $1.83 per acre in 2013 dollars (U. ID CALS, 2013). Indexed to

2020 dollars using the Consumer Price Index (BLS, 2021b) and multiplying the per-acre value over a 3,000-acre farm yields an annual liability insurance expense of $6,090 per year in 2020 dollars.

Wind and fire insurance can vary greatly depending on type, age, and quality of buildings or machinery, distance from the local fire department, and policy holder history. The cost of wind and fire insurance used in the budgets is $6.66 per $1,000 for machinery and buildings, while vehicle insurance costs $1,000 annually (UNR Coop. Ext., 2008).

2.3.6.7.5 Interest on Debt

Interest is charged on the debt portion of assets and operating costs. Debt to asset ratios and interest rates for real estate and nonreal estate for use in payment capacity studies are computed by Reclamation's Technical Service Center (TSC) each fiscal year and disseminated by Reclamation's Policy Office. The debt to asset ratios and interest rates represent a five-year moving average for all farms in the 17 Reclamation states, based on data obtained from the USDA. The debt to asset ratios and interest rates to be applied in payment capacity studies conducted in fiscal year 2021 are reported below in Table 2-8 (Reclamation, 2020a).

Table 2-8.—Debt to asset ratios and interest rates for payment capacity studies conducted in FY2021

Category	Debt to asset ratios	Interest rates
Real estate	10.0%	3.27%
Nonreal estate	18.8%	8.48%

2.3.6.7.6 Miscellaneous Expenses

An amount equal to 2 percent of total variable costs is included in each farm budget to cover any miscellaneous costs that the analysis may not have specifically accounted for.

2.3.6.8 Returns to Farm Family

The farm operator and farm family are entitled to income from the farm as a result of their investment, management, and labor. Returns to the farm family are noncash allowances for the operator's factors of production and are deducted from net farm income to determine payment capacity. These noncash allowances include returns to equity, management, and labor.

2.3.6.8.1 Return to Equity

Return to equity is an allowance for the farm family's equity, including the equity portion of land, improvements, machinery, and operating capital. The return to equity rate for use in payment capacity studies is computed by Reclamation's TSC each fiscal year and disseminated by Reclamation's Policy Office. This rate represents a 30-year moving average of return to equity on current income for all farms in the United States, based on date obtained from the

USDA. The return to equity for use in payment capacity studies conducted in fiscal year 2021 is 2.0 percent (Reclamation, 2020a).

Equity is equal to one minus the debt load percentages described above. Therefore, equity is 90.0 percent for real estate and 81.2 percent for nonreal estate.

2.3.6.8.2 Return to Management

An allowance of 10 percent of net farm income is made for the farm operator's management ability over and above the supervisory labor rate. The return to management represents an opportunity cost to the farm operator. In other words, the return to management represents the farm operator's ability to earn income by applying his/her management skills in another management operation.

2.3.6.8.3 Return-to-Labor

The farm operator and family are entitled to income for labor they perform on the farm. The farm operator's labor is valued at the current wage rate for supervisory farm labor for the crop type in the region of analysis. Labor performed by the farm operator's family should be valued at the same wage rate as hired farm labor since they are substitutes for one another. The return to labor is calculated by adding the farm operator's wages and the farm family labor wages. In this study operator wages are $22.11 per hour and hired and family labor wages are $16.55 per hour (see Section 2.3.6.7.1.1 for wage details).

2.3.7 Payment Capacity Results

Payment capacity is an on-farm analysis to determine the residual net farm income available for payment of assessed water costs, and a required input to an ATP study. All payment capacity results are calculated in 2020 dollars. This analysis indicates that payment capacity for MRP commercial agricultural lands is -$30.76 per acre. Table 2-9 displays the summary FBA results for the modeled representative farm and the calculation of payment capacity per acre based on this FBT output. Comprehensive FBT inputs, calculations, and outputs for the representative farm can be found in Appendix A of this report.

Table 2-9.—FBA summary results for modeled representative farm and calculation of payment capacity per acre

Farm income	
Crop sales	$235,988.92
Other income	$0.00
Gross farm income	$235,988.92
Farm expenses	
Variable expenses	$176,859.41
Fixed expenses	$78,338.64
Total farm expenses	$255,198.05
Net farm income[a]	-$19,209.13
Return to farm family	
Return to equity	$52,609.36
Return to management	-$1,920.91
Return to labor	$27,167.83
Total return to farm family	$77,856.27
Farm payment capacity[b]	-$97,065.40
Total farm size (acres)[c]	3,150
Payment capacity per acre[d]	**-$30.81**

[a] Calculated as gross farm income minus total farm expenses.

[b] Calculated as net farm income minus total return to farm family.

[c] Total acreage for representative farm modeled; includes farmstead, roads, and waste acreage.

[d] Payment capacity per acre for MRP commercial agricultural lands. Calculated as farm payment capacity divided by representative farm.

2.4 Evaluation of Irrigation Ability-to-Pay

An irrigation ATP study assesses the financial capability of an irrigation district (or contracting entity) to pay for existing or increased Reclamation water charges and services and is defined as the farm-level payment capacity aggregated to the entire district, minus existing district obligations, operation, maintenance, and replacement (OM&R) costs, power costs, and reserve fund requirements. If the contractor has documented sources of non-farm-related income, they may be incorporated into the analysis. Contractors may also incur long-term debt obligations to the United States and/or other entities, thus incurring annual debt service for loans, bonds, or other long-term debts.

In an ATP study, financial information is gathered to evaluate existing and projected sources of revenue and financial obligations of the contractor. This information comes from financial statements provided by the contractor. Although data on current and recent financial operations are collected, the goal of an ATP study is to determine financial capability of the contractor for five years into the future. The five-year time horizon is based on Reclamation's policy to review

ATP every five years for repayment and water service contracts entered into after March 25, 1994.

Five years of financial statements were obtained for each of the eight contractors. Each income or expense category shown on the contractors' financial records was analyzed for trends, frequency, and significant deviations from the average and a determination made by the analyst of the value most indicative of what to expect for the next five years. All district income and expenses are estimated in 2020 dollars.

Audited financial statements are preferred for use in an ATP study but were not available for all contractors in all years. Where audited financial statements are not available, non-audited annual financial reports (AFR) are analyzed. The most recent consecutive five fiscal years of available financial statements are analyzed for each contractor. Three contractors define their fiscal year as January 1 through December 31, while the remaining five define their fiscal year as July 1 through June 30. The financial statements analyzed for this study are summarized below in Table 2-10.

Table 2-10.—Summary of district financial statements used in ATP study

Contractor	Fiscal years[a]	District FY definition[b]	Audited or AFR[c]
Malta ID + Malta pumpers	2015–19	Jan 1–Dec 31	Mix[d]
Glasgow ID+ Glasgow pumpers	2015–19	Jan 1–Dec 31	Mix[e]
Harlem ID	2017–21	Jul 1–Jun 30	AFR
Paradise Valley ID	2017–21	Jul 1–Jun 30	AFR
Zurich	2016–20	Jul 1–Jun 30	AFR
Fort Belknap	2015–19	Jul 1–Jun 30	AFR
Alfalfa Valley	2017–21	Jul 1–Jun 30	AFR
Dodson Pumping Unit	2016–20	Jan 1–Dec 31	AFR

[a] The latest consecutive 5 years of financial statements available.

[b] Three of the eight districts define their FY as Jan 1–Dec 31, while the remaining five define their FY as Jul 1–Jun 30.

[c] Audited financial statements were available for select years for two districts. Otherwise, non-audited annual financial reports (AFR) are analyzed.

[d] Audited financial reports were available for 2015–18, 2019 is AFR.

[e] Audited financial reports were available for 2015–16, 2017-19 are AFR.

2.4.1 Irrigation District Income

Irrigation district income (District Income) is the sum of all revenues an irrigation contractor is expected to receive annually over the next five years. District Income for the eight contractors comes from two sources: district-level payment capacity (Payment Capacity Income) and other revenue sources, such as account charges, water sales, or earned interest (Non-Operating Income).

Payment Capacity Income is inclusive of all reasonable charges which can be assessed to irrigation, and thus, treated as district operating income for the purpose of irrigation. Payment

Capacity Income is the aggregated farm-level payment capacity calculated according to published Reclamation guidelines (Reclamation, 2004b) using information obtained from the districts, university enterprise budgets, and experts familiar with agricultural practices in the area. See Section 2.3 of this report for payment capacity analysis details.

Non-Operating Income is derived from the financial statements provided by the contractors and includes all non-farm income that can reasonably be assumed to be available for all or part of the five-year study horizon. If excess reserve funds are identified, these may be used to contribute to irrigation ATP in the first year of the repayment contract. Details and calculations for each revenue source are presented below.

2.4.1.1 Payment Capacity Income

Payment Capacity Income is the district-level payment capacity expected to be generated annually over the next five years. Payment Capacity Income for a given contractor is calculated by multiplying the acres of district land identified as commercial agriculture by the farm-level payment capacity per acre for that district. As explained in Section 2.3.1, the single representative farm modeled in the FBA represents all full-time farming operations (commercial agriculture) for the eight evaluated MRP irrigation districts and affiliated pumpers. Therefore, the payment capacity per acre value used in this calculation is common amongst all contractors. As established in Section 2.3 of this report, payment capacity per acre for all contractors is -$30.81.

District acreage and the calculation of Payment Capacity Income by district is reported below in Table 2-11. If district payment capacity is negative (i.e., there is no payment capacity), Payment Capacity Income is set to zero for use in the calculation of district ATP. Payment capacity is negative for all eight districts and affiliated pumpers, and therefore all contractors have zero Payment Capacity Income.

Table 2-11.—Calculation of Payment Capacity Income by contractor

Contractor	District acreage	PC per acre	PC Income[a] Calculated	PC Income[a] Value used
Malta ID + Malta pumpers	45,076	-$30.81	-$1,388,991	$0
Glasgow ID + Glasgow pumpers	18,338	-$30.81	-$565,075	$0
Harlem ID	11,148	-$30.81	-$343,519	$0
Paradise Valley ID	8,315	-$30.81	-$256,222	$0
Zurich	7,664	-$30.81	-$236,162	$0
Fort Belknap	6,482	-$30.81	-$199,739	$0
Alfalfa Valley	3,664	-$30.81	-$112,904	$0
Dodson Pumping Unit	1,006	-$30.81	-$30,999	$0

[a] Payment Capacity Income is calculated as a contractor's commercial agricultural acreage multiplied by payment capacity per acre. If the result is negative, $0 is carried into the ATP analysis as Payment Capacity Income, not the negative value.

2.4.1.2 Non-Operating Income

Non-Operating Income for each contractor is the sum of all non-operating income expected to be received annually over the next five years. Non-Operating Income is based on an analysis of district financial statements—inclusive of those line items identified as non-operating revenue sources expected to continue into the future.

Each line item identified as non-operating revenue is analyzed for trends, frequency, and significant deviations from the average. The value used in the calculation of Non-Operating Income is that which is determined to be most indicative of what to expect for the next five years. If a particular line item has a frequency of at least three years, and no trend or significant deviation from the average is identified, the five-year average is used as the value for analysis. The data from the most recent year available is used if an upward or downward trend is identified. In some cases, sufficient evidence is available to omit a particular line item. This can be due to the line item not being reported for three or more of the years analyzed or based on supporting textual documentation provided in the financial statements (such as evidence that a particular income source is due to cease after 2022).

The District financial statements indicate that Non-Operating Income sources include income from interest, grants, miscellaneous revenues, and other sources. Assessment fees charged to irrigators are excluded from an irrigation ATP study, as Payment Capacity Income is inclusive of all reasonable charges which can be assessed to irrigation.

Non-Operating Income varies widely by contractor, with a low of $2,006 for Paradise Valley Irrigation District, and a high of $95,059 for Malta Irrigation District and affiliated pumpers. Derivation of Non-Operating Income by contractor is detailed below in Table 2-12.

Table 2-12.—Non-Operating Income calculations for MRP contractors

Income category	Five years of financial statements examined					5-yr.	Value	Desc. for
	Year 1	Year 2	Year 3	Year 4	Year 5	average	used	val. used
Alfalfa Valley Irrigation District: 2017–2021								
Annual assessments	$91,759	$95,692	$97,105	$99,243	$95,902	$95,940		not included[a]
License & permit fees	$0	$0	$0	$0	$0	$0		
Federal grants	$0	$0	$0	$0	$0	$0		
State grants	$0	$10,000	$0	$0	$102,581	$22,516	$22,516	average
Other grants/donations	$0	$0	$0	$0	$0	$0		
Charges for services	$0	$0	$0	$0	$0	$0		
Misc. rev/asset sales	$0	$0	$4,591	$590	$319	$1,100	$1,100	average
Interest/royalty/invest.	$490	$994	$1,084	$1,285	$989	$968	$968	average
Non-Operating Income	$92,249	$106,686	$102,780	$101,118	$199,791	$120,525	$24,585	
Dodson Pumping Unit: 2016–2020								
Annual assessments	$15,597	$26,214	$14,324	$14,366	$14,303	$16,961		not included[a]
License & permit fees	$0	$0	$0	$0	$0	$0		
Federal grants	$0	$0	$0	$0	$0	$0		
State grants	$0	$0	$0	$0	$0	$0		
Other grants/donations	$0	$0	$0	$0	$0	$0		
Charges for services	$5,528	$5,898	$4,363	$13,435	$5,571	$6,959	$6,959	average
Misc. rev/asset sales	$0	$0	$0	$0	$0	$0		
Interest/royalty/invest.	$170	$1,337	$259	$545	$354	$533	$533	average
Non-Operating Income	$21,295	$33,449	$18,947	$28,347	$20,228	$24,453	$7,492	
Fort Belknap Irrigation District: 2015–2019								
Annual assessments	$141,154	$145,571	$177,288	$126,718	$118,595	$141,865		not included[a]
License & permit fees	$0	$0	$0	$0	$0	$0		
Federal grants	$0	$0	$0	$0	$0	$0		
State grants	$0	$0	$0	$0	$0	$0		
Other grants/donations	$0	$0	$0	$0	$0	$0		
Charges for services	$0	$0	$0	$0	$0	$0		
Misc. rev/asset sales	$4,513	$14,164	$1,036	$1,379	$20,310	$8,280	$8,280	average
Interest/royalty/invest.	$700	$742	$1,094	$0	$1,590	$825	$825	average
Non-Operating Income	$146,367	$160,476	$179,418	$128,097	$140,495	$150,971	$9,105	
Glasgow Irrigation District and affiliated pumpers: 2015–2019								
Annual assessments	$602,266	$609,571	$602,266	$602,343	$602,390	$603,767		not included[a]
License & permit fees	$0	$0	$7,381	$7,381	$7,381	$4,429	$7,381	2017–19 avg
Federal grants	$0	$0	$0	$14,000	$0	$2,800		not included[b]
State grants	$0	$0	$5,344	$15,000	$0	$4,069		not included[b]
Other grants/donations	$0	$0	$0	$0	$0	$0		
Charges for services	$0	$0	$925	$4,061	$7,737	$2,545	$2,545	average
Misc. rev/asset sales	$156,607	$20,446	$5,045	$2,270	-$733	$36,727	$6,757	2016–19 avg
Interest/royalty/invest.	$2,114	$2,176	$1,954	$1,163	$2,248	$1,931	$1,931	average
Non-Operating Income	$760,987	$632,193	$622,915	$646,219	$619,023	$656,267	$18,614	
Harlem Irrigation District: 2017–2021								
Annual assessments	$268,151	$283,533	$282,143	$247,498	$307,004	$277,666		not included[a]
License & permit fees	$0	$0	$0	$0	$0	$0		
Federal grants	$0	$0	$29,403	$0	$152	$5,911		not included[b]
State grants	$0	$0	$0	$0	$0	$0		
Other grants/donations	$0	$0	$0	$0	$0	$0		
Charges for services	$0	$0	$0	$0	$0	$0		
Misc. rev/asset sales	$9,206	$3,637	$17,716	$4,603	$6,236	$8,279	$8,279	average
Interest/royalty/invest.	$1,193	$1,442	$2,219	$2,493	$1,779	$1,825	$1,825	average
Non-Operating Income	$278,550	$288,612	$331,481	$254,595	$315,172	$293,682	$10,105	

Table 2-12.—Non-Operating Income calculations for MRP contractors

Income category	Five years of financial statements examined: Year 1	Year 2	Year 3	Year 4	Year 5	5-yr. average	Value used	Desc. for val. used
Malta Irrigation District and affiliated pumpers: 2017–2021								
Annual assessments	$1,358,354	$1,393,480	$1,514,955	$1,471,596	$1,330,177	$1,413,712		not included[a]
License & permit fees	$0	$0	$0	$0	$0	$0		
Federal grants	$0	$0	$0	$0	$0	$0		
State grants	$0	$0	$0	$0	$0	$0		
Other grants/donations	$0	$0	$0	$0	$0	$0		
Charges for services	$0	$0	$0	$0	$0	$0		
Misc. rev/asset sales	$11,867	$53,345	$156,956	$134,208	$75,285	$86,332	$86,332	average
Interest/royalty/invest.	$5,827	$6,372	$5,105	$6,441	$19,887	$8,726	$8,726	average
Non-Operating Income	$1,376,048	$1,453,197	$1,677,016	$1,612,245	$1,425,350	$1,508,771	$95,059	
Paradise Valley Irrigation District: 2017–2021								
Annual assessments	$213,091	$223,259	$214,835	$217,160	$219,951	$217,659		not included[a]
License & permit fees	$0	$0	$0	$0	$0	$0		
Federal grants	$0	$0	$20,000	$0	$0	$4,000		not included[b]
State grants	$0	$0	$0	$0	$15,000	$3,000		not included[b]
Other grants/donations	$0	$0	$0	$0	$0	$0		
Charges for services	$0	$0	$0	$0	$0	$0		
Misc. rev/asset sales	$0	$78	$0	$232	$211	$104	$104	average
Interest/royalty/invest.	$630	$1,084	$1,659	$1,772	$1,902	$1,409	$1,902	2021 value
Non-Operating Income	$213,721	$224,421	$236,494	$219,164	$237,064	$226,173	$2,006	
Zurich Irrigation District: 2016–2020								
Annual assessments	$148,269	$153,364	$159,246	$180,007	$162,523	$160,682		not included[a]
License & permit fees	$0	$0	$0	$0	$0	$0		
Federal grants	$0	$0	$0	$0	$0	$0		
State grants	$0	$0	$0	$0	$0	$0		
Other grants/donations	$0	$0	$0	$0	$0	$0		
Charges for services	$0	$0	$0	$0	$0	$0		
Misc. rev/asset sales	$7	$310	$432	$0	$216	$193	$193	average
Interest/royalty/invest.	$726	$968	$1,619	$2,169	$2,348	$1,566	$2,348	latest value[c]
Non-Operating Income	$149,002	$154,642	$161,298	$182,176	$165,087	$162,441	$2,541	

[a] Annual assessments paid by farmers to the district are not used in an ATP study because the Payment Capacity Income calculation is inclusive of all reasonable charges which can be assessed to irrigation.

[b] Values for this income category occur less than three times in the five years analyzed and are not considered expected income over the next five years.

[c] Income category demonstrates an increasing trend; thus, the most recent year is considered best indication of next five years.

2.4.1.3 Excess Reserves

If the contractor has a reserve fund in excess of the Reclamation-imposed minimum, and there is no available documented plan for the excess funds, these funds are considered to be available for ATP in year one of the five-year repayment period (Reclamation, 2004a). A review of contractor financial statements identifies no excess reserve funds.

2.4.1.4 Calculation of District Income

District Income for the eight contractors is the sum of revenues each is expected to receive annually over the next five years and is equal to the sum of Payment Capacity Income, Non-Operating Income, and excess reserves (exclusive to the first year of the repayment period). District Income varies widely by contractor, with a low of $2,006 for Paradise Valley Irrigation District, and a high of $95,059 for Malta Irrigation District and affiliated pumpers. The calculation of District Income for the eight contractors is shown below in Table 2-13.

Table 2-13.—Calculation of District Income by contractor

Contractor	Payment Capacity Income	+	Non-Operating Income	+	Excess Reserves	=	District Income
Malta ID + Malta pumpers	$0		$95,059		$0		$95,059
Glasgow ID+ Glasgow pumpers	$0		$18,614		$0		$18,614
Harlem ID	$0		$10,105		$0		$10,105
Paradise Valley ID	$0		$2,006		$0		$2,006
Zurich	$0		$2,541		$0		$2,541
Fort Belknap	$0		$9,105		$0		$9,105
Alfalfa Valley	$0		$24,585		$0		$24,585
Dodson Pumping Unit	$0		$7,492		$0		$7,492

2.4.2 Irrigation District Expenses

Irrigation district expenses (District Expenses) are the sum of all expenses an irrigation contractor is expected to incur annually over the next five years—inclusive of operating and non-operating expenses. Operating expenses represent the cost of operating and maintaining all assets related to water storage and delivery, while non-operating expenses include district payments to Reclamation and the interest portion of loan payments for loans on material assets (e.g., machinery and buildings). The principal portion of loan payments is a balance sheet transfer (of cash into machine/building equity), and therefore not a district expense. The annual expenses related to machinery and buildings are captured as depreciation.

District Expenses are based on an analysis of contractor financial statements—inclusive of those line items identified as expenditures expected to continue into the future. Each line item identified as an expense is analyzed for trends, frequency, and significant deviations from the average. The value used in the calculation of District Expenses is that which is determined to be most indicative of what to expect for the next five years. If a particular line item has a frequency of at least three years and no trend or significant deviation from the average is identified, the five-year average is used as the value for analysis. The data from the most recent year available is used if an upward or downward trend is identified. In some cases, sufficient evidence is available to omit a particular line item. This can be due to the line item not being reported for three or more of the years analyzed or based on supporting textual documentation provided in the financial statements (such as evidence that a particular expense is due to cease after 2022).

District Expenses vary widely by contractor, with a low of $24,450 for Dodson Pumping Unit, and a high of $1,415,491 for Malta Irrigation District and affiliated pumpers. The calculation of District Expenses for the eight contractors is shown below in Table 2-14.

Table 2-14.—District Expenses calculations for MRP contractors

Income category	Five years of financial statements examined					5-yr. average	Value used	Desc. for val. used
	Year 1	Year 2	Year 3	Year 4	Year 5			
Alfalfa Valley Irrigation District: 2017–2021								
Current expenditures	$107,394	$69,947	$64,548	$85,936	$304,960	$126,557	$126,557	5-yr average
Capital Outlay	$0	$0	$0	$3,500	$0	$700		not included[a]
Debt service	$0	$0	$0	$0	$0	$0		
Total annual expenses	$107,394	$69,947	$64,548	$89,436	$304,960	$127,257	$126,557	
Dodson Pumping Unit: 2016–2020								
Current expenditures	$33,461	$13,288	$22,004	$27,027	$26,471	$24,450	$24,450	5-yr average
Capital Outlay	$0	$0	$0	$0	$0	$0		
Debt service	$0	$0	$0	$0	$0	$0		
Total annual expenses	$33,461	$13,288	$22,004	$27,027	$26,471	$24,450	$24,450	
Fort Belknap Irrigation District: 2015–2019								
Current expenditures	$154,841	$222,807	$121,373	$152,421	$124,822	$155,253	$155,253	5-yr average
Capital Outlay	$0	$0	$0	$0	$0	$0		
Debt service	$0	$0	$0	$0	$0	$0		
Total annual expenses	$154,841	$222,807	$121,373	$152,421	$124,822	$155,253	$155,253	
Glasgow Irrigation District and affiliated pumpers: 2015–2019								
Current expenditures	$711,863	$573,457	$439,868	$494,227	$420,168	$527,917	$527,917	5-yr average
Capital Outlay	$0	$0	$0	$0	$0	$0		
Debt service	$7,667	$1,507	$57,223	$53,412	$0	$23,962	$23,962	5-yr average
Total annual expenses	$719,530	$574,964	$497,091	$547,639	$420,168	$551,879	$551,879	
Harlem Irrigation District: 2017–2021								
Current expenditures	$240,080	$201,070	$300,098	$180,771	$478,189	$280,042	$280,042	5-yr average
Capital Outlay	$3,000	$3,930	$2,306	$0	$0	$1,847	$1,847	5-yr average
Debt service	$0	$0	$0	$0	$0	$0		
Total annual expenses	$243,080	$205,000	$302,404	$180,771	$478,189	$281,889	$281,889	
Malta Irrigation District and affiliated pumpers: 2017–2021								
Current expenditures	$1,286,335	$1,524,784	$1,358,590	$1,148,741	$1,141,868	$1,292,064	$1,292,064	5-yr average
Capital Outlay	$0	$0	$0	$0	$40,653	$8,131		not included[a]
Debt service	$16,072	$11,024	$9,814	$3,489	$123,428	$32,765	$123,428	2021 value
Total annual expenses	$1,302,407	$1,535,808	$1,368,404	$1,152,230	$1,305,948	$1,332,959	$1,415,491	
Paradise Valley Irrigation District: 2017–2021								
Current expenditures	$180,743	$149,289	$191,331	$139,354	$231,389	$178,421	$178,421	5-yr average
Capital Outlay	$0	$0	$4,393	$0	$0	$879		not included[a]
Debt service	$0	$0	$0	$0	$0	$0		
Total annual expenses	$180,743	$149,289	$195,724	$139,354	$231,389	$179,300	$178,421	
Zurich Irrigation District: 2016–2020								
Current expenditures	$197,221	$105,366	$80,586	$171,353	$171,232	$145,152	$145,152	5-yr average
Capital Outlay	$0	$0	$0	$0	$0	$0		
Debt service	$0	$0	$0	$0	$0	$0		
Total annual expenses	$197,221	$105,366	$80,586	$171,353	$171,232	$145,152	$145,152	

[a] Values for this expense category occur less than three times in the five years analyzed and are not considered expected income over the next five years.

2.5 Irrigation ATP Conclusions

In summary, the goal of an irrigation ATP study is to forecast, on an annual basis, a contractor's ability to contribute financially towards the costs of a proposed action alternative over a five-year repayment period. Irrigation ATP is calculated by subtracting District Expenses from District Income. District Expenses is the sum of all expenses the contractor is expected to incur annually over the next five years (see Section 2.4.2). District Income is the sum of Payment Capacity Income and Non-Operating Income contractor is expected to receive annually over the next five years (see Section 2.4.1). In addition, any available excess reserves identified are applied as a one-time contribution to a contractor's irrigation ATP in year one of the five-year repayment period. If the resulting value is positive, the contractor can pay for existing or increased water charges and services. If the resulting value is negative, there is no ability-to-pay.

District Income minus District Expenses yields a negative result for all eight contractors, indicating that over the five-year repayment period the eight contractors have no ATP. The results of the irrigation ATP analysis are reported below in Table 2-15.

Table 2-15.—Irrigation ATP Study results

Contractor	District Income	–	District Expenses	=	Ability-to-Pay
Malta ID + Malta pumpers	$95,059		$1,415,491		-$1,320,433
Glasgow ID+ Glasgow pumpers	$18,614		$551,879		-$533,265
Harlem ID	$10,105		$281,889		-$271,784
Paradise Valley ID	$2,006		$178,421		-$176,415
Zurich	$2,541		$145,152		-$142,611
Fort Belknap	$9,105		$155,253		-$146,148
Alfalfa Valley	$24,585		$126,557		-$101,972
Dodson Pumping Unit	$7,492		$24,450		-$16,958

3 M&I Ability-to-Pay Analysis

M&I water supply is defined in Reclamation Manual PEC P05 (p. 3, note 6) (Reclamation, 2019b) as "The use of contract water for municipal, industrial, and miscellaneous other purposes not falling under the definition of 'irrigation use' or within another category of water use under an applicable Federal authority." Based on the definition of irrigation also established in PEC P05, M&I water supply is further defined as the use of contract water that is not used to irrigate land primarily used for the production of commercial agricultural crops or livestock. Thus, M&I water supply includes uses such as watering golf courses; lawns and ornamental shrubbery used in residential and commercial landscaping, household gardens, parks and other recreational facilities; pasture for animals raised for personal purposes or for nonagricultural commercial purposes; cemeteries; and similar uses. In addition, commercial agricultural uses that do not require irrigation, such as fish farms and livestock production in confined feeding or brooding operations (e.g., dairy farm operations) are also classified as M&I use.

This section presents estimates of ATP for M&I water services of residential households served by the Milk River Project.

3.1 Milk River Project M&I Contractors and Diversions

Reclamation's Montana Area Office (MTAO) provided documentation detailing M&I diversions of MRP water spanning 2004 through 2017 (Reclamation, 2018d). The data is summarized below in Table 3-1. Note that, on average, M&I users divert about 45 percent of the annual AF specified in their respective contracts. Annual diversion contracts across all users total 4,629 AF, while actual total diversions from 2004 through 2017 averaged 2,079 AF across all users.

As shown in Table 3-1, the cities of Chinook, Harlem, and Havre comprise all significant MRP M&I diversions and are therefore the entities evaluated for ATP. Figure 2 provides a geographic overview of the area of interest and identifies the three M&I contractors.

Table 3-1.—Milk River Project M&I water diversions

M&I contractor	Contracted AF[a]	Average diversions[b]	Date range for average use	% of contract used on average
City of Chinook*	700	287	2008-17	41%
City of Harlem*	500	114	2005–16	23%
City of Havre*	2,800	1,671	2004-17	60%
Grand View Cemetery, Saco	14	No reports	N/A	N/A
GSA – Piegan Border Station	15	7	2016–17	44%
Hill County Water[c]	500	0	2010–17	0%
North Havre County Water	100	No reports	N/A	N/A
Total	4,629	2,079		45%

[a] AF of water the M&I entity is entitled to divert annually via contract with Reclamation (Reclamation, 2018d).

[b] Average M&I water diversions for years reported (Reclamation, 2018d). Per the MTAO, "No reports" means that diversions might have been made, but no report was filed by the entity.

[c] Per Reclamation's MTAO (2018d): "Hill County Water has been using City of Havre water for about 7 years but keeps their contract in place as a back-up. Pays full OM&R on 500 AF."

* M&I contractors evaluated for ATP.

Source: Adaptation of Montana Physical Map (Geology.com, 2018)

Figure 2.—Cities evaluated for M&I ATP set within Montana counties of interest

3.2 Ability-to-Pay for Water Service

A household's ATP is indicated by an estimated percentage of the household income that is spent on water service. Likewise, the ATP of a commercial establishment is based on its water payments and gross taxable receipts. It can also be expressed as annual water payments as a percentage of gross taxable receipts.

To estimate ATP of residential households, the analysis here used a non-linear model from the work of Piper (2021) to predict nondiscretionary income of the residential households. Piper (2021) used household data from many Western U.S. states to estimate a non-linear function that represents necessary (nondiscretionary) expenditures. The non-linear model assumes that necessary expenditures of a household increase at a decreasing rate (and not linearly) as either the income or household size increases. Another concept used in the evaluation of household ATP is economic hardship. Both the use of a non-linear model and assessment of economic hardship in evaluating households ATP have been emphasized in the Deliberative Draft Report prepared in April 2020 for the Navajo Nation (Reclamation, 2020b). As indicated in the 2020 Deliberative Draft Report, Reclamation and the Navajo Nation agreed that the non-linear model was an appropriate method for estimating nondiscretionary income. Additionally, the consideration of economic hardship was also part of the 2020 Deliberative Draft Report.

The underlying assumptions used in this report, as well as the previous 2017 Navajo Nation ATP analyses (Navajo Nation Department of Justice, 2017) conducted for the Navajo-Gallup water supply project are that:

1. ATP is directly related to income.
2. Necessary living expenses should be included in the estimation of ATP.
3. Some consideration should be given to the existence of poor households.
4. A consistent definition for an ATP threshold does not exist in the economic community today.

This analysis considers necessary living expenses, households located in communities with high poverty rates, and procedures for estimating ATP thresholds for households and not commercial establishments.

3.3 Estimating the Ability-to-Pay Threshold

The approach that has generally been used by the Bureau of Reclamation to estimate M&I ATP is based on an evaluation of observed water payments made by households in a state or region and comparing those payments to median household income. The range of estimated water payments as a percentage of discretionary income is applied to the specific study area for which ATP is being estimated. Some analyses also included consideration of the business sector by comparing commercial water payments to business revenues. The simple comparison of water payments to household income to derive water payments as a percentage of income was later modified to include consideration of nondiscretionary household expenditures using regional estimates of different categories of household expenditures expressed as a percentage of household income. Discretionary income is defined as median household income minus necessary or nondiscretionary expenses: the estimated cost of food, housing, apparel, transportation, healthcare, and personal insurance and pensions. The nondiscretionary income is normally adjusted for cost of living.

The first modification incorporated a non-linear model to estimate nondiscretionary expenditures as a function of median household income and household size rather than a linear model. The non-linear model was developed for the 2017 Navajo Nation ATP analysis (Navajo Nation 2017 ATP Report). This non-linear model combined with the cost-of-living adjustment is used to derive discretionary income for estimating ATP percentages. The cost-of-living adjustment was included in the 2020 Deliberative Draft Report. The second modification included economic hardship as an adjustment to ATP thresholds to account for the potential impacts of water payments on low income/high poverty communities. This economic hardship adjustment is based on an evaluation of the percentage of population in poverty compared to median poverty levels. The third modification used the median observed percentage plus one median absolute deviation (MAD) of discretionary household income or gross taxable commercial revenues to define the ATP percentage. Using the median plus one MAD to determine the water payment percentage for ATP is consistent with the approach used to determine the economic hardship threshold.

3.4 Household Ability-to-Pay

The data used in this analysis includes annual water payments, median household income, household size, population of area lived, proportion of homes owned, whether household resides in the Southwestern U.S., and proportion of retirees (head of household above 64 years of age). The socio-demographic variables are 2015–2019 averages from the website of the U.S. Census Bureau. Data for 2020 was not available for use in this analysis. Cost of living indexes was obtained from www.bestplaces.net. Water rates for the studied cities are from the Montana Department of Natural Resources.

Household ATP includes an evaluation of potential economic hardship based on percentages of individuals in poverty, which could affect the ability of households to pay for water service. Economic hardship is addressed by collecting poverty data for Montana communities and identifying communities which are experiencing high levels of poverty. A threshold level of poverty is established and used to adjust ATP as a percentage of income to account for economic hardship.

To estimate ATP of residential households, nondiscretionary income of the residential households is predicted as a function of household income, household income squared, household size, household size squared, population of area lived, proportion of homes owned, either or not household resides in the Southwestern U.S., and proportion of retirees (head of household above 64 years of age). Shown below in Table 3-2 and Table 3-3 are the nondiscretionary expenditure model and the estimated nondiscretionary income for the communities, respectively.

Table 3-2.—Nondiscretionary expenditure modeling results (Dependent variable is log of necessary expenditure)

Independent variables	Coefficient
Area population size	-0.0503
Proportion of homes owned with/without mortgage	0.2136
Proportion of population retired, over 64 years	0.0129
Southwestern U.S.	0.0925
Household median income	0.00000762
Household median income squared	-0.000000964
Family size	0.2591
Family size squared	-0.0281
constant/intercept	9.2778

Source: (Piper, 2021)

Table 3-3.—Estimated nondiscretionary expenditure (Dependent variable is log of necessary expenditure)

		Census values		
Independent variables	Coefficient	City of Chinook	City of Harlem	City of Havre
Area population size	-0.0503	5	5	5
Proportion of homes owned with/without mortgage	0.2136	0.036	0.566	0.574
Proportion of population retired, over 64 years	0.0129	0.226	0.121	0.15
Southwestern US	0.0925	0	0	0
Household median income	0.00000762	$40,855	$48,125	$48,294
Household median income squared*	-0.000000964	0.1669	0.2316	0.2332
Family size	0.2591	2.98	2.82	2.25
Family size squared	-0.0281	8.8804	7.9524	5.0625
constant/intercept	9.2778	1	1	1
	Predicted log necessary expenditures	$9.87	$10.02	$9.96
	Exponentiated	$19,357	$22,532	$21,153

*Calculated as the square of household median income divided by 100,000.

Once discretionary income is estimated, it can be compared to actual water service payments to derive the water service payment percentages. An additional step to estimate discretionary income is to apply a cost-of-living adjustment to the nondiscretionary income estimate to account for differences in necessary expenditures for different communities.

It is important to understand that the estimate of residential ATP is based on the application of water bills paid as a percentage of disposable median household income. As a result, the percentages are unit-less factors that can be applied to median household income estimates for other communities and percentages from different years can be combined to evaluate the appropriate factor to apply to a community.

3.5 Water Payment Percentage Used to Represent ATP

The Environmental Protection Agency (EPA) established affordability criteria for drinking water systems as a result of 1996 amendments to the Safe Drinking Water Act. These amendments allowed small public water supply systems to use less extensive water treatment technology if the most effective technology was not considered affordable. EPA established a 4 percent of median household income benchmark for affordability (2 percent for wastewater treatment and 2 percent for drinking water supplies). This benchmark was later amended to 4.5 percent to allow 2.5 percent for drinking water expenses.

The EPA's affordability threshold of 2.5 percent is used in addition to the economic hardship in this analysis. As shown in Table 3-4, only the City of Chinook's household's percentage of discretionary income on water charges (ATP) is 2.69 percent, which is slightly above the EPA's affordability threshold of 2.5 percent. The ATP percentages of the rest of the cities are below the EPA's affordability threshold.

Table 3-4.—Estimated water payments as a percentage of discretionary income for estimating ATP

Variable	Chinook	Harlem	Havre
Population size	1,185	769	9,362
Median Household income	$40,855	$48,125	$48,294
# of Households	588	288	4,160
Household size	2.98	2.82	2.25
Proportion of homes owned with/without mortgage	0.036	0.566	0.574
Proportion of population retired, over 64 years	0.226	0.121	0.15
Estimated nondiscretionary income	$19,357	$22,532	$21,153
Cost of living index	80.3	70.1	84.3
Estimated nondiscretionary expenditures adjusted for cost of living	$15,544	$15,795	$17,832
Estimated discretionary income	$25,311	$32,330	$30,462
Average monthly water payment	$57.39	$45.00	$43.30
Estimated annual ATP per household	$688.68	$540.00	$519.60
ATP percentage applied to discretionary income	2.72%	1.67%	1.71%
Poverty percentage	16.50%	15.00%	17.80%
Economic hardship community	No	No	No
Estimated community annual ATP	$404,944	$155,520	$2,161,536

3.6 Consideration of Economic Hardship in Evaluating ATP

The procedure used to estimate the ability of households to pay for water service is based on the assumption that observed actual payments made by households relative to their income, after adjusting for necessary expenditures, reflects an amount that is within ability to pay. It is further assumed that the range of observed payment percentages for water service in a region can be applied to other service areas to estimate ATP. If the percentage of income paid for water service is an accurate gauge of ATP, then the only non-arbitrary estimate of ATP would be the highest observed percentage of income spent on water for all communities evaluated.

However, it is possible that applying the highest observed percentage of discretionary income to a community experiencing economic hardship might actually increase the hardship if that amount was imposed on water users. Although the ATP percentages are based on actual payments, it is possible that an increased water payment could shift spending away from other types of essential goods and services that are not completely accounted for in estimating non-discretionary expenditures.

In order to evaluate the potential for economic hardship associated with an increase in water service payments, those communities that are economically disadvantaged and experiencing economic hardship need to be identified. There are many definitions of economic hardship and disadvantaged areas. The Internal Revenue Service (IRS) definition of economic hardship for the purposes of collecting tax debt is derived from Treasury Regulation Section 301.6343–1(b)(4), which indicates economic hardship exists if imposition of a levy in whole or in part will cause an individual taxpayer to be unable to pay reasonable basic living expenses. This determination considers general earning potential, basic living expenses, and the cost of living in the taxpayer's geographic location. In other words, economic hardship is determined in part by income, the cost of necessary expenditures, and the relative cost of living.

An approach used to determine a threshold for the economic hardship communities is to overcome the problem of outliers in a dataset. The threshold for the economic hardship is calculated as the median poverty rate in the entire state of Montana plus one absolute deviation from the median. The median absolute deviation (MAD) is defined as,

$$\mathrm{MAD} = \mathrm{median}\ (|X_i - \mathrm{median}\ (X)|) \tag{1}$$

where $|X_i - \text{median } (X)|$ is the absolute value of i^{th} observation minus the median of all Xs in the data set. The median poverty rate value plus the MAD is used in this analysis to identify the threshold used for economic hardship.

To identify areas under economic hardship, Montana communities' poverty rate data is used. Poverty data were obtained for 360 Montana communities from the U.S. Census Bureau, American Community Survey, 2015–2019, five-year data. Poverty rate data is shown by community in Appendix B of this report. The median poverty rate for the communities included in Appendix B is 12.31 percent and the MAD is 7.59 percent. Therefore, the threshold for economic hardship is a poverty rate of 19.91 percent. A community with a poverty rate of 19.91 percent or higher is considered a community with an economic hardship. As shown in Table 3-4, none of the cities had a poverty percentage that exceeded the calculated poverty threshold of 19.91 percent.

3.7 Estimation of Household Ability to Pay

The ATP percentages used to determine household ATP are 2.5 percent of discretionary income because they are non-economic hardship households. An approach to use a MAD plus the median of percentage of discretionary income on water charges would have been used in addition to other metrics if the communities were identified as economic hardship communities.

3.8 Summary of MRP Total M&I Ability to Pay

The estimated Milk River Project total Household ATP, accounting for economic hardship, is estimated to be $2,722,000 annually in 2019 dollars. This represents the total financial resources potentially available for all Milk River Project water users to pay for water service accounting for economic hardship.

4 References

Big Flat Electric. (2021, November 8). Email correspondence between Debbie Kindle, Big Flat Electric billing clerk, and Todd Gaston, USBR economist, concerning base rates, base charges, and demand rates for Milk River Project area irrigation electricity demand.

Big Sky Blog. (2014, July 3). *Lake Sherburne Offers Scenic View to Montana Tourists*. Retrieved November 2021, from Big Sky Blog: https://bigskyblog.com/lake-sherburne-offers-scenic-view-to-montana-tourists/

BLS. (2021a, November). *Consumer Expenditure Survey.* Retrieved from US Department of Labor – Bureau of Labor Statistics: http://www.bls.gov/cex/tables.htm

BLS. (2021b, November). *CPI Inflation Calculator*. Retrieved from United States Department of Labor – Bureau of Labor Statistics: https://data.bls.gov/cgi-bin/cpicalc.pl

BLS. (2021c, November). *Occupational Employment Statistics*. Retrieved April 2018, from US Dept. of Labor, Bureau of Labor Statistics: http://www.bls.gov/oes/

Dalton, J. C. (1999). *Milk River On-Farm Irrigation Study – Blaine, Phillips, and Valley Counties, Montana.* Prepared for US Bureau of Reclamation and State of Montana Dept. of Natural Resources and Conservation.

DOI. (2015). *Department of the Interior Agency Specific Procedures For Implementing CEQ Principles & Requirements for Investments in Federal Water Resources Draft.* US Department of the Interior.

Geology.com. (2018, June). *Montana Physical Map*. Retrieved from Geoscience News and Information: https://geology.com/topographic-physical-map/montana.shtml

JBOC. (2018a, April 9). Conference call between Todd Gaston (Reclamation TSC), Reclamation MTAO personnel, and Jennifer Patrick (JBOC Project Manager) detailing irrigation diversions, project lands receiving diversions, and M&I users.

JBOC. (2018b, May 5). Email correspondence between Todd Gaston (Reclamation TSC) and Jennifer Patrick (JBOC Project Manager) concerning irrigation system types and proportions for Project-irrigated lands.

Montana State Fund. (2021, November 26). *Classification Codes & Rates - Policy Year 2020 Rates*. Retrieved from Montana State Fund website: https://www.montanastatefund.com/web/home/work-comp/class-codes-and-rates.jsf

MTDOR. (2021, November 5). Email correspondence between Angelia Mavencamp (Commercial Appraiser for Montana Department of Revenue) and Todd Gaston (USBR economist) regarding farm taxable values and rates.

Navajo Nation Department of Justice. (2017). *Navajo Nation Ability-to-Pay for Water Service (ATP); Final Report prepared by Jason Bass, AREcon.*

NDSU Ext. Service. (2014). *Projected Budgets for Irrigated Crops – Western North Dakota.* Fargo, ND: North Dakota State University Extension Service.

NDSU Ext. Service. (2017). *Projected 2017 Crop Budgets – North West North Dakota.* Fargo, ND: North Dakota State University Extension Service.

Painter, K. (2011). *Costs of Owning and Operating Farm Machinery in the Pacific Northwest: 2011.* Pacific Northwest Extension Publication – University of Idaho, Washington State University, Oregon State University.

Phillips Co. Ext. (2018, May 4). 4/4/2018 , 4/13/2018, and 5/4 calls between Todd Gaston (Reclamation TSC) and Marko Manoukian (Phillips County MSU Extension) concerning Milk River Project water rights, cropping patterns, irrigation systems, prices, yields, and growing seasons.

Phillips Co. FSA. (2018, April 10). Call between Todd Gaston (Reclamation TSC) and Russell Snedigar (Phillips County USDA FSA Executive Director) concerning Milk River Project cropping patterns, yields, and growing seasons.

Piper, S. (2021). *Estimating the Ability to Pay for Domestic Water Service. Paper prepared for presentation consideration at the 2022 Western Regional Science Association Annual Meeting. Scottsdale, AZ. February 12–20, 2022.*

Reclamation. (2003). *Milk River – Benefits Analysis; prepared by Roger S. Otstot.* Billings, MT: US Bureau of Reclamation, Great Plains Region.

Reclamation. (2004a). *Technical Guidance for Irrigation Ability to Pay.* US Bureau of Reclamation.

Reclamation. (2004b). *Technical Guidance for Irrigation Payment Capacity.* US Bureau of Reclamation.

Reclamation. (2005). *Allocation of Operation, Maintenance and Replacement Expenses: Milk River Project.* US Bureau of Reclamation.

Reclamation. (2012). *St. Mary River and Milk River Basins Study Summary Report.* US Bureau of Reclamation.

Reclamation. (2014a). *Hyatt Dam Safety of Dams: Irrigation Benefits Technical Report.* Denver, CO: US Bureau of Reclamation, Technical Service Center.

Reclamation. (2014b). *Reclamation Manual – Directives and Standards: PEC P05; Subject: Water-Related Contracts—General Principles and Requirements; Supersedes PEC P05*

(254) 9/11/2006; Minor revisions approved 12/18/2013, 3/21/2014, 11/20/2014. US Bureau of Reclamation.

Reclamation. (2018a, January 18). Conference call between Todd Gaston (Reclamation TSC) and Steve Darlinton and Clayton Jordan (both of Reclamation MTAO) regarding Milk River Project deliveries, irrigation season, and Fresno Dam SOD objectives.

Reclamation. (2018b, March 16-19). Email correspondence between Todd Gaston (Reclamation TSC) and Mark Beatty, Steve Darlinton, and Clayton Jordan (all Reclamation MTAO) regarding Milk River Project irrigated lands and irrigators.

Reclamation. (2018c, April). *Milk River Project*. Retrieved from US Department of Interior, Bureau of Reclamation, Projects & Facilities: https://www.usbr.gov/projects/index.php?id=352

Reclamation. (2018d, March 6). Microsoft Excel spreadsheet detailing MRP water contracted and used by M&I entities from 2004–17, sent via email from Steve Darlinton (Reclamation MTAO) to Todd Gaston (Reclamation TSC). *Milk River M&I*.

Reclamation. (2019a). *Fresno Dam Safety of Dams – Irrigation Benefits Technical Report.* Denver Technical Service Center: US Bureau of Reclamation.

Reclamation. (2019b). *Reclamation Manual – Directives and Standards: PEC 11-01; Subject: Irrigation Ability-to-Pay Analyses; (626) 08/26/2019; Incorporates PEC TRMR-122 (625) 08/26/2019 and minor revisions 07/14/2020; Minor revisions 08/25/2021.* US Bureau of Reclamation.

Reclamation. (2020a, August 7). Email from Karl Stock, Manager of Reclamtion Law Administration Division, providing FY2021 values for use in calculating return to equity, debt-to-asset ratios, and interest rates.

Reclamation. (2020b). *Navajo Nation Water Users Ability to Pay for Water Service; Deliberative draft report.* Denver Technical Service Center: US Bureau of Reclamation.

U. ID CALS. (2007). *2007 Costs and Returns Estimate – Southcentral Idaho: Magic Valley Pasture.* Moscow, ID: University of Idaho College of Agricultural and Life Sciences.

U. ID CALS. (2013). *2013 Costs and Returns Estimate – Northern Idaho: Alfalfa Establishment with Barley.* Moscow, ID: University of Idaho College of Agricultural and Life Sciences.

U. ID CALS. (2016). *2016 Enterprise Budgets: District 1 Wheat Rotations Under Conventional Tillage.* Moscow, ID: University of Idaho College of Agricultural and Life Sciences.

U. ID CALS. (2017a). *2017 Costs and Returns Estimate – Eastern Idaho: Alfalfa Hay Establishment in Grain Stubble.* Moscow, ID: University of Idaho College of Agricultural and Life Sciences.

U. ID CALS. (2017b). *2017 Costs and Returns Estimate – Eastern Idaho: Alfalfa Hay Production.* Moscow, ID: University of Idaho College of Agricultural and Life Sciences.

U. ID CALS. (2017c). *2017 Costs and Returns Estimate – Eastern Idaho: Lower Rainfall Dryland Feed Barley.* Moscow, ID: University of Idaho College of Agriculture and Life Sciences.

U. ID CALS. (2017d). *2017 Costs and Returns Estimate – Eastern Idaho: Lower Rainfall Dryland Hard White Spring Wheat.* Moscow, ID: University of Idaho College of Agricultural and Life Sciences.

U. ID CALS. (2017e). *2017 Costs and Returns Estimate – Eastern Idaho: Spring Feed Barley.* Moscow, ID: University of Idaho College of Agricultural and Life Sciences.

UC Coop. Ext. (2008). *Sample Costs to Establish and Produce Pasture – Irrigated in the Intermountain Region – Shasta, Lassen, and Modoc Counties.* Davis, CA: University of California Cooperative Extension.

UC Coop. Ext. (2012). *Sample Costs to Establish and Produce Alfalfa Hay – Intermountain Siskiyou County, Scott Valley – Mixed Irrigation.* Davis, CA: University of California Cooperative Extension.

UNR Coop. Ext. (2008). *Northwestern Nevada Alfalfa Hay Establishment, Production Costs and Returns, 2008.* Reno, NV: University of Nevada Cooperative Extension.

USDA-NASS. (2021, October). *Quick States 2.0*. Retrieved January 2019, from United States Departmnet of Agriculture, National Agricultural Statistics Service: http://quickstats.nass.usda.gov/

USDA-NRCS. (2008). *Range Technical Note No. MT-32 (Rev. 2) – Montana Grazing Animal Unit Month (AUM) Estimator.* US Department of Agriculture, Natural Resrouces Conservation Service.

USDA-NRCS. (2010). *Unlocking the Power of Irrigated Pasture.* Dillon, MT: US Department of Agriculture, Natural Resources Conservation Service.

Valley Co. FSA. (2018, May 23). 4/12/2018 phone call and 5/23/2018 follow-up email correspondence between Todd Gaston (Reclamation TSC) and Mike Hagfeldt (Valley County USDA FSA Executive Director) concerning Milk River Project cropping patterns, yields, and growing seasons.

Appendices

Appendix A. Farm Budget Tool data and outputs for representative farm payment capacity analysis

Appendix B. Poverty percentages for Montana communities

Appendix A.

FBT data and outputs for farm-level payment capacity analysis

Appendix A. FBT data and outputs for farm-level payment capacity analysis

Version 2.1.5

Farm Summary

	Acres	Avg. market value ($/acre)
Total farm size	3,150	
Total cropped acres	3,000	755.55
Farmstead, roads, waste	150	828.00

Note: all 'per acre' totals based upon 3,150 total farm acres (cropped and waste acres)

	Acres	Avg. market value ($/acre)
Irrigated land	3,000	755.55
Irrig. Alfalfa FP	80	828.00
Irrig. Alfalfa Est.	20	828.00
Irrig. Barley	70	828.00
Irrig. Pasture	30	828.00
Dryland Pasture	1,350	667.00
Dryland Spr. Wht.	1,000	828.00
Dryland Barley	300	828.00
Dryland Peas	150	828.00
Non-irrigated land	0	0.00

Summary of Farm Investment

Item	**Total**	**Per acre**
Land	2,390,850	759.00
Land development	0	0.00
Improvements		
Irrigation system	117,819	37.40
Permanent plantings	0	0.00
Buildings and fences	107,101	34.00
Farmstead, waste acres	0	0.00
Equipment		
Power implements	448,894	142.51
Non-power implements	186,174	59.10
Vehicles	29,073	9.23
Small tools	18,617	5.91
Total farm investment	**$3,298,529**	**$1,047.15**

Summary of Farm Work

Work by (in hours):	**Total**	**Per acre**
Farm operator	1,229	0.39
Farm family	0	0.00
Hired labor	0	0.00

Financial Summary

Variable expenses	**Total**	**Per acre**
Crop expenses		
Custom work	$29,160.53	$9.26
Fertilizer	$44,323.80	$14.07
Herbicides	$15,608.00	$4.95
Insect control	$3,076.86	$0.98
Seed	$25,939.14	$8.23
Disease control	$0.00	$0.00
Misc. crop expenses	$0.00	$0.00
On-farm irrigation pumping	$2,045.15	$0.65
General expenses		
Hired labor	$0.00	$0.00
Workmen's compensation	$0.00	$0.00
Social Security	$0.00	$0.00
Repairs	$28,068.21	$8.91
Fuel, grease & oil	$22,989.68	$7.30
Telephone	$385.25	$0.12
Electricity	$423.75	$0.13
Other farm expenses	$0.00	$0.00
Miscellaneous (2% of variable)	$3,440.41	$1.09
Interest on operating capital	$1,398.63	$0.44
Subtotal - variable expenses	**$176,859.41**	**$56.15**
Fixed expenses		
Depreciation	$38,652.02	$12.27
Taxes	$14,984.07	$4.76
Insurance	$10,537.33	$3.35
Interest on debt	$14,165.22	$4.50
Subtotal - fixed expenses	**$78,338.64**	**$24.87**
Farm income analysis		
Crop sales	$235,988.92	$74.92
Other income	$0.00	$0.00
Gross income	**$235,988.92**	**$74.92**
Total farm expenses	$255,198.05	$81.02
Net farm income	**-$19,209.13**	**-$6.10**
Return to family farm		
Return to equity	$52,609.36	$16.70
Return to management	-$1,920.91	-$0.61
Return to labor	$27,167.83	$8.62
Total return to farm family	**$77,856.27**	**$24.72**
Payment Capacity analysis		
Net returns	**-$97,065.40**	

Note: The payment capacity per acre is calculated outside of the farm budget tool (FBT).
The per acre payment capacity is estimated as the total farm net returns developed in the FBT divided by the farm acreage irrigated with project water and associated waste acreage.

Appendix A. FBT data and outputs for farm-level payment capacity analysis

Crop revenues

Crop	Yield per acre	units	Acres	Total produced	Total fed to livestock	Total sold	Price	Revenue
Irrig. Alfalfa FP	3.46	tons	80	277		277	$139.80	$38,696.64
Irrig. Alfalfa Est.	2.08	tons	20	42		42	139.80	5,815.68
Irrig. Barley	70.00	BU	70	4,900		4,900	3.00	14,700.00
Irrig. Pasture	2.50	AUM	30	75		75	24.20	1,815.00
Dryland Pasture	0.28	AUM	1350	378		378	24.20	9,147.60
Dryland Spr. Wht.	20.00	BU	1000	20,000		20,000	5.30	106,000.00
Dryland Barley	40.00	BU	300	12,000		12,000	3.00	36,000.00
Dryland Peas	16.20	CWT	150	2,430		2,430	9.80	23,814.00
							Total	**$235,988.92**

Financial & Miscellaneous input data for this farm budget

Financial input data

Return on Equity	2.00%	*Interest rates:*					Adjustment
Return on Management	10.00%	Real estate	3.270%	*Tax rates:*			
Return on Management (Benefits analysis)	6.00%	Non-real estate	8.480%		Land	1.245%	1.00
		Depreciation	0.000%		Equipment	1.500%	0.50
Return to farm family (Land class analysis)	$0				Improvements	1.245%	0.50
		Months of interest bearing on operating capital	6				
				Debt levels:	Land	10.00%	
Waste acre tax value	$553	per acre			Equipment	18.80%	

Miscellaneous farm input data

Misc. expenses per farm	$0	Base rate per kWH	$0.08
Misc. expenses per acre	$0	Adjusted rate per kWH	$0.00
Misc. income per farm	$0	Homestead & waste acres	150
Total vehicle taxes	$0	Homestead & waste acre mkt value	$828
Total vehicle insurance	$1,000	Meter or other change	$58.00
Building insurance rate	$7	Demand charge per HP	$6.96
Machinery insurance rate	$7	Electricity expenses	$424
Liability insurance	$6,090	Phone expenses	385.25

Equipment input data for this farm budget

Power implement input data

Name	Base price	Base year	Budget year	Indexed price	Salvage value	Life hours	Max use/yr	Fuel cost per hour	Repair cost per hour
Tractor-300HP	$120,000	2015	2020	$129,738	$12,974	9600	1000	$42.32	$8.59
Tractor-145HP	60,000	2015	2020	64,869	6,487	7200	800	20.45	4.68
Combine-25'	190,200	2015	2020	205,635	20,564	3000	500	24.31	45.29
Truck-10 wheel	45,000	2015	2020	48,652	4,865	1500	300	10.17	9.54

Non-power implement input data

Name	Base price	Base year	Budget year	Indexed price	Salvage value	Life hours	Max use/yr	Repair cost per hour
Sprayer-50'	$13,200	2015	2020	$14,271	$1,427	1500	300	$9.71
Chisel Plow-27'	25,200	2015	2020	27,245	2,725	1500	300	13.89
Cultivator-36'	34,800	2015	2020	37,624	3,762	1500	300	18.48
Air Seeder Drill-35'	99,000	2015	2020	107,034	10,703	1500	300	73.43

Vehicle input data

Name	Base price	Base year	Budget price	Indexed price	Salvage value	Life miles	Max use/yr	Fuel cost per mile	Repair cost per mile	Miles to hour conversion
Pickup-3/4 ton	$25,200	2015	2020	$25,439	$2,544	60000	20000	$0.45	$0.18	20
ATV-4wd	3,600	2015	2020	3,634	363	30000	5000	0.07	0.07	10

Building and fence input data

Name	Base price	Base year	Budget year	Indexed price	Salvage value	Life years	Repair cost per year
Machine shed	$60,000	2010	2020	$74,722	$0	40	$782.73
Storage shed	26,000	2010	2020	32,379	0	40	339.18

Labor input data for this farm budget

Labor input data

Hourly wages:		*Miscellaneous:*	
Operator	$22.11	Percent added to machine labor	10.00%
Family	$16.55	Percent added to machine usage	10.00%
Hired	$16.55	Worker's compensation rate/$100	$7.95
Base Wage Year	2020		
Hired labor Social Security rate	$7.65		

Monthly labor data

Hour limits	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Operator	240	240	240	240	240	240	240	240	240	240	240	240
Family	70	70	70	70	70	140	140	140	70	70	70	70
Manual labor distribution %												
Irrig. Alfalfa FP	3	3	5	10	10	15	15	15	10	5	5	4
Irrig. Alfalfa Est.	5	5	10	10	10	10	10	10	10	10	5	5
Irrig. Barley	3	3	5	5	15	15	10	15	10	10	6	3
Irrig. Pasture	3	3	5	5	10	10	15	15	15	10	5	4
Dryland Pasture	3	3	5	5	10	10	15	15	15	10	5	4
Dryland Spr. Wht	3	3	4	5	10	15	15	15	15	10	3	2
Dryland Barley	3	3	4	5	10	15	15	15	10	10	5	5
Dryland Peas	3	3	4	5	10	15	15	15	15	5	5	5
Operator labor distribution %												
Irrig. Alfalfa FP	3	3	5	10	10	15	15	15	10	5	5	4
Irrig. Alfalfa Est.	5	5	10	10	10	10	10	10	10	10	5	5
Irrig. Barley	3	3	5	5	15	15	10	15	10	10	6	3
Irrig. Pasture	3	3	5	5	10	10	15	15	15	10	5	4
Dryland Pasture	3	3	5	5	10	10	15	15	15	10	5	4
Dryland Spr. Wht	3	3	4	5	10	15	15	15	15	10	3	2
Dryland Barley	3	3	4	5	10	15	15	15	10	10	5	5
Dryland Peas	3	3	4	5	10	15	15	15	15	5	5	5

Appendix A. FBT data and outputs for farm-level payment capacity analysis

All costs are indexed to year 2020

Crop expenses by type of expense

Manual Labor

Item	Crop	Acres	Units per acre	Units	Total Hours
Irrigation labor	Irrig. Alfalfa Est.	20	1	hours	20
Irrigation labor	Irrig. Pasture	30	1	hours	30
				Total	**50.00**

Custom work

Item	Crop	Acres	Units per acre		Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Custom fert.	Irrig. Alfalfa FP	80	1	acres	2017	$7.75	$8.03	$8.03	$642.40
Custom swath	Irrig. Alfalfa FP	80	2	acres	2017	18.00	18.66	37.32	2,985.60
Custom rake	Irrig. Alfalfa FP	80	2	acres	2017	6.50	6.74	13.48	1,078.40
Custom bale	Irrig. Alfalfa FP	80	3.46	tons	2017	16.00	16.58	57.37	4,589.34
Custom haul/stack	Irrig. Alfalfa FP	80	3.46	tons	2017	5.50	5.70	19.72	1,577.76
Custom air spray	Irrig. Alfalfa FP	80	1	acres	2017	7.75	8.03	8.03	642.40
Custom fert.	Irrig. Alfalfa Est.	20	1	acres	2017	7.25	7.51	7.51	150.20
Custom swath	Irrig. Alfalfa Est.	20	1	acres	2017	18.00	18.66	18.66	373.20
Custom rake	Irrig. Alfalfa Est.	20	1	acres	2017	6.50	6.74	6.74	134.80
Custom bale	Irrig. Alfalfa Est.	20	2.08	tons	2017	16.00	16.58	34.49	689.73
Custon haul/stack	Irrig. Alfalfa Est.	20	2.08	tons	2017	5.50	5.70	11.86	237.12
Custom fertilize	Irrig. Barley	70	1	acres	2017	7.25	7.51	7.51	525.70
Custom air spray	Irrig. Barley	70	1	acres	2017	8.75	9.07	9.07	634.90
Custom haul - barley	Irrig. Barley	70	70	bu	2017	0.15	0.16	11.20	784.00
Custom Haul Manure	Irrig. Pasture	30	1	tons	2007	2.00	2.59	2.59	77.70
Custom fertilize	Irrig. Pasture	30	1	acres	2007	3.00	3.88	3.88	116.40
Custom haul manure	Dryland Pasture	1350	1	tons	2007	2.00	2.59	2.59	3,496.50
Custom fertilize	Dryland Pasture	1350	0.25	acres	2007	6.00	7.77	1.94	2,622.38
Custom haul	Dryland Spr. Wht.	1000	20	bu	2017	0.18	0.19	3.80	3,800.00
Custom haul	Dryland Barley	300	40	bu	2017	0.15	0.16	6.40	1,920.00
Aerial spray	Dryland Peas	150	1	acres	2016	8.95	9.02	9.02	1,353.00
Custom haul	Dryland Peas	150	16.2	cwt	2016	0.30	0.30	4.86	729.00
								Total	**$29,160.53**

Fertilizer

Item	Crop	Acres	Units per acre		Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Dry P2O5	Irrig. Alfalfa FP	80	80	lbs	2017	$0.38	$0.42	$33.60	$2,688.00
K2O	Irrig. Alfalfa FP	80	45	lbs	2017	0.31	0.34	15.30	1,224.00
Dry Nitrogen - preplar	Irrig. Alfalfa FP	80	17	lbs	2017	0.40	0.44	7.48	598.40
Sulfur	Irrig. Alfalfa FP	80	13	lbs	2017	0.22	0.24	3.12	249.60
Dry N - pre-plant	Irrig. Alfalfa Est.	20	16	lbs	2017	0.40	0.44	7.04	140.80
Dry P2O5	Irrig. Alfalfa Est.	20	78	lbs	2017	0.38	0.42	32.76	655.20
K2O	Irrig. Alfalfa Est.	20	20	lbs	2017	0.31	0.34	6.80	136.00
Sulfur	Irrig. Alfalfa Est.	20	15	lbs	2017	0.22	0.24	3.60	72.00
Dry N - pre-plant	Irrig. Barley	70	70	lbs	2017	0.40	0.44	30.80	2,156.00
Dry P2O5	Irrig. Barley	70	25	lbs	2017	0.38	0.42	10.50	735.00
K2O	Irrig. Barley	70	6	lbs	2017	0.31	0.34	2.04	142.80
Urea	Irrig. Pasture	30	20	lbs	2007	0.23	0.25	5.00	150.00
Urea	Dryland Pasture	1350	20	lbs	2007	0.23	0.25	5.00	6,750.00
Liquid N	Dryland Spr. Wht.	1000	3.3	lbs	2017	0.50	0.55	1.82	1,815.00
Liquid P2O5	Dryland Spr. Wht.	1000	10	lbs	2017	0.56	0.61	6.10	6,100.00
Dry N	Dryland Spr. Wht.	1000	23	lbs	2017	0.40	0.44	10.12	10,120.00
Sulfur	Dryland Spr. Wht.	1000	6.7	lbs	2017	0.22	0.24	1.61	1,608.00
Ammonium Sulfate	Dryland Spr. Wht.	1000	2	lbs	2017	0.70	0.77	1.54	1,540.00
Dry N	Dryland Barley	300	35	lbs	2017	0.40	0.44	15.40	4,620.00
Dry P2O5	Dryland Barley	300	10	lbs	2017	0.38	0.42	4.20	1,260.00
Sulfur	Dryland Barley	300	10	lbs	2017	0.22	0.24	2.40	720.00
Ammonium Sulfate	Dryland Barley	300	3	lbs	2017	0.70	0.77	2.31	693.00
Ammonium Sulfate	Dryland Peas	150	50	oz	2016	0.02	0.02	1.00	150.00
								Total	**$44,323.80**

All costs are indexed to year 2020

Crop expenses by type of expense

Herbicide

Item	Crop	Acres	Units per acre		Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Metribuzin 75DF	Irrig. Alfalfa FP	80	0.75	lbs	2017	$11.50	$10.98	$8.23	$658.80
Axial XL	Irrig. Barley	70	10	oz	2017	1.00	0.95	9.50	665.00
Affinity Tank Mix 50S	Irrig. Barley	70	0.4	oz	2017	8.55	8.16	3.26	228.48
Starane Ultra	Irrig. Barley	70	0.2	pints	2017	28.10	26.83	5.37	375.62
Twinline	Irrig. Barley	70	4	oz	2017	1.65	1.58	6.32	442.40
Roundup PM 4.5	Dryland Spr. Wht.	1000	10	oz	2017	0.18	0.17	1.70	1,700.00
2,4-D Amine	Dryland Spr. Wht.	1000	0.67	pt	2017	2.10	2.01	1.35	1,346.70
Banvel 4L	Dryland Spr. Wht.	1000	2	oz	2017	0.65	0.62	1.24	1,240.00
Fallow-Roundup	Dryland Spr. Wht.	1000	14	oz	2017	0.18	0.17	2.38	2,380.00
Fallow-Ultrapro	Dryland Spr. Wht.	1000	33	oz	2017	0.02	0.02	0.66	660.00
Fallow-Excel90	Dryland Spr. Wht.	1000	1	oz	2017	0.20	0.19	0.19	190.00
Roundup PM4.5	Dryland Barley	300	16	oz	2017	0.18	0.17	2.72	816.00
2,4-D Amine	Dryland Barley	300	1	pt	2017	2.10	2.01	2.01	603.00
Banvel 4L	Dryland Barley	300	3	oz	2017	0.65	0.62	1.86	558.00
Pursuit	Dryland Peas	150	3	oz	2016	3.53	3.25	9.75	1,462.50
Prowl	Dryland Peas	150	24	oz	2016	0.46	0.42	10.08	1,512.00
Far-GO	Dryland Peas	150	1	qt	2016	5.56	5.13	5.13	769.50
								Total	**$15,608.00**

Insect control

Item	Crop	Acres	Units per acre		Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Warrior II w/Zeon Tec	Irrig. Alfalfa FP	80	3	oz	2017	$2.35	$2.24	$6.72	$537.60
2,4-D Amine	Irrig. Pasture	30	0.1	qt	2007	3.65	4.07	0.41	12.21
Surfacant	Dryland Peas	150	1.5	oz	2016	0.23	0.21	0.31	47.25
Imidan 70	Dryland Peas	150	1	lbs	2016	15.41	14.21	14.21	2,131.50
Dimethoate	Dryland Peas	150	0.3	pt	2016	8.40	7.74	2.32	348.30
								Total	**$3,076.86**

Seed cost

Item	Crop	Acres	Units per acre		Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Seed - pvt, incoc.	Irrig. Alfalfa Est.	20	18	lbs	2017	$4.25	$4.02	$72.36	$1,447.20
Barley seed	Irrig. Barley	70	60	lbs	2017	0.22	0.21	12.60	882.00
Orchardgrass seed	Irrig. Pasture	30	0.6	lbs	2008	3.33	4.84	2.90	87.12
Tall Fescue seed	Irrig. Pasture	30	0.8	lbs	2008	1.48	2.15	1.72	51.60
Ladino seed	Irrig. Pasture	30	0.05	lbs	2008	2.71	3.94	0.20	5.91
White Dutch seed	Irrig. Pasture	30	0.025	lbs	2008	2.71	3.94	0.10	2.96
Alsike seed	Irrig. Pasture	30	0.025	lbs	2008	2.85	4.14	0.10	3.11
Orchardgrass seed	Dryland Pasture	1350	0.15	lbs	2008	3.33	4.84	0.73	980.10
Tall Fescue seed	Dryland Pasture	1350	0.2	lbs	2008	1.48	2.15	0.43	580.50
Ladino seed	Dryland Pasture	1350	0.03	lbs	2008	2.71	3.94	0.12	159.57
White Dutch seed	Dryland Pasture	1350	0.01	lbs	2008	2.71	3.94	0.04	53.19
Alsike seed	Dryland Pasture	1350	0.01	lbs	2008	2.85	4.14	0.04	55.89
Wheat seed	Dryland Spr. Wht.	1000	43	lbs	2017	0.22	0.21	9.03	9,030.00
Feed barley seed	Dryland Barley	300	50	lbs	2017	0.22	0.21	10.50	3,150.00
Pea seed	Dryland Peas	150	180	lbs	2016	0.38	0.35	63.00	9,450.00
								Total	**$25,939.14**

Disease control

Item	Crop	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
							Total	**$0.00**

Miscellaneous expenses

Item	Crop	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
							Total	**$0.00**

Appendix A. FBT data and outputs for farm-level payment capacity analysis

All costs are indexed to year 2020

Crop expenses by crop

Irrig. Alfalfa FP

Item	Category	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Dry P2O5	fertilizer	80	80 lbs	2017	$0.38	$0.42	$33.60	$2,688.00
K2O	fertilizer	80	45 lbs	2017	0.31	0.34	15.30	1,224.00
Dry Nitrogen - preplant	fertilizer	80	17 lbs	2017	0.40	0.44	7.48	598.40
Sulfur	fertilizer	80	13 lbs	2017	0.22	0.24	3.12	249.60
Metribuzin 75DF	herbicide	80	0.75 lbs	2017	11.50	10.98	8.23	658.80
Warrior II w/Zeon Tech	insect control	80	3 oz	2017	2.35	2.24	6.72	537.60
Custom fert.	custom work	80	1 acres	2017	7.75	8.03	8.03	642.40
Custom swath	custom work	80	2 acres	2017	18.00	18.66	37.32	2,985.60
Custom rake	custom work	80	2 acres	2017	6.50	6.74	13.48	1,078.40
Custom bale	custom work	80	3.46 tons	2017	16.00	16.58	57.37	4,589.34
Custom haul/stack	custom work	80	3.46 tons	2017	5.50	5.70	19.72	1,577.76
Custom air spray	custom work	80	1 acres	2017	7.75	8.03	8.03	642.40
							Total	**$17,472.30**

Irrig. Alfalfa Est.

Item	Category	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Seed - pvt, incoc.	seed cost	20	18 lbs	2017	$4.25	$4.02	$72.36	$1,447.20
Dry N - pre-plant	fertilizer	20	16 lbs	2017	0.40	0.44	7.04	140.80
Dry P2O5	fertilizer	20	78 lbs	2017	0.38	0.42	32.76	655.20
K2O	fertilizer	20	20 lbs	2017	0.31	0.34	6.80	136.00
Sulfur	fertilizer	20	15 lbs	2017	0.22	0.24	3.60	72.00
Custom fert.	custom work	20	1 acres	2017	7.25	7.51	7.51	150.20
Custom swath	custom work	20	1 acres	2017	18.00	18.66	18.66	373.20
Custom rake	custom work	20	1 acres	2017	6.50	6.74	6.74	134.80
Custom bale	custom work	20	2.08 tons	2017	16.00	16.58	34.49	689.73
Custon haul/stack	custom work	20	2.08 tons	2017	5.50	5.70	11.86	237.12
							Total	**$4,036.25**

Irrig. Barley

Item	Category	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Barley seed	seed cost	70	60 lbs	2017	$0.22	$0.21	$12.60	$882.00
Dry N - pre-plant	fertilizer	70	70 lbs	2017	0.40	0.44	30.80	2,156.00
Dry P2O5	fertilizer	70	25 lbs	2017	0.38	0.42	10.50	735.00
K2O	fertilizer	70	6 lbs	2017	0.31	0.34	2.04	142.80
Axial XL	herbicide	70	10 oz	2017	1.00	0.95	9.50	665.00
Affinity Tank Mix 50SG	herbicide	70	0.4 oz	2017	8.55	8.16	3.26	228.48
Starane Ultra	herbicide	70	0.2 pints	2017	28.10	26.83	5.37	375.62
Twinline	herbicide	70	4 oz	2017	1.65	1.58	6.32	442.40
Custom fertilize	custom work	70	1 acres	2017	7.25	7.51	7.51	525.70
Custom air spray	custom work	70	1 acres	2017	8.75	9.07	9.07	634.90
Custom haul - barley	custom work	70	70 bu	2017	0.15	0.16	11.20	784.00
							Total	**$7,571.90**

Irrig. Pasture

Item	Category	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Urea	fertilizer	30	20 lbs	2007	$0.23	$0.25	$5.00	$150.00
2,4-D Amine	insect control	30	0.1 qt	2007	3.65	4.07	0.41	12.21
Custom Haul Manure	custom work	30	1 tons	2007	2.00	2.59	2.59	77.70
Custom fertilize	custom work	30	1 acres	2007	3.00	3.88	3.88	116.40
Orchardgrass seed	seed cost	30	0.6 lbs	2008	3.33	4.84	2.90	87.12
Tall Fescue seed	seed cost	30	0.8 lbs	2008	1.48	2.15	1.72	51.60
Ladino seed	seed cost	30	0.05 lbs	2008	2.71	3.94	0.20	5.91
White Dutch seed	seed cost	30	0.025 lbs	2008	2.71	3.94	0.10	2.96
Alsike seed	seed cost	30	0.025 lbs	2008	2.85	4.14	0.10	3.11
							Total	**$507.00**

Appendix A. FBT data and outputs for farm-level payment capacity analysis

All costs are indexed to year 2020

Crop expenses by crop

Dryland Pasture

Item	Category	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Urea	fertilizer	1350	20 lbs	2007	$0.23	$0.25	$5.00	$6,750.00
Custom haul manure	custom work	1350	1 tons	2007	2.00	2.59	2.59	3,496.50
Custom fertilize	custom work	1350	0.25 acres	2007	6.00	7.77	1.94	2,622.38
Orchardgrass seed	seed cost	1350	0.15 lbs	2008	3.33	4.84	0.73	980.10
Tall Fescue seed	seed cost	1350	0.2 lbs	2008	1.48	2.15	0.43	580.50
Ladino seed	seed cost	1350	0.03 lbs	2008	2.71	3.94	0.12	159.57
White Dutch seed	seed cost	1350	0.01 lbs	2008	2.71	3.94	0.04	53.19
Alsike seed	seed cost	1350	0.01 lbs	2008	2.85	4.14	0.04	55.89
							Total	**$14,698.13**

Dryland Spr. Wht.

Item	Category	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Wheat seed	seed cost	1000	43 lbs	2017	$0.22	$0.21	$9.03	$9,030.00
Liquid N	fertilizer	1000	3.3 lbs	2017	0.50	0.55	1.82	1,815.00
Liquid P2O5	fertilizer	1000	10 lbs	2017	0.56	0.61	6.10	6,100.00
Dry N	fertilizer	1000	23 lbs	2017	0.40	0.44	10.12	10,120.00
Sulfur	fertilizer	1000	6.7 lbs	2017	0.22	0.24	1.61	1,608.00
Roundup PM 4.5	herbicide	1000	10 oz	2017	0.18	0.17	1.70	1,700.00
Ammonium Sulfate	fertilizer	1000	2 lbs	2017	0.70	0.77	1.54	1,540.00
2,4-D Amine	herbicide	1000	0.67 pt	2017	2.10	2.01	1.35	1,346.70
Banvel 4L	herbicide	1000	2 oz	2017	0.65	0.62	1.24	1,240.00
Custom haul	custom work	1000	20 bu	2017	0.18	0.19	3.80	3,800.00
Fallow-Roundup	herbicide	1000	14 oz	2017	0.18	0.17	2.38	2,380.00
Fallow-Ultrapro	herbicide	1000	33 oz	2017	0.02	0.02	0.66	660.00
Fallow-Excel90	herbicide	1000	1 oz	2017	0.20	0.19	0.19	190.00
							Total	**$41,529.70**

Dryland Barley

Item	Category	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Feed barley seed	seed cost	300	50 lbs	2017	$0.22	$0.21	$10.50	$3,150.00
Dry N	fertilizer	300	35 lbs	2017	0.40	0.44	15.40	4,620.00
Dry P2O5	fertilizer	300	10 lbs	2017	0.38	0.42	4.20	1,260.00
Sulfur	fertilizer	300	10 lbs	2017	0.22	0.24	2.40	720.00
Roundup PM4.5	herbicide	300	16 oz	2017	0.18	0.17	2.72	816.00
Ammonium Sulfate	fertilizer	300	3 lbs	2017	0.70	0.77	2.31	693.00
2,4-D Amine	herbicide	300	1 pt	2017	2.10	2.01	2.01	603.00
Banvel 4L	herbicide	300	3 oz	2017	0.65	0.62	1.86	558.00
Custom haul	custom work	300	40 bu	2017	0.15	0.16	6.40	1,920.00
							Total	**$14,340.00**

Dryland Peas

Item	Category	Acres	Units per acre	Base year index	Non-indexed cost per unit	Cost per unit	Cost per acre	Total cost
Pea seed	seed cost	150	180 lbs	2016	$0.38	$0.35	$63.00	$9,450.00
Pursuit	herbicide	150	3 oz	2016	3.53	3.25	9.75	1,462.50
Prowl	herbicide	150	24 oz	2016	0.46	0.42	10.08	1,512.00
Ammonium Sulfate	fertilizer	150	50 oz	2016	0.02	0.02	1.00	150.00
Surfacant	insect control	150	1.5 oz	2016	0.23	0.21	0.31	47.25
Imidan 70	insect control	150	1 lbs	2016	15.41	14.21	14.21	2,131.50
Dimethoate	insect control	150	0.3 pt	2016	8.40	7.74	2.32	348.30
Far-GO	herbicide	150	1 qt	2016	5.56	5.13	5.13	769.50
Aerial spray	custom work	150	1 acres	2016	8.95	9.02	9.02	1,353.00
Custom haul	custom work	150	16.2 cwt	2016	0.30	0.30	4.86	729.00
							Total	**$17,953.05**

Appendix A. FBT data and outputs for farm-level payment capacity analysis

On-farm irrigation pumping expenses

	Monthly charge		Months	Total HP	Charge
Meter charge	$58.00		5		$290.00
Demand charge	$6.96	per HP	5	8.4700003	$294.71

	Energy rates per kWh			
	Base	Adj.	Total kWh	
Energy charge	$0.07700	$0.00000	18966.76	$1,460.44
			Total	$2,045.15

Energy charge algorithm

Step 1: Determine the required GPM
= (Acres irrigated * Amount pumped (AFI) * gal/AF) / (Days of pumping)/(Hours of use)/(min/hr)
(Hours of use assumed to be 18)
Step 2: Determine the required head
= (Pumping pressure * (ft/PSI)) + (Pumping lift)
Step 3: Determine pump size, required HP
= (Required GPM * Required Head)/(HP conversion * Pump efficiency)
(Pump efficiency assumed to be 0.70)
Step 4: Determine kWh to pump 1 AF
= (kWh conversion * Required head)/ (Pumping efficiency * Total efficiency)
(Total efficiency assumed to be 0.90)
Step 5: Determine irrigation season pumping capacity
= (Days of pumping * Required GPM * Hours of use * min/hr)/(gal/AF)
Step 6: Determine total required kWh
= (Season pumping capacity) * (kWh to pump 1 AF)
Step 7: Determine pumping expense
= Total required kWh * (base rate per kWh)

Conversions
1 AF = 325,900 gallons
1 PSI = 2.31 ft.
HP conversion = 3960
kWh conversion = 1.024

Energy rate per kWh:
Base rate: $0.07700
Adjusted rat $0.00000 (currently not used)

Surface water requirements

Crop	Amount pumped	Acres irrigated	Days of pumping	Pumping PSI	Pumping lift (ft)	Required kWh	Pumping cost
Irrig. Alfalfa Est.	1.75	10	150	70	5	4741.689	365.11
Irrig. Pasture	1.75	30	150	70	5	14225.07	1095.33
						Total	1460.44

Groundwater requirements

Crop	Amount pumped	Acres irrigated	Days of pumping	Pumping PSI	Pumping lift (ft)	Required kWh	Pumping cost
						Total	0

Return flow requirements

Crop	Amount pumped	Acres irrigated	Days of pumping	Pumping PSI	Pumping lift (ft)	Required kWh	Pumping cost
						Total	0

Computation of Interest and Return to Equity on Operating Capital

Equipment interest rate:	8.48%
Return to equity:	2.00%
Equipment debt:	18.80%

Category	Total Operating	Interest	Return to equity	Crops: Irrig. Alfalfa FP	Irrig. Alfalfa Est.	Irrig. Barley	Irrig. Pasture	Dryland Pasture	Dryland Spr. Wht.	Dryland Barley	Dryland Peas
Custom work	$29,160.53	$232.44	$236.78	$11,515.90	$1,585.05	$1,944.60	$194.10	$6,118.88	$3,800.00	$1,920.00	$2,082.00
Fertilizer	$44,323.80	$353.31	$359.91	$4,760.00	$1,004.00	$3,033.80	150.00	6,750.00	21,183.00	7,293.00	150.00
Herbicide	$15,608.00	$124.41	$126.74	$658.80	$0.00	$1,711.50	0.00	0.00	7,516.70	1,977.00	3,744.00
Insect control	$3,076.86	$24.53	$24.98	$537.60	$0.00	$0.00	12.21	0.00	0.00	0.00	2,527.05
Seed cost	$25,939.14	$206.77	$210.63	$0.00	$1,447.20	$882.00	150.69	1,829.25	9,030.00	3,150.00	9,450.00
Disease control	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	0.00
Miscellaneous	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00	0.00	0.00	0.00	0.00
Irrigation pumping	$2,045.15	$16.30	$16.61	$0.00	$365.11	$0.00	1,095.33	0.00	0.00	0.00	0.00
Fuel	$22,989.68	$183.26	$186.68	$120.65	$168.88	$919.11	42.47	2,735.82	12,735.36	4,141.50	2,125.89
Equipment repairs	$23,840.80	$190.04	$193.59	$49.37	$168.16	$1,065.89	33.55	1,652.91	13,679.97	4,701.82	2,489.14
Hired labor	$0.00	$0.00	$0.00								
Workmen's compensation	$0.00	$0.00	$0.00								
Social Security	$0.00	$0.00	$0.00								
Other repairs	$4,227.41	$33.70	$34.33								
Telephone	$385.25	$3.07	$3.13								
Electricity	$423.75	$3.38	$3.44								
Other farm expenses	$0.00	$0.00	$0.00								
Misc. (2% add-on)	$3,440.41	$27.42	$27.94								
Total	**$175,460.78**	**$1,398.63**	**$1,424.74**	**$17,642.32**	**$4,738.40**	**$9,556.90**	**$1,678.35**	**$19,086.85**	**$67,945.03**	**$23,183.32**	**$22,568.08**

Return to Equity on Investment

	Land	Equipment	Return to Equity
Equity/Asset ratio	90.00%	81.20%	2.00%

All 'per acre' totals based upon 3,150 acres.

	Computation value	Return to Equity Per farm	Return to Equity Per acre
Real Estate Investment			
Land	$2,390,850.00	$43,035.30	$13.66
Land development	0.00	0.00	0.00
Improvements	53,550.52	963.91	0.31
Permanent plantings	0.00	0.00	0.00
Non-real estate investment			
Irrigation and return flow system	61,228.85	994.36	0.32
Non-power equipment	102,395.89	1,662.91	0.53
Power equipment	246,891.81	4,009.52	1.27
Vehicles	15,990.14	259.68	0.08
	9,308.72	151.17	0.05
Small tools	0.00	0.00	0.00
Total	**$2,880,216.00**	**$51,184.61**	**$16.25**
		51,076.85	16.21

Farm taxes

	Taxable value	Adjustment factor	Adjusted taxable value	Tax rate	Tax
Land taxes	966,350.00	1.00	$966,350.00	1.24500%	$12,031.06
Improvement taxes	53,550.52	0.50	26,775.26	1.24500%	333.35
Equipment taxes	349,287.69	0.50	174,643.84	1.50000%	2,619.66
Vehicle taxes					0.00
				Total taxes	**$14,984.07**

Farm insurance expenses

	Rate	Investment value* (1000's)	Total
Building insurance	6.66	$107.10	$713.29
Machinery insurance	6.66	410.52	2,734.04
Liability insurance			6,090.00
Vehicle insurance			1,000.00
		Total insurance	**$10,537.33**

* The fire and wind insurance rate for buildings and machinery is per $1000 of investments (including all power and non-power equipment, buildings, and irrigation system). Irrigation and return flow systems are included in the machinery insurance calculation.
* Investment values for insurance purposes are based upon the average of purchase price and salvage value.

Labor limits by month (for entire operation)

	Total	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Farm operator	2,880.00	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0	240.0
Family	1,050.00	70.0	70.0	70.0	70.0	70.0	140.0	140.0	140.0	70.0	70.0	70.0	70.0

Labor used each month (for entire operation)

	Total	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Farm operator	1,228.76	37.4	37.4	53.2	63.7	125.2	174.2	180.6	182.9	169.4	116.3	49.1	39.4
Family	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hired	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1,228.76	37.4	37.4	53.2	63.7	125.2	174.2	180.6	182.9	169.4	116.3	49.1	39.4

Total labor

	Total	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Irrig. Alfalfa FP	17.42	0.5	0.5	0.9	1.7	1.7	2.6	2.6	2.6	1.7	0.9	0.9	0.7
Irrig. Alfalfa Est.	28.71	1.4	1.4	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	1.4	1.4
Irrig. Barley	45.74	1.4	1.4	2.3	2.3	6.9	6.9	4.6	6.9	4.6	4.6	2.7	1.4
Irrig. Pasture	33.85	1.0	1.0	1.7	1.7	3.4	3.4	5.1	5.1	5.1	3.4	1.7	1.4
Dryland Pasture	140.48	4.2	4.2	7.0	7.0	14.0	14.0	21.1	21.1	21.1	14.0	7.0	5.6
Dryland Spr. Wht.	641.30	19.2	19.2	25.7	32.1	64.1	96.2	96.2	96.2	96.2	64.1	19.2	12.8
Dryland Barley	206.91	6.2	6.2	8.3	10.3	20.7	31.0	31.0	31.0	20.7	20.7	10.3	10.3
Dryland Peas	114.35	3.4	3.4	4.6	5.7	11.4	17.2	17.2	17.2	17.2	5.7	5.7	5.7
Total	1,228.76	37.4	37.4	53.2	63.7	125.2	174.2	180.6	182.9	169.4	116.3	49.1	39.4

Equipment operator labor

	Total	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Irrig. Alfalfa FP	17.42	0.5	0.5	0.9	1.7	1.7	2.6	2.6	2.6	1.7	0.9	0.9	0.7
Irrig. Alfalfa Est.	8.71	0.4	0.4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.4	0.4
Irrig. Barley	45.74	1.4	1.4	2.3	2.3	6.9	6.9	4.6	6.9	4.6	4.6	2.7	1.4
Irrig. Pasture	3.85	0.1	0.1	0.2	0.2	0.4	0.4	0.6	0.6	0.6	0.4	0.2	0.2
Dryland Pasture	140.48	4.2	4.2	7.0	7.0	14.0	14.0	21.1	21.1	21.1	14.0	7.0	5.6
Dryland Spr. Wht.	641.30	19.2	19.2	25.7	32.1	64.1	96.2	96.2	96.2	96.2	64.1	19.2	12.8
Dryland Barley	206.91	6.2	6.2	8.3	10.3	20.7	31.0	31.0	31.0	20.7	20.7	10.3	10.3
Dryland Peas	114.35	3.4	3.4	4.6	5.7	11.4	17.2	17.2	17.2	17.2	5.7	5.7	5.7
Total	1,178.76	35.5	35.5	49.7	60.2	120.2	169.2	174.1	176.4	162.9	111.3	46.6	37.2

Manual labor

	Total	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Irrig. Alfalfa FP	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Irrig. Alfalfa Est.	20.00	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0
Irrig. Barley	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Irrig. Pasture	30.00	0.9	0.9	1.5	1.5	3.0	3.0	4.5	4.5	4.5	3.0	1.5	1.2
Dryland Pasture	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryland Spr. Wht.	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryland Barley	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dryland Peas	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	50.00	1.9	1.9	3.5	3.5	5.0	5.0	6.5	6.5	6.5	5.0	2.5	2.2

Hired labor expenses

Hired labor hours	Hourly wage	**Total**
0.00	$16.55	$0.00
0.00	$10.00	$0.00
		$0.00

	Rate	
Social Security	0.08	$0.00
Worker's Comp.	$ 7.95/$100	$0.00
	Grand Total	$0.00

Return to Labor

	Hours	Wage	Total
Farm operator	1,228.76	$22.11	$27,167.83
Farm family	0.00	16.55	0.00
		Grand Total	$27,167.83

Farm investment expenses

	Land	Equipment	
Interest rate	3.27%	8.48%	
Debt/Asset ratio	10.00%	18.80%	All 'per acre' totals based upon 3,150 acres.

Item	Investment Value	Salvage Value	Computation Value	Interest on debt Per farm	Per acre
Real Estate Investment Costs					
Land	$2,390,850.00		$2,390,850.00	$7,818.08	$2.48
Improvement costs					
Machine shed	$74,721.65	$0.00	$37,360.82	$122.17	$0.04
Storage shed	32,379.38	0.00	16,189.69	52.94	0.02
Sub-total	**$107,101.03**	**$0.00**	**$53,550.52**	**$175.11**	**$0.06**
Irrigation system costs					
Irrigation system Irrig. Alfalfa FP	$46,091.20	$0.00	$23,045.60	$75.36	$0.02
Irrigation system Irrig. Alfalfa Est.	$10,655.40	$490.60	$5,573.00	$18.22	$0.01
Irrigation system Irrig. Barley	$40,329.80	$0.00	$20,164.90	$65.94	$0.02
Irrigation system Irrig. Pasture	$20,742.30	$4,148.40	$12,445.35	$40.70	$0.01
Sub-total	**$117,818.70**	**$4,639.00**	**$61,228.85**	**$200.22**	**$0.06**
Non-power equipment					
Sprayer-50'	$14,271.20	$1,427.12	$7,849.16	$125.13	$0.04
Chisel Plow-27'	27,245.03	2,724.50	14,984.76	238.89	0.08
Cultivator-36'	37,624.09	3,762.41	20,693.25	329.90	0.10
Air Seeder Drill-35'	107,034.03	10,703.40	58,868.71	938.51	0.30
Small tools	18,617.43		9,308.72	148.40	0.05
Sub-total	**$204,791.78**	**$18,617.43**	**$111,704.61**	**$1,780.84**	**$0.57**
Power equipment					
Tractor-300HP	$129,738.22	$12,973.82	$71,356.02	$1,137.59	$0.36
Tractor-145HP	64,869.11	6,486.91	35,678.01	568.79	0.18
Combine-25'	205,635.08	20,563.51	113,099.30	1,803.07	0.57
Truck-10 wheel	48,651.83	4,865.18	26,758.50	426.59	0.14
Sub-total	**$448,894.25**	**$44,889.42**	**$246,891.81**	**$3,936.05**	**$1.25**
Vehicles					
Pickup-3/4 ton	$25,438.86	$2,543.89	$13,991.38	$223.06	$0.07
ATV-4wd	3,634.12	363.41	1,998.77	31.87	0.01
Sub-total	**$29,072.98**	**$2,907.30**	**$15,990.14**	**$254.92**	**$0.08**
Total	**$3,298,528.75**	**$66,414.15**	**$2,880,216.00**	**$14,165.22**	**$4.50**

Note: Investment value is based upon the number required,
not unit value. See Depreciation table for details.

Equipment & Repair Expense Table

Equipment	Actual annual use (hours, miles if vehicle)	Cost per unit of use: Repairs	Cost per unit of use: Fuel	Annual costs: Repairs	Fuel	Depreciation	Total	Per acre
				All 'per acre' totals based upon 3,150 acres.				
Tractor-300HP	265.0	$8.59	$42.32	$2,276.17	$11,213.91	$4,670.58	$18,160.66	$5.77
Tractor-145HP	227.4	4.68	20.45	1,064.04	4,649.49	2,335.29	8,048.82	2.56
Combine-25'	156.6	45.29	24.31	7,094.23	3,807.92	9,740.61	20,642.75	6.55
Truck-10 wheel	18.4	9.54	10.17	175.25	186.82	1,751.47	2,113.54	0.67
Sprayer-50'	108.6	9.71		1,054.12		917.43	1,971.55	0.63
Chisel Plow-27'	165.3	13.89		2,295.60		2,724.50	5,020.10	1.59
Cultivator-36'	75.6	18.48		1,397.46		1,693.08	3,090.54	0.98
Air Seeder Drill-35'	98.1	73.43		7,205.69		6,422.04	13,627.73	4.33
Pickup-3/4 ton	6,864.0	0.18	0.45	1,235.52	3,088.80	2,543.89	6,868.21	2.18
ATV-4wd	610.5	0.07	0.07	42.74	42.74	327.07	412.54	0.13
Machine shed				$782.73		$1,868.04	$2,650.77	$0.84
Storage shed				$339.18		$809.48	$1,148.66	$0.36
Irrigation system Irrig. Alfalfa FP				$ 1,300.00		$ 921.82	$ 2,221.82	$ 0.71
Irrigation system Irrig. Alfalfa Est.				$ 254.60		$ 290.42	$ 545.02	$ 0.17
Irrigation system Irrig. Barley				$ 1,137.50		$ 806.60	$ 1,944.10	$ 0.62
Irrigation system Irrig. Pasture				$ 413.40		$ 829.69	$ 1,243.09	$ 0.39
			Total	**$28,068.21**	**$22,989.68**	**$38,652.02**	**$89,709.91**	**$28.48**

Depreciation Table

Use units (hours, miles if vehicle, years if building)

Item	Investment value	Salvage value	Expected life	Annual maximum	Actual Annual	# Required	Years of life	Annual depreciation cost
Tractor-300HP	$129,738	$12,974	9600	1000	265.0	1	25	$4,670.58
Tractor-145HP	$64,869	$6,487	7200	800	227.4	1	25	$2,335.29
Combine-25'	$205,635	$20,564	3000	500	156.6	1	19	$9,740.61
Truck-10 wheel	$48,652	$4,865	1500	300	18.4	1	25	$1,751.47
Sprayer-50'	$14,271.20	$1,427.12	1500	300	108.6	1	14	$917.43
Chisel Plow-27'	$27,245.03	$2,724.50	1500	300	165.3	1	9	$2,724.50
Cultivator-36'	$37,624.09	$3,762.41	1500	300	75.6	1	20	$1,693.08
Air Seeder Drill-35'	$107,034.03	$10,703.40	1500	300	98.1	1	15	$6,422.04
Pickup-3/4 ton	$25,439	$2,544	60000	20000	6,864.0	1	9	$2,543.89
ATV-4wd	$3,634	$363	30000	5000	610.5	1	10	$327.07
Machine shed	$74,722	$0					40	$1,868.04
Storage shed	$32,379	$0					40	$809.48
Irrigation system Irrig. Alfalfa FP	$46,091.20	$0.00					50	$921.82
Irrigation system Irrig. Alfalfa Est.	$10,655.40	$490.60					35	$290.42
Irrigation system Irrig. Barley	$40,329.80	$0.00					50	$806.60
Irrigation system Irrig. Pasture	$20,742.30	$4,148.40					20	$829.69
							Total	**$38,652.02**

Value to be depreciated = (investment value - salvage value)
Depreciation cost = (investment value - salvage value) / (years of life)

Total Machinery Use for Crops

Equipment	Total (hours)	Irrig. Alfalfa FP	Irrig. Alfalfa Est	Irrig. Barley	Irrig. Pasture	Dryland Pasture	Dryland Spr. Wht.	Dryland Barley	Dryland Peas
Sprayer-50'	108.56	-	-	2.80	0.21	4.05	70.00	21.00	10.50
Chisel Plow-27'	165.27	-	1.20	6.30	0.27	27.00	90.00	27.00	13.50
Cultivator-36'	75.62	-	1.20	2.80	0.12	13.50	40.00	12.00	6.00
Air Seeder Drill-35'	98.13	-	1.20	4.20	0.18	4.05	60.00	18.00	10.50
Power equipment*									
Tractor-300HP	264.98	-	2.64	10.01	0.43	44.55	143.00	42.90	21.45
Tractor-145HP	227.36	-	1.32	7.70	0.43	8.91	143.00	42.90	23.10
Combine-25'	156.64	-	-	9.24	-	-	88.00	39.60	19.80
Truck-10 wheel	18.37	-	-	0.77	-	-	11.00	3.30	3.30
Vehicles (use units in miles)									
Pickup-3/4 ton	6,864	264.0	66.0	231.0	33.0	1,485.0	3,300.0	990.0	495.0
ATV-4wd	611	26.4	6.6	23.1	9.9	0.0	330.0	99.0	115.5

* Includes additional 10%.

Appendix A. FBT data and outputs for farm-level payment capacity analysis

Crop Machinery Use

		Acres:	80	20	70	30	1350	1000	300	150								
			Hours used per acre								**Times over land**							
Equipment	**Total Use (hours)**	**Assigned Power Equipment**	Irrig. Alfalfa FP	Irrig. Alfalfa Est.	Irrig. Barley	Irrig. Pasture	Dryland Pasture	Dryland Spr. Wht.	Dryland Barley	Dryland Peas	Irrig. Alfalfa F	rig. Alfalfa Es	Irrig. Barley	rrig. Pasture	ryland Pastu	yland Spr. W	ryland Barle	Dryland Peas
Sprayer-50'	108.56	Tractor-145HP	0.00	0.00	0.04	0.01	0.00	0.07	0.07	0.07	-	-	1	1	1	1	1	1
Chisel Plow-27'	165.27	Tractor-300HP	0.00	0.06	0.09	0.01	0.02	0.09	0.09	0.09	-	1	1	1	1	1	1	1
Cultivator-36'	75.62	Tractor-300HP	0.00	0.06	0.04	0.00	0.01	0.04	0.04	0.04	-	1	1	1	1	1	1	1
Air Seeder Drill-35'	98.13	Tractor-145HP	0.00	0.06	0.06	0.01	0.00	0.06	0.06	0.07	-	1	1	1	1	1	1	1
Power equipment*																		
Tractor-300HP	264.98		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tractor-145HP	227.36		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Combine-25'	156.64		-	-	0.12	-	-	0.08	0.12	0.12	-	-	1	-	-	1	1	1
Truck-10 wheel	18.37		-	-	0.01	-	-	0.01	0.01	0.02	-	-	1	-	-	1	1	1
Vehicles (use units in miles)																		
Pickup-3/4 ton	6,864.0		3	3	3	1	1	3	3	3	1	1	1	1	1	1	1	1
ATV-4wd	610.5		0.300000012	0.300000012	0.300000012	0.300000012	0	0.300000012	0.300000012	0.699999988	1	1	1	1	0	1	1	1

* Includes additional 10%.

Appendix B.

Poverty percentages for Montana communities

Community (A–F)	Poverty rate	Community (F–P)	Poverty rate	Community (P–Z)	Poverty rate
Absarokee CDP	1.23%	Fox Lake CDP	1.00%	Plains town	17.84%
Alberton town	22.06%	Frazer CDP	36.31%	Plentywood city	7.57%
Alder CDP	17.43%	Frenchtown CDP	1.28%	Plevna town	11.32%
Alzada CDP	34.78%	Froid town	5.11%	Polson city	19.27%
Amsterdam CDP	10.84%	Fromberg town	6.24%	Ponderosa Pines CDP	0.00%
Anaconda-Deer Lodge County	20.24%	Gallatin Gateway CDP	2.83%	Pony CDP	19.86%
Antelope CDP	0.00%	Gallatin River Ranch CDP	0.00%	Poplar city	23.76%
Arlee CDP	31.18%	Gardiner CDP	11.42%	Power CDP	3.05%
Ashland CDP	23.86%	Garrison CDP	17.50%	Pray CDP	14.55%
Augusta CDP	16.98%	Geraldine town	9.50%	Pryor CDP	29.13%
Avon CDP	26.92%	Geyser CDP	27.91%	Rader Creek CDP	4.97%
Azure CDP	18.78%	Gibson Flats CDP	6.50%	Radersburg CDP	13.12%
Babb CDP	47.22%	Gildford CDP	1.75%	Ravalli CDP	45.56%
Bainville town	3.72%	Glasgow city	7.38%	Red Lodge city	12.47%
Baker city	9.36%	Glendive city	11.37%	Reed Point CDP	9.84%
Ballantine CDP	4.00%	Grass Range town	8.33%	Reserve CDP	11.43%
Basin CDP	15.95%	Great Falls city	14.69%	Rexford town	23.58%
Batavia CDP	3.44%	Greycliff CDP	8.43%	Richey town	10.75%
Bear Dance CDP	3.55%	Hamilton city	19.24%	Riverbend CDP	15.44%
Bearcreek town	11.21%	Happys Inn CDP	22.06%	Roberts CDP	10.70%
Beaver Creek CDP	3.26%	Hardin city	25.00%	Rocky Boy West CDP	47.59%
Belfry CDP	22.30%	Harlem city	15.00%	Rocky Boy's Agency CDP	19.40%
Belgrade city	6.83%	Harlowton city	12.82%	Rocky Point CDP	0.00%
Belknap CDP	0.00%	Harrison CDP	26.21%	Rollins CDP	31.31%
Belt town	12.45%	Havre city	17.80%	Ronan city	24.14%
Biddle CDP	6.25%	Havre North CDP	32.25%	Roscoe CDP	0.00%
Big Arm CDP	28.40%	Hays CDP	45.70%	Rosebud CDP	13.89%
Big Sandy town	11.96%	Heart Butte CDP	43.96%	Roundup city	14.03%
Big Sky CDP	14.65%	Hebgen Lake Estates CDP	0.00%	Roy CDP	28.26%
Big Timber city	3.06%	Helena city	13.75%	Rudyard CDP	2.73%
Bigfork CDP	12.31%	Helena Flats CDP	11.59%	Ryegate town	11.88%
Billings city	10.01%	Helena Valley Northeast CDP	4.44%	Saco town	21.72%
Birney CDP	0.00%	Helena Valley Northwest CDP	2.62%	Saddle Butte CDP	9.23%
Black Eagle CDP	17.66%	Helena Valley Southeast CDP	14.60%	Sand Coulee CDP	5.71%
Boneau CDP	62.15%	Helena Valley W. Central CDP	5.10%	Sangrey CDP	39.32%
Bonner-West Riverside CDP	18.64%	Helena West Side CDP	9.61%	Santa Rita CDP	57.20%
Boulder city	20.64%	Heron CDP	13.67%	Savage CDP	11.55%
Box Elder CDP	19.15%	Herron CDP	0.00%	Scobey city	4.78%
Boyd CDP	37.71%	Highwood CDP	4.48%	Sedan CDP	27.27%
Bozeman city	17.79%	Hingham town	9.60%	Seeley Lake CDP	4.90%
Brady CDP	0.00%	Hinsdale CDP	18.91%	Shawmut CDP	9.80%
Bridger CDP	11.65%	Hobson city	15.39%	Shelby city	10.50%
Bridger town	14.32%	Hot Springs town	35.66%	Shepherd CDP	3.35%
Broadus town	4.69%	Hungry Horse CDP	47.63%	Sheridan town	3.89%
Broadview town	15.33%	Huntley CDP	0.00%	Sidney city	5.39%
Brockton CDP	46.20%	Huson CDP	32.14%	Silesia CDP	0.00%
Browning town	31.92%	Hysham town	26.77%	Silver Gate CDP	0.00%
Busby CDP	12.74%	Inverness CDP	0.00%	Simms CDP	1.46%
Butte-Silver Bow (balance)	17.32%	Jardine CDP	0.00%	Somers CDP	0.00%
Bynum CDP	0.00%	Jefferson City CDP	3.44%	South Browning CDP	44.82%
Camas CDP	56.16%	Jette CDP	0.00%	South Glastonbury CDP	22.03%
Camp Three CDP	10.40%	Joliet town	27.68%	South Hills CDP	0.00%
Cardwell CDP	6.73%	Joplin CDP	1.84%	Spokane Creek CDP	0.00%
Carlton CDP	15.87%	Jordan town	5.20%	Springdale CDP	21.05%
Carter CDP	18.39%	Judith Gap city	6.25%	Springhill CDP	0.00%
Cascade town	22.36%	Kalispell city	13.27%	St. Ignatius town	21.26%
Charlo CDP	8.74%	Kerr CDP	0.00%	St. Marie CDP	24.47%
Charlos Heights CDP	0.00%	Kevin town	7.19%	St. Pierre CDP	46.65%
Chester town	8.26%	Kicking Horse CDP	0.00%	St. Regis CDP	31.43%

Community (A–F)	Poverty rate	Community (F–P)	Poverty rate	Community (P–Z)	Poverty rate
Chinook city	16.46%	Kila CDP	25.71%	St. Xavier CDP	16.91%
Choteau city	14.08%	King Arthur Park CDP	3.68%	Stanford town	30.26%
Churchill CDP	6.24%	Kings Point CDP	0.00%	Starr School CDP	50.76%
Circle town	7.38%	Klein CDP	0.00%	Stevensville town	25.58%
Clancy CDP	5.76%	Kremlin CDP	22.73%	Stockett CDP	8.89%
Clinton CDP	14.66%	Lake Mary Ronan CDP	6.38%	Stryker CDP	84.21%
Clyde Park town	18.22%	Lakeside CDP	19.88%	Sula CDP	0.00%
Colstrip city	5.35%	Lame Deer CDP	29.74%	Sun Prairie CDP	13.92%
Columbia Falls city	10.03%	Laurel city	7.35%	Sun River CDP	25.00%
Columbus town	8.78%	Lavina town	17.78%	Sunburst town	4.51%
Condon CDP	8.50%	Lewistown city	19.39%	Superior town	21.54%
Conner CDP	19.39%	Lewistown Heights CDP	5.26%	Swan Lake CDP	12.50%
Conrad city	17.29%	Libby city	19.10%	Sweet Grass CDP	10.35%
Cooke City CDP	0.00%	Lima town	28.89%	Sylvanite CDP	2.56%
Coram CDP	9.91%	Lincoln CDP	11.44%	Terry town	16.77%
Corvallis CDP	18.75%	Lindisfarne CDP	0.00%	The Silos CDP	3.35%
Corwin Springs CDP	4.60%	Little Bitterroot Lake CDP	3.90%	Thompson Falls city	20.18%
Craig CDP	12.50%	Little Browning CDP	28.57%	Three Forks city	5.84%
Crane CDP	8.07%	Livingston city	14.48%	Toston CDP	30.14%
Crow Agency CDP	39.56%	Lockwood CDP	12.89%	Townsend city	11.90%
Culbertson town	8.98%	Lodge Grass town	57.27%	Trego CDP	9.54%
Custer CDP	11.67%	Lodge Pole CDP	32.79%	Trout Creek CDP	10.67%
Cut Bank city	27.76%	Logan CDP	0.00%	Troy city	16.64%
Darby town	20.49%	Lolo CDP	7.89%	Turah CDP	1.37%
Dayton CDP	0.00%	Loma CDP	0.00%	Turner CDP	9.41%
De Borgia CDP	12.79%	Lonepine CDP	8.13%	Turtle Lake CDP	75.47%
Deer Lodge city	16.16%	Malmstrom AFB CDP	3.64%	Twin Bridges town	19.57%
Denton town	7.77%	Malta city	8.38%	Ulm CDP	5.08%
Dillon city	26.78%	Manhattan town	9.29%	Valier town	22.87%
Dixon CDP	22.33%	Marion CDP	33.30%	Vaughn CDP	18.22%
Dodson town	45.75%	Martin City CDP	40.37%	Victor CDP	13.78%
Drummond town	8.86%	Martinsdale CDP	14.82%	Virginia City town	22.06%
Dupuyer CDP	9.32%	Marysville CDP	18.61%	Walkerville town	20.81%
Dutton town	11.85%	Maxville CDP	8.92%	Weeksville CDP	0.00%
East Glacier Park Village CDP	27.06%	Medicine Lake town	2.48%	West Glacier CDP	5.63%
East Helena city	6.80%	Melstone town	14.84%	West Glendive CDP	9.38%
East Missoula CDP	12.32%	Miles City city	14.20%	West Havre CDP	1.08%
Edgar CDP	16.30%	Missoula city	17.52%	West Kootenai CDP	0.00%
Ekalaka town	8.26%	Montana City CDP	3.77%	West Yellowstone town	14.64%
Elliston CDP	9.18%	Moore town	5.53%	Westby town	5.97%
Elmo CDP	34.55%	Muddy CDP	39.71%	Wheatland CDP	0.00%
Emigrant CDP	26.94%	Musselshell CDP	15.91%	White Haven CDP	16.00%
Ennis town	5.22%	Nashua town	14.50%	White Sulphur Springs city	14.37%
Eureka town	29.27%	Neihart town	21.62%	Whitefish city	7.56%
Evaro CDP	1.24%	Niarada CDP	0.00%	Whitehall town	14.01%
Evergreen CDP	10.53%	North Browning CDP	42.62%	Whitewater CDP	38.58%
Fairfield town	16.47%	Noxon CDP	23.32%	Wibaux town	10.84%
Fairview town	3.92%	Old Agency CDP	58.11%	Willow Creek CDP	1.94%
Fallon CDP	22.43%	Olney CDP	21.23%	Wilsall CDP	3.56%
Finley Point CDP	7.26%	Opheim town	1.04%	Wineglass CDP	3.84%
Flaxville town	0.00%	Orchard Homes CDP	13.88%	Winifred town	7.21%
Florence CDP	7.31%	Outlook town	2.44%	Winnett town	5.98%
Forest Hill Village CDP	29.92%	Ovando CDP	14.06%	Winston CDP	11.90%
Forsyth city	13.43%	Pablo CDP	45.30%	Wisdom CDP	2.20%
Fort Belknap Agency CDP	50.80%	Paradise CDP	19.62%	Wolf Point city	28.26%
Fort Benton city	8.25%	Park City CDP	7.75%	Woods Bay CDP	2.84%
Fort Peck town	0.00%	Parker School CDP	28.16%	Worden CDP	40.77%
Fort Shaw CDP	0.00%	Philipsburg town	9.55%	Wye CDP	25.89%
Fort Smith CDP	23.53%	Piltzville CDP	0.00%	Wyola CDP	34.09%
Fortine CDP	5.23%	Pinesdale town	22.62%	Yaak CDP	13.33%
Four Corners CDP	7.19%	Pioneer Junction CDP	15.62%	Zortman CDP	73.08%