



Technical Memorandum

To: Cass County Joint Water Resource District
Mark Brodshaug - Chairman
1201 Main Avenue
West Fargo, ND 58078

From: AE2S, Inc.

Re: FM Area Diversion Project
Diversion Project Assessment Committee
Assessment District Methodology and Development
FM Flood Risk Management District No. 1

Date: June 10, 2015

1 Diversion Project Background

The Fargo-Moorhead (FM) Area Diversion Project (Diversion Project) will reduce the flood risk to the metropolitan area, including the North Dakota cities of Fargo, West Fargo, Harwood, Horace, Reiles Acres, Frontier, Prairie Rose, Briarwood, and North River, as well as provide reduction in flood risk to some residents of non-metropolitan Cass County including portions of Barnes, Berlin, Harwood, Mapleton, Pleasant, Raymond, Reed, Stanley, Warren, and Wiser Townships. The Diversion Project will reduce flood risk through construction of a 36-mile, 20,000 cubic feet per second (cfs) diversion channel that will start approximately three miles south of the confluence of the Red River and the Wild Rice River and extend west and north around the metropolitan area before re-entering the Red River east of Argusville. The Project provides flood risk reduction from the Red River and its North Dakota tributaries, including the Wild Rice, Sheyenne, Maple, Rush, and Lower Rush Rivers. The Project includes an embankment and tie-back levees that will temporarily stage flood waters upstream of the metropolitan area to ensure no downstream impacts. The Project features include gated control structures on the Red River, Wild Rice River, and the inlet to the Diversion Channel. The Project also includes aqueduct structures on the Sheyenne and Maple Rivers as they cross the Diversion Channel. In addition to the Diversion Channel and associated structures, the Diversion Project includes levees along the Red River through Fargo. The In-Town Levees enable flood waters to safely pass through the Red River as well as the Diversion Channel, which helps reduce Project

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

impacts and provide more robust flood risk reduction. A map of the Diversion Project is included as Attachment 1.

Construction will involve excavation of approximately 50 million cubic yards of earth to form the Diversion Channel. Construction also involves six interstate highway bridges, 12 county and township road bridges, four railroad bridges, three gated control structures, two aqueduct structures, a rock-ramp outlet structure, and other structures.

2 Introduction to Assessment District Development

The voters in the City of Fargo and Cass County have approved two sales taxes for funding the Diversion Project. The City and County have a 20-year history of strong sales tax growth (see Figure 1, which shows historical growth of Cass County taxable sales) and sales tax revenues are expected to provide the funding necessary to meet the local North Dakota cost share obligation. However, it is clear that the pace of expenditures necessary to construct the Diversion Project will exceed the pace of revenue generated by the sales taxes.

The Diversion Project is expected to be constructed over an approximately eight-year timeframe, but the funding will likely to take longer to generate. The local sales taxes passed by Fargo and Cass County have 20-year durations and are currently set to expire in 2029 and 2031, respectively. Due to costs of construction outpacing the current revenue streams, the Diversion Authority has considered multiple methods to finance the local cost share. Various short- and long-term financing options have been considered for funding North Dakota's local share of the Diversion Project, of which include a sales tax revenue bond, Bank of North Dakota loan, general obligation bond, and a direct-funded loan through bank financing. However, many of these financing options come with shortfalls including the requirement of large reserve funds (approximately 10 percent of issue size), high interest rates, and coverage issues (approximately 40 percent reduction in bonding capacity). These shortfalls can be compensated through the use of special assessment backed bonds, issued by the Cass County Joint Water Resource District (CCJWRD). Special assessment backed bonds not only eliminate coverage issues and the need for large reserve funds, but also manage to lower interest rates. These special assessment backed bonds require the formation of an assessment district to assign benefits and determine assessments to individual parcels within an assessment district. An assessment district also has the potential to provide operating revenue for long-term maintenance of the Project.

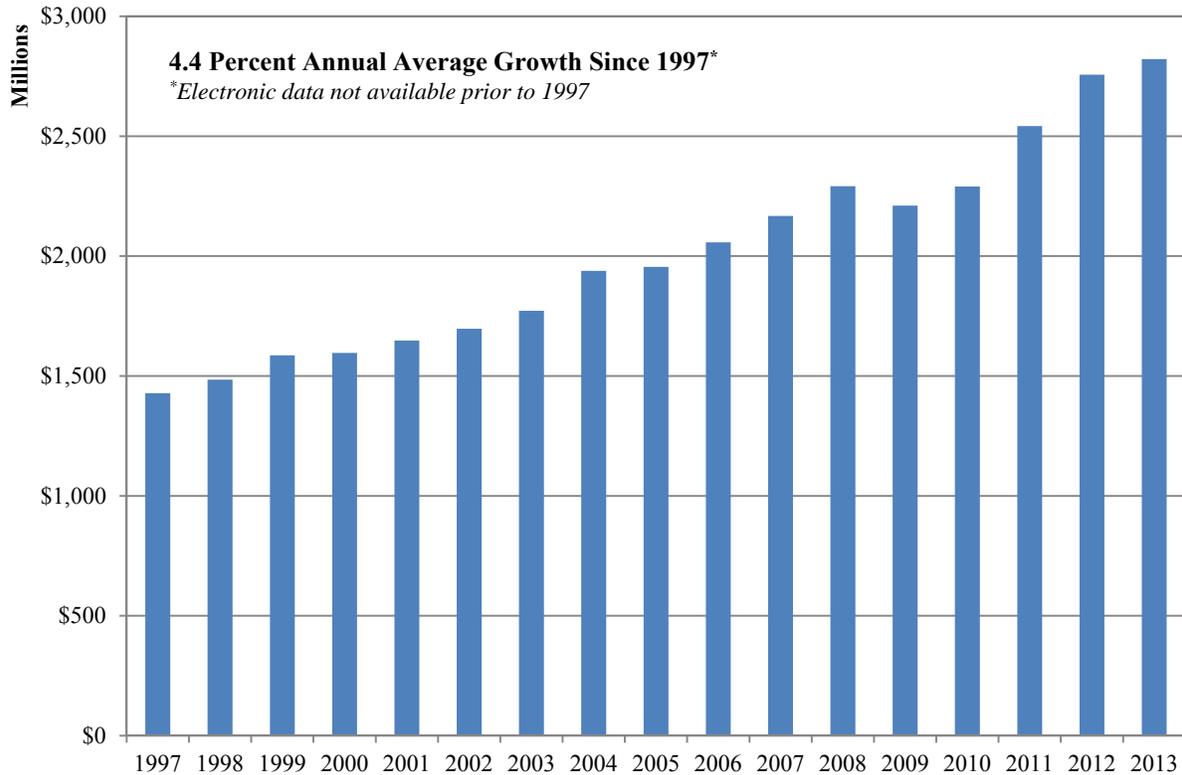
Using the sales tax revenues alone as the backing for a bond was considered. Unfortunately, the bond market does not look favorably on bonds backed solely by sales taxes. Ultimately, the terms available for this method made the option undesirable. In comparison, special assessment backed bonds are seen favorably by the bond market. Special assessment backed bonds could result in significantly lower interest rates and increased coverage amounts. According to

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

financial advisors the PFM Group, the development of a special assessment district could result in significant financing savings of at least \$100 Million in taxpayer dollars through more beneficial bond terms.



**Figure 1. Historical Growth of Cass County Taxable Sales
Indicating an Average Annual Growth of 4.4 Percent**

What makes this an ideal and unique financing option for the Diversion Project is that there is already a funding source in place to pay the bond payments. This revenue from the sales taxes is estimated to be sufficient to pay the payments for the bond as long as the sales tax remains in place.

As such, this proposed special assessment district could be equated to Cass County and Fargo hypothetically asking property owners to co-sign the loan to pay for the Diversion Project, with the recognition that sales tax revenues would pay for the bond payment. The property owners would just be using their good collateral in order to establish better financing terms. Again, saving money and helping stretch the taxpayer dollar further.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

In addition to using the special assessment district as a financing mechanism for the Diversion Project, the work done to date has the potential to be utilized for a maintenance district to fund ongoing operations and maintenance of the Diversion Project in the future.

3 Voting and Assessment District Process

The voting and assessment district process is well defined by the laws of the State of North Dakota. These laws were strictly followed while conducting the voting and assessment district process for financing the Diversion Project. The following sections discuss the key components of the voting and assessment district process, and include discussions pertaining to the involvement of the local water resource district, the development of a committee of regional leaders to develop the district, listing of key State statutes, and the process for establishing benefits and impacts from the Diversion Project.

3.1 *Cass County Joint Water Resource District Involvement*

The Diversion Authority tasked the Cass County Joint Water Resources District (CCJWRD), as one of the six member-entities of the Diversion Authority, with the development of a potential special assessment district to assist with the financing needs of the Diversion Project. The CCJWRD has the unique ability under the North Dakota Century Code (NDCC) to administer an assessment district across multiple jurisdictions throughout the benefiting area within North Dakota. The CCJWRD has also demonstrated the knowledge and experience necessary through the management of other assessment districts for water projects with similarities to the Diversion Project in Cass County.

3.2 *Diversion Project Assessment Committee*

The CCJWRD formed the Diversion Project Assessment Committee (DPAC) to help establish a methodology for assigning benefits and to coordinate its actions with that of the Diversion Authority. DPAC includes representatives from the City of Fargo, the City of West Fargo, Cass County, and the CCJWRD board. The 11 member DPAC met regularly between late 2012 and early 2015 to establish the methodology to assign direct and indirect benefits across the benefiting area in North Dakota.

3.3 *State of North Dakota Statutes*

The development of the assessment district was done following the laws set forth within the NDCC CHAPTER 61-16.1 OPERATION OF WATER RESOURCE DISTRICTS. More specifically, within NDCC §61-16.1-21, the law indicates that when apportioning benefits from a project and

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

determining potential liabilities for funding a project, a water resource districts should assign benefits/assessments to:

- “ 1. Any county, township, or city, in its corporate capacity, which may be benefitted directly or indirectly thereby.
 2. Any lot, piece, or parcel of land which is directly benefit by such improvement. ”
- (NDCC §61-16.1-21)

NDCC §61-16.1-21 directs water resource districts to “consider, among other factors, property value, degree of improvement of properties, productivity, and the water management policy” when determining benefits from a project. The law continues to state that “benefitted property belonging to counties, cities, school districts, park districts, and townships shall not be exempt” from receiving benefit and assessment. In addition, NDCC §61-16.1-20 states that “in order that there may be a fair relation between the amount of liability for assessments and the power of objecting to the establishment of a proposed project”, affected landowners are entitled to “one vote for each dollar of the assessed valuation of land condemned”. The voting power assigned to acquired/impacted lands does NOT indicate the property will carry an assessment.

3.4 District Voting Development

There are three voting blocs defined in NDCC §61-16.1; directly benefiting property owners, indirectly benefiting jurisdictions, and property owners where land is being acquired/impacted or acquired. Acquired/impacted lands generally includes permanent easements and right-of-way, temporary construction easements, and land potentially receiving flowage easements More information on voting blocs can be found in Table 1 and in subsequent sections.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

Table 1. Voting Blocs

Direct Benefits	Indirect Benefits	Acquired/Impacted Lands
Specific Benefits to Individual Parcels	Global Benefits Assigned to Jurisdictions	Voting Power to Acquired/Impacted Parcels
Considerations: <ul style="list-style-type: none"> • Flood Risk Reduction • Existing Protection Level • Property Value Protected • Area Protected • Access to Neighborhood 	Considerations: <ul style="list-style-type: none"> • Infrastructure • Community & Lifestyle • Business & Economy • Salient Benefits • Protection of Economic Opportunity for All Residents 	Considerations: <ul style="list-style-type: none"> • Fixed Voting Amount Based on County Assessed Value of Lands Acquired/Impacted
Vote by Property Owners Vote is equal to dollars assessed	Vote by Jurisdiction Leaders Vote is equal to dollars assessed	Vote by Property Owners Vote is equal to assessed value of acquired/impacted property Property is NOT assessed

3.5 Establishing Project Benefits and Impacts

Benefits and impacts from the project closely align with the above mentioned voting power. Directly benefitting property and indirectly benefitting jurisdictions are assigned potential assessment/liability amounts in proportion to the amount of benefits received. Lands to be acquired/impacted as results of the Diversion Project are afforded a voting right; however, they are NOT assigned a potential liability/assessment and will not be part of the assessment district if approved. The following sections contain discussions about the methodology of how the two types of benefits (direct and indirect) and the impacts (acquired/impacted lands) from the project were established.

3.5.1 Direct Benefits

Direct benefits pertain to “any lot, piece, or parcel” (NDCC §61-16.1-21) within North Dakota receiving benefit from the Diversion Project. This benefit was determined through use of a variety of factors, including; the parcel’s existing protection level versus the flood risk reduction after the Diversion Project, the property value of the parcel, and the area of parcel. Each parcels vote is weighted on the amount of assessment it receives. In total, 49,208 parcels were

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

determined to be directly benefited by the Diversion Project. The only properties exempt from assessment, and as such not assigned direct benefits, were properties owned by the United States, the State of North Dakota, North Dakota State University, low-income public housing authority properties, and cemeteries.

3.5.2 Indirect Benefits

CCJWRD and DPAC determined and defined the indirect benefits (after careful analysis) in accordance with NDCC §61-16.1-21. These benefits are assigned to “any county, township, or city, in its corporate capacity” (NDCC §61-16.1-21), which receives benefit from the Diversion Project within North Dakota. Indirect benefits take into consideration infrastructure, community and lifestyle, business and economy (as shown in Table 2), as well as multiple salient benefits of providing a flood free community. Indirect benefits also are benefits received by all citizens of a jurisdiction, regardless of property ownership, through the protection of the local economy and its opportunities. CCJWRD apportioned indirect benefits based on the benefit to each jurisdiction. Therefore, the vote of each jurisdiction is weighted on the amount of benefit it receives. In total, 20 jurisdictions (Cass County, multiple cities, and multiple townships) indirectly benefit from the Diversion Project.

Table 2. Indirect Benefit Considerations

Infrastructure	Community & Lifestyle	Business & Economy
<ul style="list-style-type: none">• Traffic/Transportation Systems• Water & Wastewater System• Power Supply & Communication Systems	<ul style="list-style-type: none">• Education Centers• Shopping & Entertainment• Recreation Opportunities• Flooded Community Stigma Avoidance• Health Care Facilities• Mental Health• Law Enforcement	<ul style="list-style-type: none">• Economic Stability• Business Retention• Business Attraction / Job Creation• Continued Employment• Avoiding Lost Wages• Airport• Municipal Credit Rating

Individual aspects of indirect benefits may not be of equal value to each individual. For instance, if the general public was to weight each indirect benefit against each other, there may be a multitude of different results. These various weights of different indirect benefits are represented in the Wordle below (Figure 2). The Wordle shows one example of how an individual weighted a sampling of the indirect benefits with the more weight being shown by size of the word.



Figure 2. Indirect Benefit Wordle (CCJWRD and DPAC)

To further this point, the City of Fargo conducted a heavily participated in public process to complete its Go2030 Comprehensive Plan (www.cityoffargo.com). This Comprehensive Plan received significant public input through the use of an interactive website, public meetings, and weighted polling methods. As a result of the data gathered, flood protection was determined to be the top priority for the City of Fargo. The Comprehensive Plan also included a Wordle of the most common subjects talked about by the public during the data gathering phase that rated flood protection as the top priority. Interestingly, the Wordle, shown below as Figure 3, includes almost exclusively those items that could be classified as indirect benefits in the categories above.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

parcels were determined through the use of the hydraulic modeling consistent with that used for development of the Project. It was determined that impacts would be considered down to one-tenth of a foot of additional water inundation on a parcel during a 100-year flood event and modeling inundation to a level less than one-tenth of a foot is not technically feasible.

In addition, the footprint of the Oxbow-Hickson-Bakke Ring Levee Project was also included in these acquired/impacted properties list. The area internal to the Oxbow-Hickson-Bakke Ring Levee Project was excluded from the assessment district as the parcels within were considered mitigated properties and determined to be neither benefitted nor impacted.

4 Assessment Model Development

The Assessment Model was developed in two parts; (1) the Direct Assessment Model used to calculate direct benefits/assessments to individual properties as well as to determine the vote amounts for acquired/impacted lands, (2) the Indirect Assessment Model used to calculate indirect benefits/assessments to benefiting jurisdictions. The methodology used to develop the Direct and Indirect Assessment Model is presented in the following sections.

4.1 *Direct Assessment Model*

The Direct Assessment Model was developed to assign benefits and assessments to individual properties that are protected by the Diversion Project. The Direct Assessment Model included three main factors that can be calculated or established for each property; (1) property area, (2) property value, and (3) benefit level of the property. Using the factors, the Direct Assessment Model calculated a percentage of total benefit/assessment for the 49,000+ properties that are benefitted by the Diversion Project. The development of the Direct Assessment Model is described herein.

4.1.1 GIS-Based Assessment Model

To best determine assessments for benefitting parcels within the assessment district a Geographical Information System (GIS)-based assessment model was developed. The model allows for assessments to be made based on a parcel's benefit from the Diversion Project, true & full valuation, and gross acreage. A key component of this model is its ability to spatially relate and analyze parcel location, benefit, true & full valuation, and acreage, as well as attach site specific data/attributes. The spatial and tabular relation of parcel characteristics helps to minimize bias in determining project boundaries and provides an objective and scientific approach for determining direct assessments.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

In addition, the GIS-based assessment model is appealing not only for its robustness and ability to be readily updated, but also because it can be used in conjunction with existing tax/valuation records, such that as tax/valuation records are updated the GIS-based assessment model is updated in conjunction. Thus, providing a model which is equipped for the long-term assessment process and easily modified due to various economic, community, or project based input.

4.1.2 Concept of Flood Risk Reduction

To determine a parcels benefit, consideration was given to the probability of flooding before and after the Diversion Project as a primary factor. Existing floodplains and project specific floodplains were used to determine the pre- and post-flooding probabilities. These factors help to determine the flood risk reduction provided by the Diversion Project and assist with the assignment of a Benefit Weighting Factor (BWF) to each “pixel” (8x8-foot grid) of the entire project boundary. The BWFs offer an objective, repeatable, and scientific process to determine the benefit each “pixel” receives from the Diversion Project. The BWFs for each “pixel” were then averaged for each parcel and parcels/neighborhoods with similar regional benefits were combined into specific Benefit Regions (BR). A summary of the how the BWFs for each “pixel” was calculated is presented in Table 3. The calculated BWFs utilize the existing and proposed 50-year, 100-year, and 500-year floodplains derived from the Phase 7 Hydraulic Model utilized by the US Army Corps of Engineers (USACE) for the Diversion Project.

Table 3. Benefit Weighting Factors (BWF) Determination

Before Diversion Project			After Diversion Project			Benefit Weighting Factor (BWF)* [A] – [B]
Without Project Floodplain	Probability of Equal or Greater Flood	Expected Number of Events in 50 Years [A]	Within Project Floodplain	Probability of Equal or Greater Flood	Expected Number of Events in 50 Years [B]	
50-year	2.0%	1.0	>500-year	0.0%	0.0	1.0
50-year	2.0%	1.0	500-year	0.2%	0.1	0.9
100-year	1.0%	0.5	>500-year	0.0%	0.0	0.5
100-year	1.0%	0.5	500-year	0.2%	0.1	0.4
500-year	0.2%	0.1	>500-year	0.0%	0.0	0.1

* The Benefit Weighting Factor (BWF) is calculated by subtracting the number of expected events in 50 years after the project [B] from the number of expected events in 50 years before the project [A].

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

4.1.3 Benefit Region (BR) Approach

The DPAC adopted a methodology of assigning Direct Benefits from the Diversion Project based on the flood risk reduction to parcels calculated by comparing the flood risk before and after the Project is implemented. In addition, Direct Benefits to parcels also include the benefit of having services to and usability of the parcel during a flood.

A BWF can be calculated for each “pixel” (8x8-foot grid) of the hydraulic model for the Project boundary using a comparison of the statistical flood return frequencies before and after the Diversion Project as discussed in the previous section. Originally, a BWF was calculated for each parcel (by averaging the 8x8-foot grid contained within each parcel) within the Project boundary and presented to DPAC for consideration. Due to concerns that this flood risk reduction of the specific parcel failed to consider the impacts of flooding, and the benefits of flood protection, in regards to having access and usability of the parcel. Also, there were concerns where adjacent parcels in the same neighborhood could have different BWFs when looking at each parcel, DPAC wanted to develop larger zones, or Benefit Regions (BRs), that included several adjacent parcels in order to be fair, just, and equitable in assigning benefits. BRs were then developed utilizing area of similar flood risk reduction, geo-political boundaries, geographic features, elevations, and Federal Emergency Management Agency (FEMA) floodplain boundaries. Also used, due to the experience of flood fighting in the past, the best of CCJWRD’s board’s judgement was also used. Using the BR approach, Direct Benefits are applied to each parcel within a BR using the BWF of the BR as of whole in which the parcel is located, along with the value and area of the specific parcel. The BWFs for each BR are used as one of the considerations used by DPAC for assigning Benefit Levels to a region as discussed in following sections.

Several revisions of the BR boundaries were developed and considered by DPAC, engineers, and consultants. A map of the BR boundaries (and the final DPAC assigned Benefit Levels) is shown in Attachment 2. While the actual boundaries are important, the purpose of this Technical Memorandum is to gain understanding of the general approach, benefits, and limitations of BRs for assigning benefits from the Diversion Project. Also, it is important to note that the actual BR boundaries are anticipated to continue to evolve as development occurs, continued hydraulic modeling, policy decisions occur, and reassessment processes are undertaken. However, use of the BR approach presented with a variety of advantages and some limitation discussed in subsequent sections.

4.1.3.1 Advantages of a Benefit Region Approach

- This approach assigns direct benefits based upon an objective, repeatable, and math-based process utilizing hydraulic modeling for the Diversion Project.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

- The BR approach is similar to previous assessment districts locally in that it treats neighbors similarly. In doing so, BRs create conditions in which the flood risk reduction and benefit across parcels of like characteristics within a region are fair, just, and equitable.
- BRs allow for benefits to a parcel to be captured that are separate from the specific water elevation on a property during a flood. These benefits include access to and from the property and general usability of the parcel.
- The BR approach simplifies the assessment process in that each parcel's benefit is easily identifiable and will stay consistent through the reassessment process.

4.1.3.2 *Limitations of a Benefit Region Approach*

- While the BWF of the BR utilizes the flood risk reduction to each parcel down to an 8x8-foot grid, the BR approach calculates a BWF by leveling the benefit across all parcels within the region. The result of this are:
 - Some unique aspects of parcels are lumped together with their surrounding area. (i.e. small spots of higher or lower elevation, non-certified flood levees, flood proofing, etc. may not be recognized)
 - Some parcels may have structures where they primarily receive flood risk reduction from the Project through the continued delivery of services and overall use of the parcel, which could otherwise be compromised during a flood, as opposed to actual flood risk to the structure itself.
- The BR approach results in boundaries where one side has a much larger BWF than the other side even though they may appear similar. However, all efforts were made to avoid this, including using very definitive boundaries such as major roadways, elevated railroad tracks, and drainage channels.

4.1.4 *Direct Assessment Model Inputs*

The inputs to the GIS-based Direct Assessment Model include Area, Value, and Benefit Level. The Area component was calculated from GIS data of each parcel and the Value component was taken from County and city assessor's information and the County tax rolls with some additional considerations discussed herein. The Benefit Levels were determined based on analyzing each BR and the corresponding property contained within each BR. This section contains additional discussion on the Direct Assessment Model Inputs used for calculating the benefit amount and assessment amount for each property.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

4.1.4.1 GIS-Based Area

The area of individual properties was used as one of the inputs to the Direct Assessment Model. The area was calculated in acres from Cass County and City of Fargo maintained parcel databases. For parcels where only a portion of the property was to be protected by the Diversion Project the area was calculated for only the benefitting fraction of the property.

4.1.4.2 Assessed Valuation

True and Full valuation maintained by the City of Fargo, City of West Fargo, and Cass County Assessors (including the listed valuation for agricultural land) was used as another input into for the Direct Assessment Model. These databases included valuation for nearly all the benefitting property within the Diversion Project. However, not all legally assessable property had a valuation contained within the City of Fargo, City of West Fargo, or Cass County databases. As such, additional data sources and some assumptions were used by DPAC and include:

- Utilized insured property values from the State Fire and Tornado Fund,
- Requested the City and County Assessors to value buildings and structures,
- Calculated equivalent agricultural land value per unit area to assign values to parks, storm water ponds and drains, private driveways and sidewalks, etc., and
- Treated open greenways, walk/bike paths, public roadways, and right-of-way as part of the indirect benefit assignment.

Once the value of all benefitting properties was established, a correction was performed to adjust the valuation data for those parcels that only partially benefit from the Diversion Project. The adjustment was done by multiplying the value by the percentage of the property that received benefit (that was previously established in the area calculation).

4.1.4.3 Weight between Area and Valuation

Because both area and value were determined to be inputs into the Direct Assessment Model, a method needed to be established to define how much weight would be applied to the area component and how much weight would be applied to the value component. It was decided that the average benefit/assessment percentage to a residential property within each BR should approximately equal the average benefit/assessment percentage to 40-acres of agricultural land with the same BR. This aligns closely with Cass County's Subdivision Planning Ordinance SECTION 306 "Minor Subdivision Plans" where only one buildable lot is allowed per 40-acres in rural subdivisions. Ultimately to satisfy the 40-acre of agricultural land equating to residential property, 95 percent of the benefit/assessment calculations needed to be calculated based on value and five percent of the benefit/assessment needed to be calculated based on area resulting in a 95/5 relationship between value and area.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

4.1.4.4 Benefit Level

The assigned Benefit Levels were determined for each BR utilizing the established BWFs of the parcels within the BR. DPAC first determined the actual BWF then scaled the BWF to achieve a 100 percent level. DPAC further assigned Benefit Levels based on land elevations, FEMA floodplain maps, local technical expertise, and the best of CCJWRD’s board’s judgement. The calculated BWF, the scaled BWF, and the DPAC and CCJWRD’s assigned Benefit Levels for each BR are show in Table 4. BR 0 showed only slight improvements from the Diversion Project and as such, the DPAC and the CCJWRD decided that this area does not directly benefit and a Benefit Level of 0.0 percent was assigned. A map of the latest BRs and assigned Benefit Levels is included as Attachment 2.

Table 4. Assigned Benefit Levels for Each Benefit Region

Benefit Region (BR)	Benefit Weighting Factor (BWF)	Scaled BWF	DPAC Assigned Benefit Level
BR 0	0.009	0.011	0%
BR I	0.219	0.286	25%
BR II	0.766	1.000	100%
BR III	0.107	0.140	10%
BR IV	0.368	0.481	50%
BR V	0.104	0.136	15%
BR VI	0.550	0.718	75%

4.1.5 Direct Assessment Model Outputs

The output of the Direct Assessment Model is a list of the amount of assessment and benefit assigned to all benefitting property. The model calculates assessments and benefits in percentage form indicating what percentage of the benefit/assessment a property received out of the total 100-percent direct benefit/assessment for the Diversion Project. The formula for calculating the benefit/assessment percentage for each property combines the three inputs; Benefit Level (BL) as a fraction, Area in acres, and Value as dollars, and appropriated factors to account for the 95/5 value/area relationship. The resulting equation is shown below. This equation can then be used to calculate the benefit and the assessment amount to a parcel by multiplying the formula results by the total amount to be assessed or the total amount of benefit received from the Diversion Project. A summary of the Direct Assessment Model inputs and resulting benefit/assessment percentage total by BR is shown in Table 5.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

Direct Assessment / Benefit Percentage Formula:

$$Benefit/Assessment \% = BL \times \left(9.747 \times Area + \frac{1.615 \times Value}{1,000} \right) \times 10^{-5}$$

Table 5. Direct Benefit Distribution to Benefit Regions

Benefit Region	Protected Area (Acres)	Protected Value (\$ Millions)	Number of Protected Properties	Percent of Direct Benefit and Assessment
BR 0	0	\$0.0	0	0.00%
BR I	9,662	\$48.5	426	0.43%
BR II	21,982	\$167.8	1,219	4.85%
BR III	8,904	\$3,175.4	8,921	5.21%
BR IV	13,442	\$4,238.4	16,975	34.88%
BR V	8,946	\$1,728.0	7,532	4.32%
BR VI	23,927	\$4,008.9	14,135	50.31%
Total	86,863	\$13,367.0	49,208	100.00%

The Direct Assessment Model was also used to determine the amount of vote assigned to the Acquired/Impacted property. This was done because the inputs needed, as indicated in state statutes, are the percentage of the property impacted (area based) and the assessed value from the County’s tax records. The formula used to determine the vote amount for each Acquired/Impacted property is:

Acquired/Impacted Lands Vote Formula:

$$Acquired/Impacted Lands Vote = Impacted Area \% \times Assessed Value$$

4.2 Indirect Assessment Model

Indirect benefits are the global benefits assigned to any county, township, or city, in its corporate capacity, which receives benefit from the Project. Indirect benefits take into consideration infrastructure, community and lifestyle, business and economy, as well as multiple salient benefits of providing a flood free community as shown previously in Table 2. Indirect benefits also are benefits received by all citizens of a jurisdiction, regardless of ownership class, through the protection of the local economy and opportunities within it. The following sections discuss the development of the Indirect Assessment Model development.

Technical Memorandum

Re: Assessment District Methodology and Development

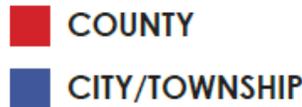
Date: June 10, 2015

4.2.1 Indirect Assessment Model Inputs

The DPAC and CCJWRD determined that population (2010 Census) was to be utilized as the input for the Indirect Assessment Model to spread the amount of indirect benefit across the benefiting jurisdictions for four primary reasons:

1. Indirect benefits are really about the protection benefits for all the people who live, work, and recreate within the protected County, Cities, and Townships
2. Population numbers are easy to calculate for each benefiting jurisdiction,
3. Population is a fair mechanism and is easy to explain, and
4. Population changes will be easy to capture during reassessments of the district though regular census updates.

Using population as the determinant to spread the indirect benefit required splitting the population to all counties, cities, and townships receiving benefit. Given that the townships and cities benefiting were all contiguous within Cass County, the board determined to fairly and properly allocate population by allocating half of each population unit to Cass County and the other half to the city or township. This split of indirect benefits between County and the City/Township is illustrated by the red/blue person shown here.



This method of spreading the indirect benefit also required special consideration when the jurisdiction was located both within and outside of the protective boundaries of the Project. To fairly and equitably take this into account, the Census data was apportioned in such a way that equated the percentage of total land of the jurisdiction within the benefiting area would be assigned to the total population of the township. The apportioned population was referred to as “protected population”. A summary of the 2010 Census population, percent of jurisdiction area protected by the Diversion Project, and protected population for all indirectly benefiting jurisdictions is shown in the next section as Table 6.

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

Table 6. Indirect Benefit Distribution to Benefitting Jurisdictions

Jurisdiction	Percent of Jurisdiction within Project	2010 Census Population	Protected Population	Percent of Indirect Benefit and Assessment
1. Cass County	n/a	n/a	137,299	50.000%
Cities				
2. Fargo	99.7%	105,549	105,267	38.335%
3. West Fargo	100.0%	25,830	25,830	9.4065%
4. Briarwood	100.0%	73	73	0.0266%
5. Frontier	100.0%	214	214	0.0779%
6. Harwood	100.0%	718	718	0.2615%
7. Horace	73.7%	2,430	1,792	0.6526%
8. North River	100.0%	56	56	0.0204%
9. Prairie Rose	100.0%	73	73	0.0266%
10. Reiles Acres	100.0%	513	513	0.1868%
Townships				
11. Barnes	100.0%	25	25	0.0091%
12. Berlin	1.8%	124	2	0.0007%
13. Harwood	69.8%	352	246	0.0896%
14. Mapleton	15.7%	188	29	0.0106%
15. Pleasant	0.6%	468	3	0.0011%
16. Raymond	26.8%	254	68	0.0248%
17. Reed	99.9%	1,175	1,174	0.4275%
18. Stanley	99.4%	1,218	1,211	0.4410%
19. Warren	2.6%	139	4	0.0015%
20. Wiser	1.4%	88	1	0.0004%
Total		139,487	137,299	100.00%

4.2.2 Indirect Assessment Model Outputs

Similar to the Direct Assessment Model, the Indirect Assessment Model output is a calculated percentage of indirect benefit/assessment for each jurisdiction out of a total 100-percent indirect benefit/assessment. Because a person is both in the county and in a city or township, Cass County accounts for 50 percent of the indirect benefit/assessment and the remaining cities and townships account for the remaining 50 percent. The following formula shows how the percentage of indirect benefit/assessment for the cities and townships were calculated. In the formula, the total protected population is 137,299 people and the protected population is the

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

protected population of the city or township being calculated. A summary of the indirect benefit/assessment for all benefitting jurisdictions is shown in Table 6.

City/Township Indirect Assessment / Benefit Formula:

$$\text{Benefit/Assessment \%} = 50 \times \frac{\text{Protected Population}}{\text{Total Protected Population}}$$

4.3 Voting Split / Defining Indirect and Direct Benefit Apportionments

As shown in Section 3.5.2 of this Technical Memorandum, it was clear, through the lengthy effort by the DPAC to determine benefits, that there was a significant amount of Indirect Benefit associated with flood protection. The work done by the City of Fargo on its Go2030 Comprehensive Plan further concluded that public sentiment also recognized the significant Indirect Benefit. The DPAC spent a healthy amount of time trying to best determine how much Indirect Benefit there was in comparison to the Direct Benefit. Early on in the discussion it was decided that there were clearly more Indirect Benefits associated with having a community with flood protection than there was to having flood protection for individual parcels. The general consensus was that the sum of the parts of jurisdictions is not as great as the whole together. There was significant discussion on whether the Indirect Benefit was so great that it should be entirely assigned as Indirect Benefits. This would not have recognized the flood protection to individual properties though, and so with DPAC's guidance, CCJWRD ultimately decided that two-thirds of the total benefit should be assigned as Indirect Benefits, with the remaining one-third being assigned as Direct Benefits.

4.4 Assessment Model Development Summary

After defining the split between indirect and direct benefits at two-thirds indirect and one-third direct, the methodology for the assessment district was completely established. A percentage of benefit/assessment was assigned to all benefitting properties (49,208 properties) and a percentage of benefit/assessment was assigned to all benefitting jurisdictions (20 jurisdictions). A voting amount had also been established for 901 properties acquired/impacted for the Diversion Project. A summary table, excluding the acquired/impacted property vote, of the benefit/assessment percentages is shown in Table 7, where the indirect benefits to be voted to assessed to jurisdictions are shown in orange and the direct benefits to be voted and assessed to individual property owners are shown in blue and vary based on which BR the property is located within.

Table 7. Percentage Based Benefit/Assessment Model Summary by Jurisdiction and BR

Location	Benefits to Jurisdictions		Benefits to Property Owners						Total Percentage
	Total Indirect Percentage	BR I	BR II	BR III	BR IV	BR V	BR VI	Total Direct Percentage	
1. Cass County	33.3333%	<i>Direct Benefits within Cass County are Shown at the City/Township Level</i>						33.3333%	
Cities									
2. Fargo	25.5566%		0.003%	0.791%	11.418%	0.496%	15.690%	28.398%	
3. West Fargo	6.2710%		0.064%	0.927%		0.751%		1.741%	
4. Briarwood	0.0177%						0.034%	0.034%	
5. Frontier	0.0520%						0.079%	0.079%	
6. Harwood	0.1743%	0.037%	0.116%		0.014%			0.167%	
7. Horace	0.4351%					0.173%	0.094%	0.267%	
8. North River	0.0136%				0.013%			0.013%	
9. Prairie Rose	0.0177%						0.018%	0.018%	
10. Reiles Acres	0.1245%		0.248%					0.248%	
Townships									
11. Barnes	0.0061%		0.003%	0.007%		0.001%		0.011%	
12. Berlin	0.0005%		0.015%					0.015%	
13. Harwood	0.0597%	0.107%	0.163%					0.269%	
14. Mapleton	0.0070%		0.118%	0.014%			0.006%	0.132%	
15. Pleasant	0.0007%							0.006%	
16. Raymond	0.0165%		0.257%					0.257%	
17. Reed	0.2850%		0.631%		0.181%			0.813%	
18. Stanley	0.2940%					0.014%	0.847%	0.861%	
19. Warren	0.0010%					0.003%		0.003%	
20. Wiser	0.0002%							0.000%	
Total	66.6667%	0.144%	1.617%	1.738%	11.626%	1.439%	16.768%	33.333%	

5 Assessment Model Results and District Summary

As discussed in previous sections, the Assessment Model (both the Direct Assessment Model and Indirect Assessment Model) were developed to assign benefits and assessments on a percentage basis. To convert the percentages into actual benefit amounts, assessment amounts, and voting amounts, the total cost to assess needed to be established. The following sections discuss how the total cost to assess was determined and provides various summaries of the assessment model results and sample assessments in a variety of tables and breakdowns. It is important to note that establishing the amount to assess does not affect the methodology established for building the Assessment Model because of the percentage based nature of the model.

5.1 Total Cost Breakdown and Amount to Assess

The total estimated Project cost, per the USACE's Feasibility Study is \$1,781.5 Million. The North Dakota legislature has approved \$175 Million for the Diversion Project during the 61st, 62nd, and 63rd legislative sessions. In addition, the North Dakota legislature passed legislative intent to provide an additional \$275 Million over the next four bienniums. The federal government is estimated to provide \$801.5 Million to the Project and the State of Minnesota is estimated to provide \$100 Million. The proposed cost to assess is based on the outstanding commitment from the State of North Dakota (\$275 Million) and the local cost share (\$450 Million). The resulting amount to assess is \$725 Million. The tables below summarize the Project cost and amount to assess as defined in the Amended Engineer's Report (March 26, 2015). The total project cost and the amount to assess are then used to calculate benefits from the Diversion Project and to calculate assessment amounts, respectively.

Project Cost Summary

Total Construction		\$1,164.9M
Planning, Engineering, and Design	+	\$183.9M
Lands, Right-of-Way, and Relocations	+	<u>\$432.7M</u>
Total Estimated Project Cost	=	\$1,781.5M

(based on the Feasibility Report and Environmental Impact Statement prepared by USACE, in July, 2011.)

Amount to Assess Summary

Total Local North Dakota Cost Share		\$450.0M
Outstanding State of North Dakota Funding	+	<u>\$275.0M</u>
Amount to Assess	=	\$725.0M

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

5.2 Assessment District Model Results and Summary

The \$725 Million to be assessed is then multiplied the benefit/assessment percentages developed as results of the Assessment Model to determine direct assessments to individual properties and to determine indirect assessments to jurisdictions. To determine direct benefits to properties the \$1,781.5 Million total project cost is multiplied by the same benefit/assessment percentage developed using the Assessment Model. The vote amounts for direct and indirect benefits are equal to the assessment amount while the vote amounts for acquired/impacted lands are calculated using the previous equation that takes into account the percentage of the property acquired/impacted and the assessed value of the property. A summary of the total vote, total benefit, and total assessment for each benefit/vote type is presented as Table 8. The proposed FM Flood Risk Management District No. 1 results in \$1,781.5 Million in benefits, requires \$725 Million in assessments when implemented, and is voted on by \$759.2 Million. Incidentally, the established methodology and amount to assess result in an indirect assessment of \$3,520.30 per person living within the benefitting area in North Dakota. The information from Table 8 is broken down further by jurisdictions and locations within Cass County (and acquired/impacted land votes in Richland County) in Table 9.

Table 8. Vote, Benefit, and Assessment Summary by Benefit/Vote Type

Benefit/Vote Type	Vote Amount	Share of the Total Cost based on Benefit Percentage	Assessment Amount
Direct Benefits	\$241,666,666.67	\$593,833,333.33	\$241,666,666.67
Indirect Benefits	\$483,333,333.33	\$1,187,666,666.67	\$483,333,333.33
Acquired/Impacted Lands	\$34,215,663.00	\$0.00	\$0.00
Total	\$759,215,663.00	\$1,781,500,000.00	\$725,000,000.00

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

Table 9. Vote and Assessment Summary by Benefit/Vote Type and Location

Location	Benefits to Jurisdictions	Benefits to Property Owners	Votes to Property Owners
	Indirect Assessment/Vote	Direct Assessment/Vote	Acquired/Impacted Lands Vote
Cass County	\$241,666,666.67	<i>Shown by City/Township</i>	\$27,556,764.62
<i>Cass Cities</i>			
Fargo	\$185,285,581.10	\$205,885,227.12	
West Fargo	\$45,464,642.86	\$12,623,825.17	
Briarwood	\$128,490.86	\$248,636.91	
Frontier	\$376,671.84	\$575,835.68	
Harwood	\$1,263,786.82	\$1,212,934.22	
Horace	\$3,154,186.60	\$1,935,184.01	
North River	\$98,568.33	\$94,815.22	
Prairie Rose	\$128,490.86	\$132,332.80	
Reiles Acres	\$902,956.32	\$1,797,306.20	
<i>Cass Townships</i>			
Barnes	\$44,003.72	\$79,912.57	
Berlin	\$3,520.30	\$109,095.16	
Harwood	\$432,996.60	\$1,952,417.71	
Mapleton	\$51,044.31	\$954,284.46	
Pleasant	\$5,280.45	\$40,929.90	
Raymond	\$119,690.12	\$1,864,823.14	
Reed	\$2,066,414.66	\$5,891,307.22	
Stanley	\$2,131,540.17	\$6,243,109.40	
Warren	\$7,040.60	\$24,689.80	
Wiser	\$1,760.15	\$0.00	
Richland County	\$0.00	\$0.00	\$6,658,898.38
Subtotal	\$483,333,333.33	\$241,666,666.67	\$34,215,663.00
Total Assessment	\$725,000,000.00		
Total Vote	\$759,215,663.00		

The following formula is used to calculate the exact assessment (and vote) amount for each property that received benefit in North Dakota. Following the previously discussed methodology, the inputs in the formula are; (1) Benefit Level (BL) as previously defined for each BR, (2) area

Technical Memorandum

Re: Assessment District Methodology and Development

Date: June 10, 2015

in acres adjusted for only portions within the project boundary), and (3) value in dollars adjusted for only portions within the project boundary. By assumed representative residual property values, Table 10 was developed to show direct assessments by BR as well as examples of how direct assessments vary with respect to BR and property value. The average agricultural land assessment per acre for each BR is also included in Table 10.

Direct Assessment / Benefit Formula for Individual Property:

$$Property\ Direct\ Assessment,\ \$ = BL \times \left(\$235.56 \times Area + \frac{\$39.03 \times Value}{1,000} \right)$$

Table 10. Direct Assessment by BR and Property Value and Average Agricultural Land Assessment per Acre

Direct Property Assessment \$725 Million Bond (≈\$242 Million of Direct Assessment)				
Benefit Region	Residential Property Value (1/4 acre lot)			Average Agricultural Land Assessment per Acre
	\$100,000	\$200,000	\$500,000	
BR 0	\$0.00	\$0.00	\$0.00	\$0.00
BR I	\$990.42	\$1,966.12	\$4,893.23	\$68.03
BR II	\$3,961.69	\$7,864.50	\$19,572.91	\$271.52
BR III	\$396.17	\$786.45	\$1,957.29	\$28.14
BR IV	\$1,980.85	\$3,932.25	\$9,786.46	\$137.18
BR V	\$594.25	\$1,179.67	\$2,935.94	\$42.58
BR VI	\$2,971.27	\$5,898.37	\$14,679.68	\$225.83

6 Conclusions and Moving Forward

In summary, the CCJWRD and DPAC spent over two years carefully considering a variety of factors and ultimately developed an objective and sophisticated model to calculate and apportion the benefits and potential assessments for the FM Flood Risk Management District No. 1 for financing the Diversion Project. Utilizing the special assessment district will save significant dollars and help to expedite the construction of the project. Because of the detail used for development and the GIS based nature of the model, it will be relatively easy to updated and/or modify the model to be used for periodic reassessments and/or for a future maintenance assessment.

Think Big. Go Beyond.



www.ae2s.com

Attachment 1 Diversion Project Features Map

Think Big. Go Beyond.



www.ae2s.com

Attachment 2 Benefit Regions and Benefit Levels Map

**FM Flood
Risk Management
District No. 1
Benefit Region
Map**



Coordinate System: NAD 1983 StatePlane ND S FIPS 4300 F1
Projection: Lambert Conformal Conic Datum: North American 1983
Parcel Data & Assessed Value Information Courtesy of Cass County, ND

Maps are for graphical purposes only. They do not represent a legal survey. While every effort has been made to ensure that these data are accurate & reliable, The Diversion Authority, Cass County, & AES2 does not guarantee the accuracy of the information, & waives any warranty or guarantee of any kind, express or implied. The data involved in the project is continuously refined & revised, you should not rely on this information for technical purposes or complete accuracy.

**January
2015**



Key

-  Benefit Regions (BR)
-  Diversion Channel

