DEPARTMENT OF TRANSPORTATION

Evaluation of Slurry Spreaders and Plows (Underbody, Wing, and Two-Way Reversible)

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CTC & Associates LLC

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Research Report
Final Report 2023-31

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16. Abstract (Limit: 250 words)

MnDOT evaluated five pieces of new winter maintenance equipment: two slurry spreaders, an underbody scraper, a true-float wing plow and a two-way reversible plow. For Winter 1 of the evaluation program, all equipment was acquired, installed, and field-tested in MnDOT District 2. For Winter 2, a data collection program was developed to capture quantitative data on how well the equipment worked in District 2, compared side by side against comparable routes with traditional spreaders. Winter 1 and 2 field testing of the three types of plow equipment allowed operators to fix operational problems and led participants to agree that MnDOT should continue to use such equipment and acquire more. MnDOT participants did not reach consensus on whether to continue to use or buy more of the two slurry spreaders. Data analysis showed that they performed comparably to traditional slurry spreaders in terms of road regain time and salt use when they were operational. Issues included equipment height, causing loading and maintenance worker safety concerns; equipment weight, reducing how much material could be loaded in the truck; difficulty in setup; equipment not operating as expected; and difficulty obtaining vendor parts and getting vendor support. These issues led to the cancellation of a third winter of testing in a different district. It was suggested that the equipment might better suit MnDOT's needs by mounting it on a boxless truck.

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Our gratitude is also extended to all operators, maintenance staff, and technicians who worked on setting up, operating, and troubleshooting the equipment studied in this research project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

MnDOT sought the evaluation of five pieces of new winter maintenance equipment through this project. These included two slurry spreaders—one from manufacturer Henke and one from manufacturer Swenson—that were designed to outperform traditional slurry spreading systems, leading to quicker clearing and safer roads. Also studied were three types of plowing equipment: an underbody scraper, a true-float wing plow, and a two-way reversible plow—all from Henke—which were intended to clear roads more quickly, improving safety for motorists and other travelers.

The evaluation of this equipment proceeded over three winters.

WINTER 1: INITIAL EXPERIENCE AND EVALUATION

For Winter 1 of the evaluation program, all equipment was acquired, installed, and used in MnDOT District 2, headquartered in Bemidji in the north-central part of the state. Winter 1 included an initial assessment of all equipment in the field, as well as a detailed survey and interviews with District 2 staff, including operators, maintenance staff, and supervisors.

WINTER 2: DETAILED ASSESSMENT AND ANALYSIS

For Winter 2, all equipment remained in District 2.

Data Collection

A data collection program was developed to capture quantitative data on how well the equipment works. These plans included identifying side-by-side comparable routes for the slurry spreaders to see how they compare with traditional slurry spreading equipment. The Henke slurry spreader was to be compared against a traditional spreader on comparable longer rural routes, and the Swenson spreader was to be compared against a traditional spreader on comparable shorter urban routes.

The Winter 2 data collection and analysis method for the slurry spreaders aimed to draw from data that are already captured through existing automated and manual processes.

For the three pieces of plow equipment, investigators developed an end-of-shift survey form for operators to provide immediate feedback on how well the individual equipment performed.

Data Analysis

Apples-to-apples comparisons of the slurry spreaders with their traditional counterparts proved to be difficult. (District 2's operational priority was always clearing the road, not making operational decisions in service to this study.) However, the efforts did reveal some important findings.

First, the Swenson spreader was up to the task of regaining roads that were lost to snow and ice for certain storms. (The Henke spreader may have been able to as well, but this cannot be extracted from

the data.) For these events, the Swenson ranged from 0.08 to 0.14 tons of salt per mile, or an average of 0.10 tons per mile.

Second, the Henke spreader could be compared against like equipment for nonroad-loss events, and it was found that the spreader's use of salt was on par with traditional equipment: sometimes more, sometimes less, with no clear pattern emerging. In this case, absence of data prevents the drawing of any conclusion on this point about the Swenson spreader. (The Swenson comparable equipment was rarely used on its own.)

The two-way reversible plow was shown to have performance issues at the start of the winter, with notes of poor/unacceptable performance. By November, adjustments were made that included a change in blade type and the addition of brackets to change the plow angle. From that time forward, there were no reports of mechanical issues; the equipment was performing very well/better than traditional equipment.

There were no mechanical issues with the true-float wing plow, and it similarly performed very well/better than traditional equipment. There were issues with the underbody scraper, indicating that it was hard to control pressure. It was reported to perform acceptably/as well as traditional equipment.

WINTER 3: PLANNED FURTHER EVALUATION OF SLURRY SPREADERS

For the third and final winter of this project, MnDOT had planned to move the Henke and Swenson slurry spreaders to a different district in the state. This would have provided insights into how well a different district's maintenance shop was able to set up, run, and maintain the new equipment based on the benefit of experience from District 2 in Winters 1 and 2.

The scope from the original research plan was to use the equipment in MnDOT's Metro District for winter 2021-2022. However, due to COVID-19-related staffing shortages, the district was unable to participate in this study. MnDOT District 1, which includes Duluth in the northeastern part of the state, was identified as an alternative site for Winter 3 of this study, with a plan to proceed one year later, in winter 2022-2023. Due to difficulty in setting up and using the equipment, the technical advisory panel (TAP) elected not to proceed with data collection and analysis, and to terminate field investigation. Discussions and informal interviews with District 1 staff captured the type and extent of issues that maintenance staff faced.

RECOMMENDATIONS

Consensus recommendations for continued use and future purchase of the equipment studied in this research project are based on data collection and analysis from Winter 2 and interview responses collected over all years of this study.

Underbody Scraper, True-Float Wing Plow and Two-Way Reversible Plow

MnDOT participants generally agreed that MnDOT should continue to use and consider buying more of the Henke underbody scraper, the Henke true-float wing plow, and the Henke two-way reversible plow.

By the end of Winter 2, all three pieces of equipment performed as expected and presented few issues.

- Initial adjustments were needed to exert proper pressure on the underbody scraper to assure good ground contact and snow removal.
- The significant Winter 1 performance issue with the two-way reversible plow was that it caused the windshield to become covered in snow and required several maintenance activities per shift. This issue was resolved in Winter 2 with the reconfiguration of equipment.

Slurry Box Spreaders

MnDOT participants did not reach consensus on whether to continue to use or buy more of the Henke slurry box and the Swenson slurry box.

Early in the study, operators generally believed the difficulties with the spreaders outweighed potential benefits. Managers had a more positive view while acknowledging poor performance and noting that a full winter of proper operation was necessary to judge the spreaders.

By the end of the study, after Winter 2 and then planned-but-not-executed Winter 3, operators and staff were more in agreement. This equipment was not viewed as workable for MnDOT as tested for this study (equipment to be slid into existing box truck). Documented concerns included:

- Equipment height, causing loading and safety concerns
- Equipment weight, reducing how much material could be used
- Difficulty in setup
- Equipment not operating as expected
- Difficulty in obtaining required vendor parts, particularly after COVID
- Challenges in getting vendor support, particularly after COVID

Several MnDOT staff members suggested that the type of slurry box equipment investigated in this study might work better in a different configuration: attached directly to the truck chassis in place of the existing box. This would yield multiple benefits:

- A lower loading height for easier access by a bucket loader
- A lower height for accessing and clearing bridged salt
- A lower vehicle weight, allowing for the use of more salt

Another possible change would be the use of this equipment in an urban setting, where shorter routes would require less material. This would make the capacity limits of this equipment less of an issue.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Equipment manufacturers regularly develop and deliver new technologies that have the potential to improve winter maintenance operations. These are commonly designed to handle snow and ice with increased efficiency, safety and cost-effectiveness compared with traditional winter maintenance equipment.

From experience, MnDOT's Office of Maintenance staff understands the importance of carefully vetting new technologies. Equipment may not work as advertised or may not be feasible for MnDOT for any number of reasons: cost, effectiveness, ease of use, safety and other factors.

This project investigated several promising pieces of winter maintenance technologies in MnDOT over the course of multiple winters to assess their viability as tools for use by MnDOT winter maintenance staff.

1.1.1 Personnel and Oversight

This project was performed at the request of the MnDOT Office of Maintenance and was funded through the MnDOT Office of Research & Innovation (R&I). It was guided by a technical advisory panel (TAP) consisting of the following MnDOT staff:

Office of Research & Innovation

- Barbara Fraley, TAP project coordinator
- Katie Fleming-Vogl, TAP project coordinator (previous)
- Leif Halverson, TAP project coordinator (previous)

Office of Maintenance

- Tom Peters, TAP technical liaison and project advisor
- Robert Buhl
- Dan Flatgard
- James Grebenc
- Shannon McIntyre
- Ryan Sodd

District Offices

- District 1 Maintenance
  - Jeremy Birr
  - Chris Cheney
  - Perry Collins
  - Scott Collver
  - Holly Johnson

- District 2 Maintenance
  - Tony Bowe
  - Ryan Erickson
  - Gale Tiedemann
- Metro District Maintenance
  - Dan Reimann

Office of Environmental Stewardship

- Laura Lyle

Office of Administration

- Todd Haglin

The TAP met regularly over the course of the project to provide project guidance and oversight and make key decisions about the project scope and direction.

MnDOT contracted with Lincoln, Nebraska-based technical consulting firm CTC & Associates to perform the work detailed in this report.

CHAPTER 2: PRODUCT EVALUATION PROGRAM

MnDOT sought the evaluation of five pieces of equipment through this project.

Two **slurry spreaders**—one from manufacturer Henke and one from manufacturer Swenson—are designed to outperform traditional slurry spreading systems, leading to quicker clearing and safer roads. Their modular features are intended to provide safer operation and maintenance by MnDOT staff as well. If effective, the slurry system would have other benefits associated with reduced salt use: lower costs and less environmental impact.

An **underbody scraper**, a **true-float wing plow** and a **two-way reversible plow**—all from Henke—are intended to clear roads more quickly, improving safety for motorists and other travelers. Increased ease of use would also save MnDOT in operations costs.

Specifications of these pieces of equipment appear in manufacturer product fact sheets presented in Appendix A to this report. Options selected for the pieces procured by MnDOT are listed below.

Slurry spreader (Henke, Figure 2.1)

- Henke V-Box HXC 2000
- 12’ long
- Single 9” auger
- 800-gallon liquid system with slurry spray nozzles mounted at rear of hopper in spinner chute
- Quad 100-gallon tanks (200 gallons per side, 400 gallons total) pumping into front-mounted 400-gallon tank via electric transfer pump hooked to Force America 6100 controls

Figure 2.1. Henke slurry spreader.

Slurry spreader (Swenson, Figure 2.2)

- 79010-0001 EVolution Smart Spreader
- 10’ long x 82” wide x 56” high
- 6.7 cubic yard dry material, 470-gallon liquid capacity
- Dual auger
- Empty weight: 3,840 pounds
- Unit has its own sander control system and does not use Force America controller.

Figure 2.2. Swenson slurry spreader.

Underbody scraper (Henke, Figure 2.3)

- Power-reversing moldboard
- 11’ long x 20” high

Figure 2.3. Underbody scraper.

True-float wing plow (Henke, Figure 2.4)

- True-float postless wing
- 11’ mid-mount
- Rear lift
- Hydraulic pushbeam

Figure 2.4. True-float wing plow.

Two-way reversible plow (Henke, Figure 2.5)

- Henke Road Warrior 12’ Reversible Plow
- External compression trip (ECT) mechanism
- Sliding level lift
- 46B plow swivel with 42” straight moldboard

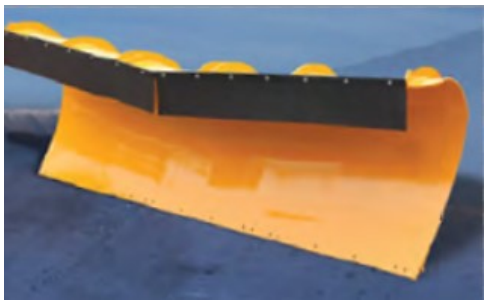


Figure 2.5. Two-way reversible plow.

2.1 EVALUATION PROGRAM

The evaluation of this equipment, as initially scoped and later amended, proceeded over three winters.

2.1.1 Winter 1 (2019-2020)

Location: MnDOT District 2
Equipment: Slurry spreaders, underbody scraper, true-float wing plow, two-way reversible plow
Approach: Interview survey of practitioners and managers after the completion of the winter season

For Winter 1 of the evaluation program, all equipment was acquired, installed and used in MnDOT District 2 (Figure 2.6), headquartered in Bemidji. Winter 1 included an initial assessment of all equipment in the field, as well as a detailed survey and interviews with District 2 staff, including operators, maintenance staff and supervisors.

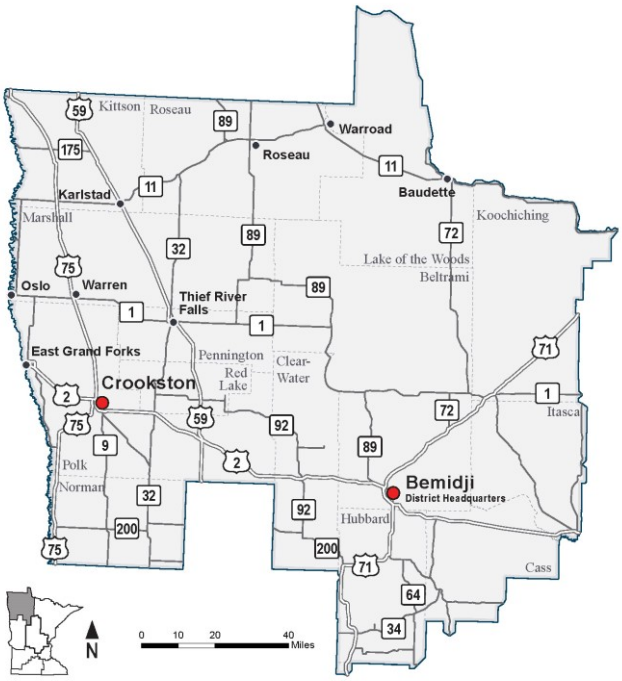


Figure 2.6. Map of MnDOT District 2.

The equipment was used on the following routes in the southeastern portion of District 2:

- Henke slurry spreader
    - East of Bemidji, on Minnesota Trunk Highway (TH) 2 from Deer River to Sucker Bay Road near Ryan Village
- Swenson slurry spreader
    - In Bemidji, on TH 197 from East Junction TH 2 to West Junction TH 2

- Henke underbody scraper, Henke true-float wing plow and Henke two-way reversible plow
    - Northeast of Bemidji, on TH 1 from South Junction TH 71 near Battle Lake to Junction TH 89 in Little Rock
    - North of Bemidji, on TH 72 from East Junction TH 1 at Shooks to Kelliher

The original project plan had called for a small-scale data collection project during Winter 1. The investigators and the TAP worked to identify data measures and possible collection methods in the areas of installation/maintenance, safety (both operational and public), efficiency/performance and environmental. These are detailed in Table 2.1.

Table 2.1. Initial concepts for data collection measures and methods.

Area	Measure	Method
Installation/Maintenance	Installation time (labor hours)	Ask shop supervisor for estimate at end of winter
Installation/Maintenance	Shop maintenance time (labor hours)	Establish log book (Excel or Google sheet)
Installation/Maintenance	Troubleshooting/minor field repair time (labor hours)	Establish log book (Excel or Google sheet)
Installation/Maintenance	Troubleshooting/minor field repair instances (count)	Establish log book (Excel or Google sheet)
Installation/Maintenance	Ease of installation	Use 5-point rating scale end of winter
Installation/Maintenance	Ease of shop maintenance	Use 5-point rating scale end of winter
Installation/Maintenance	Ease of calibration	Use 5-point rating scale end of winter
Installation/Maintenance	Cost per year (initial capital + parts + labor)	Calculate end of winter
Safety (Operational)	Injuries installing/maintaining equipment (count)	Log and tally end of winter
Safety (Public)	Crashes on road sections maintained with equipment (count)	Track times/segments used; look up end of winter
Efficiency/Performance	Passes per road section (number of passes; time per pass in minutes)	Use Maintenance Decision Support System (MDSS)/shift reports
Efficiency/Performance	Time to bare lane (hours)	Use MDSS/shift reports
Efficiency/Performance	Time to manipulate (minutes or seconds)	Ask operator for estimate
Efficiency/Performance	Mechanical issues per season (count)	Establish log book (Excel or Google sheet)
Efficiency/Performance	Ease of operator use	Use 5-point rating scale end of winter
Efficiency/Performance	Accuracy (gallon or pound per mile)	Use MDSS
Environmental	Bounce and scatter (estimation)	Ask operator for estimate
Environmental	Salt used (tons)	Use MDSS
Environmental	Residual salt on road (estimation)	Ask operator for estimate

However, District 2 was unable to run all of the new equipment through the entire winter. Time was needed for the acquisition and setup of the equipment, with some of the pieces requiring extensive modification and troubleshooting; in some cases, product vendors were called to Bemidji to address the issues.

Such delays are common with the acquisition and installation of new equipment. However, as a result of these issues, the Henke slurry spreader ran only about half a dozen times, and the Swenson spreader about a dozen times. The two-way reversible plow was used in approximately five storms.

For the purposes of this project, it was not feasible to develop and run a data collection program in Winter 1. The TAP instead elected to use a survey methodology for Winter 1 to collect qualitative feedback on the equipment.

With the TAP's input, the investigators developed a survey tool to learn about benefits and challenges related to installation, operations and maintenance. This survey was administered by phone to operators, maintenance staff and managers after the completion of Winter 1 and is detailed in Chapter 3 of this report. The survey also included an opportunity for investigators to elicit strategies for Winter 2 data collection.

Issues related to specific pieces of equipment, as well as the Winter 1 survey and its results, are discussed in Chapter 3.

2.1.2 Winter 2 (2020-2021)

Location: MnDOT District 2
Equipment: Slurry spreaders, underbody scraper, true-float wing plow, two-way reversible plow
Approach: Data collection and analysis of equipment, follow-up interview questions

For Winter 2, all equipment remained in District 2. Working closely with the TAP and other District 2 staff and referring to the survey results, the investigators develop a data collection program intended to capture quantitative data on how well the equipment works. These plans included identifying side-by-side comparable routes for the slurry spreaders to see how they compare with traditional slurry spreading equipment. The Henke slurry spreader was to be compared against a traditional spreader on comparable longer rural routes, and the Swenson spreader compared against a traditional spreader on comparable shorter urban routes.

The Winter 2 data collection and analysis method for the slurry spreaders aimed to draw from data that are already captured through existing processes. These include automated systems, such as onboard automated vehicle location (AVL) data recorded in end-of-shift reports, as well as manual processes, such as driver-completed resource consumption application (RCA) timesheets that feed into an Oracle Business Intelligence (BI) database.

For the three pieces of plow equipment, investigators developed an end-of-shift survey form for operators to provide immediate feedback on how well the individual equipment performed.

Finally, follow-up interviews with selected MnDOT staff at the end of Winter 2 informed the quantitative findings and captured further thoughts on the benefits and potential value of all five pieces of equipment.

Winter 2 efforts are detailed in Chapters 4 through 6.

2.1.3 Winter 3 (Not conducted; planned for 2021-2022 and then for 2022-2023)

Planned Locations: MnDOT Metro District, MnDOT District 1
Planned Equipment: Slurry spreaders only
Planned Approach: Data collection and analysis of equipment, follow-up interview questions

For the third and final winter of this project, MnDOT had planned to move the Henke and Swenson slurry spreaders to a different district in the state. This would provide insights into how well a different district's maintenance shop is able to set up, run and maintain the new equipment based on the benefit of experience from District 2 in Winters 1 and 2.

The scope from the original research plan was to use the equipment in MnDOT's Metro District for winter 2021-2022. However, due to COVID 19-related staffing shortages, the district was unable to participate in this study.

MnDOT District 1, which includes Duluth, was identified as an alternative site for Winter 3 of this study, with a plan to proceed one year later, in winter 2022-2023. Due to difficulty in setting up and using the equipment, the TAP elected not to proceed with data collection and analysis and to terminate field investigation. Interviews with District 1 staff captured the type and extent of issues that maintenance staff faced.

Efforts surrounding planned Winter 3 are documented in Chapter 7.

CHAPTER 3: WINTER 1 QUALITATIVE EVALUATION

3.1 SURVEY

The qualitative survey tool used after Winter 1 is Appendix B to this report.

The investigators conducted seven interviews (six by telephone and one by email) with staff responsible for the installation, operation, management and oversight of five pieces of equipment evaluated during Winter 1:

- Henke slurry spreader
- Swenson slurry spreader
- Henke underbody scraper
- Henke true-float wing plow
- Henke two-way reversible plow

The **Key Survey Findings** section below summarizes the most noteworthy and most frequently heard responses from survey respondents. Comprehensive survey results are attached as Appendix C to this report. Numbered items correspond to the numbered questions in the survey tool.

3.2 KEY SURVEY FINDINGS

3.2.1 Installation and Setup

- Interviewees found the Henke slurry spreader easier to set up than the Swenson slurry spreader. Managers generally viewed all of the equipment as easier to set up than did mechanics and operators.
- The Swenson spreader, using its own controller rather than the standard Force America controller, required additional effort to get it working properly.
- Both spreader systems had flow issues.
- The auger in the Swenson slurry spreader was preinstalled backward.
- The Swenson slurry spreader did not see full-time use in Winter 1 due to ongoing setup issues.
- Vendor support was needed to get the equipment working properly, including calls and on-site visits for both of the slurry spreaders. The Swenson spreader required significantly more vendor support than the Henke spreader.

3.2.2 Maintenance and Operation

- Shop labor maintenance before and after a storm ranged from 15 minutes to two hours for the different pieces of equipment.

- Stated maintenance safety concerns for both models of slurry spreaders were that workers needed to stand on a ladder to work on these, and the equipment needed to be loaded from the top of a sometimes icy loading ramp.
    - It is noted that these units were modified to fit the U-shaped boxes in plow trucks temporarily. If these were installed in square-shaped boxes, they would sit much lower and not require material loading from a loading ramp. The temporary configuration was agreed upon to avoid the excessive cost of changing out boxes in case this equipment did not work out.
- On a scale of 1 (very difficult to operate in the field) to 5 (very easy to operate in the field), the Henke slurry spreader (3.7 average) was seen as easier to operate than the Swenson slurry spreader (1.8 average).
- Again, managers generally viewed all of the equipment as easier to operate than did drivers.
- Both slurry spreaders saw multiple field maintenance activities per shift. These involved spreader mechanicals (jams, stuck augers), sensors/electronics and computer codes. The two-way reversible plow required one to three maintenance activities per shift as well.
- Operational safety concerns for the slurry spreaders involved their high center of gravity and the exposure of legs that stick out behind the back of the truck. Emptying the slurry box was also a possible pinch or cutting hazard.
    - As noted, the spreaders were mounted higher for this test than would be typical for a permanent installation.
    - A chute will be added to the Henke spreader in Winter 2 to aid with dumping material from the box.
- Several operators noted that an unacceptable amount of snow went over the top of the two-way reversible plow. This happened even in light snows and moderate speeds, and this was not fixed by the end of the winter.

3.2.3 Performance

- Operators generally believed the difficulties with the spreaders outweighed potential benefits that were not realized over the first partial winter. They described overly complicated systems that frequently did not work and were not an improvement over current equipment. The advertised benefit of being able to spread slurry over multiple lanes was not realized. Managers had a more positive view of the potential equipment while acknowledging poor performance and noting that a full winter of proper operation was necessary to judge the spreaders.
- The underbody scraper and true-float wing plow had good performance.
- Two reported performance issues about the two-way reversible plow were that it caused the windshield to become covered in snow and that it was too light to apply proper blade pressure against the ground.
- Based on their observations of the performance of each piece of equipment, interviewees indicated whether MnDOT should continue to use the equipment and consider acquiring more.

Not all interviewees provided a response for each piece of equipment. Responses are summarized in Table 3.1.

Table 3.1. Survey responses on MnDOT's future use of equipment.

Equipment	MnDOT should continue to use this equipment?	MnDOT should consider acquiring more of this equipment?
Henke slurry spreader	Yes: 2 respondents, No: 2 respondents	Yes: 2 respondents, No: 2 respondents
Swenson slurry spreader	Yes: 2, No: 3	Yes: 0, No: 2
Henke underbody scraper	Yes: 4, No: 0	Yes: 4, No: 0
Henke true-float wing plow	Yes: 4, No: 0	Yes: 3, No: 1
Henke two-way reversible plow	Yes: 1, No: 3	Yes: 0, No: 5

3.2.4 Data Collection for Winter 2

Interviewees provided thoughts on how these metrics can be measured and recorded in Winter 2, as well as effective ways to compare this equipment with similarly tasked existing equipment on parallel/comparable routes. These were incorporated into the Winter 2 evaluation plan detailed in the next chapter.

CHAPTER 4: WINTER 2 EVALUATION PLAN

This chapter details the equipment evaluation plan developed by the investigators and the project TAP.

It had been an original goal of this project to compare like-with-like equipment while controlling other variables as much as possible. The two pieces of equipment where such comparisons were viewed as possible to achieve were the slurry spreaders. The first part of the Winter 2 evaluation plan is the **quantitative plan** for the slurry spreaders, as detailed in Section 4.1 below.

Due to the extensive use of plow equipment—typically with several in use on the same route at the same time—it was not feasible to create a quantitative data collection plan for this equipment. Instead, an operator **survey tool** was used for the three types of plows, as detailed in Section 4.2 below.

NOTE: The remainder of this chapter is presented as the final plan language as approved by the TAP and refers to Winter 2 in the future tense ("We will examine ..." etc.).

4.1 SLURRY SPREADERS—QUANTITATIVE COMPARISONS

4.1.1 Methodology

To enable like-with-like comparisons, and to compare both material use and effectiveness, the goal is to study:

- A new slurry spreader versus a traditional slurry spreader on similar routes
- Storms where just a single spreader was used on a route, and where the road was lost and later regained

4.1.2 Equipment and Routes

- Henke slurry spreader versus traditional on two longer country routes:
  - Henke—TH 2 Deer River to Sucker Bay Road
  - Traditional spreader—TH 2 mile post 121 to Sucker Bay Road
- Swenson slurry spreader versus traditional on shorter in-town routes:
  - Swenson—197 East Junction TH 2 to West Junction TH 2
  - Traditional spreader—197 Junction South 197 and 71 to Junction 197 and CSH 50, and 71 Junction S197 and 71 to Junction CSH 9

These routes were selected to be as similar as possible: same number of lanes, same north-south or east-west direction, same topography (flat/hilly, open/tree-lined).

4.1.3 Data Collection

We will examine data for a pair of slurry trucks (traditional and new) on these comparable routes for a given storm event to assess:

- How much material they put down
- How long it took to regain the road

Data Source 1

- Database: Oracle BI
- Report: Snow and Ice Estimate Usage and Cost—Work Item Detail. Output: All resources (vehicles and materials) for identified route
- What this tells us:
    - Which vehicles were used on a route for a given time period (one storm)
    - How much brine (gallons) and salt (tons) each vehicle spread

Data Source 2

- Database: webMDSS
- Report: AVL, all activity for identified route
- What this tells us:
    - Which vehicles were used on a route for a given time period (one storm)
    - Time periods each vehicle was actively spreading material

Data Source 3

- Database: Oracle BI
- Report: Bare Lane for identified route
- What this tells us:
    - Regain time (time between end of storm and regain of road)

Data Source 4

- Database: National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA) or MnDOT database to be identified
- Report: Storm vitals (start/end date and time, inches of precipitation, etc.)
- What this tells us:
    - How to identify appropriate storms to study

4.1.4 Considerations

In practice, the slurry equipment will be used as needed to fight each storm in real time. In many cases, the slurry spreader will be used in a configuration that does not serve the needs of the study (that is, it will be used with other equipment on the same route).

As noted in Section 4.1.1, this analysis hinges on winter storms where just one slurry spreader is used (therefore, not too heavy a storm) and where the road was lost and regained (therefore, not too light a storm).

CTC will work with MnDOT staff to help identify appropriate storms and to receive the data reports in Section 4.1.3 of this plan. The TAP should address the likelihood of whether there will be many or few such storms.

Equipment operators' regular and careful submission of resource consumption application (RCA) timesheets as inputs to the Oracle BI system will assure quality outputs for Data Sources 1 and 3 noted in Section 4.1.3.

4.1.5 Analysis Approach

The investigators will use the collected data to make like-with-like comparisons of:

- How much material was put down with each spreader
    - Effectiveness in spreading material
    - Secondary conclusions about environmental impacts
- Actual usage/operation time
    - Effectiveness in spreading material
- How quickly each route was regained with each spreader
    - Effectiveness in maintaining road
    - Secondary conclusions about safety

4.2 PLOW EQUIPMENT—JUST-IN-TIME SURVEY FEEDBACK

4.2.1 Methodology

Since the Henke underbody scraper, true-float wing plow and two-way reversible plow will be used in the field in conjunction with other equipment, like-with-like comparisons will not be possible for these items. However, near-real-time operator feedback on effectiveness and issues via a short survey tool will provide valuable information about these pieces of equipment.

4.2.2 Equipment and Routes

Equipment:

- Henke underbody scraper
- Henke true-float wing plow
- Henke two-way reversible plow
- (No comparison equipment)

Routes

- As identified by District 2

4.2.3 Data Collection

Operators will have a short survey sheet to complete at the end of their shifts for each piece of equipment. It will be a printed table intended to be completed by hand in less than two minutes. The example on the next page is for the Henke underbody scraper. Other equipment would have an identical form.

The forms are reproduced as Appendix D to this report.

4.2.4 Considerations

Operators may need prompting or reminding to complete the survey sheets after a shift.

It is important that an assigned staff member keep track of sheets so they are not lost and are submitted to the investigators.

4.2.5 Analysis Approach

The investigators will use the collected information to get a better picture of how well each piece of equipment is performing. Over time, the survey sheets may illustrate trends during the winter (for example, improved performance as drivers learn the nuances of operating each piece of equipment). This just-in-time information will complement the end-of-Winter-1 survey results.

CHAPTER 5: WINTER 2 COLLECTED DATA

The results of the Winter 2 data collection efforts are detailed below. As in Chapter 4, they are divided into two sections: the quantitative data collected for the slurry spreader and the survey data collected for the plow equipment.

5.1 SLURRY SPREADERS—QUANTITATIVE

5.1.1 Equipment and Routes

Henke spreader and Henke comparable (urban route)

Unit: 216561	Route: TP2J1972	Henke
Unit: 216561	Route: TP2J0711	Henke
Unit: 208556	Route: TP2J0713	Henke comparable

Swenson spreader and Swenson comparable (rural route)

Unit: 212504	Route: TP2J1971	Swenson
Unit: 212505	Route: TP2J0713	Swenson comparable
Unit: 212505	Route: TP2J0024	Swenson comparable

5.1.2 Report Types

The following two report types were requested to acquire the required data:

1. **Oracle BI Snow and Ice Estimate Usage and Cost—Work Item Detail.** Output is all resources (vehicles and materials) for identified route.
2. **Oracle BI Bare Lane.** Output is loss and regain for identified routes.

5.1.3 Report Dates

December 1, 2020, to April 15, 2021, collected over three periods and provided by MnDOT staff member Dan Flatgard.

- December 1, 2020, to January 10, 2021
- January 1, 2021, to February 10, 2021
- February 1, 2021, to April 15, 2021

5.1.4 Spreadsheets

The data provided by Dan Flatgard, compiled by type and lightly conditioned for clarity, are found in the two spreadsheets:

- Appendix E: Use and Cost Data
- Appendix F: Bare Lane Data

For Excel spreadsheet versions of these appendices, please contact MnDOT.

5.2 PLOW EQUIPMENT—SURVEY

Tony Bowe provided PDF scans of survey responses from equipment operators. These were completed after operators used different pieces of plow equipment on various days.

Two operators (given identifiers Operator 1 and Operator 2) submitted end-of-shift handwritten comments on all three types of plow equipment. Table 5.1 captures 16 submissions over the course of the winter. The three options for "How well did the equipment perform?" were:

- Very well/better than traditional equipment
- Acceptably/as well as traditional equipment
- Poorly/not acceptable

Table 5.1. Plow equipment survey results.

Equipment	Date	Operator ID	Mechanical Issues (Y/N)	Performance	Comments
Two-Way Reversible Plow	10/20/2020	1	Y	Poorly/not acceptable	Snow came over the top of the plow. Changed from Joma cutting edges to steel.
Two-Way Reversible Plow	11/24/2020	1	Y	Poorly/not acceptable	Still had snow coming over the top of the plow. Added brackets to roll plow forward more than the factory settings.
Two-Way Reversible Plow	11/26/2020	1	N	Very well/better than traditional equipment	Standing up plow reduced the snow coming over the top. Would like longer flap in front.
Two-Way Reversible Plow	11/27/2020	1	N	Very well/better than traditional equipment	
Two-Way Reversible Plow	12/23/2020	1	N	Very well/better than traditional equipment	
Two-Way Reversible Plow	12/29/2020	1	N	Very well/better than traditional equipment	
Two-Way Reversible Plow	1/14/2021	1	N	Very well/better than traditional equipment	
Two-Way Reversible Plow	4/20/2021	1	N	Very well/better than traditional equipment	
True-Float Wing Plow	12/18/2020	2	N	Very well/better than traditional equipment	
True-Float Wing Plow	12/21/2020	2	N	Very well/better than traditional equipment	
True-Float Wing Plow	12/23/2020	2	N	Very well/better than traditional equipment	
True-Float Wing Plow	12/30/2020	2	N	Very well/better than traditional equipment	

Equipment	Date	Operator ID	Mechanical Issues (Y/N)	Performance	Comments
Underbody Scraper	12/18/2020	2	Y	Acceptably/as well as traditional equipment	Hard to control pressure.
Underbody Scraper	12/21/2020	2	Y	Acceptably/as well as traditional equipment	Hard to control pressure.
Underbody Scraper	12/23/2020	2	Y	Acceptably/as well as traditional equipment	Hard to control pressure.
Underbody Scraper	12/30/2020	2	Y	Acceptably/as well as traditional equipment	Hard to control pressure.

CHAPTER 6: WINTER 2 DATA ANALYSIS

6.1 SLURRY SPREADERS—QUANTITATIVE

6.1.1 Examination of Time to Regain

The basis of the analysis was to be "like with like": the Swenson slurry spreader versus the Swenson comparable spreader (or the Henke versus the Henke comparable) on similar routes, for storm events where the pavement was lost and then regained.

The Appendix F spreadsheet of bare lane data lists all dates when any of the study routes were lost for any length of time. Ignoring rows showing "no loss," there were 18 such events. Equipment used on these routes for these dates were established from the Appendix E use spreadsheet.

Among the 18 events, 11 used equipment outside the scope of this study or multiple pieces of equipment on the same route. The remaining seven qualifying events are shown in chronological order in Table 6.1.

Table 6.1. Qualifying winter storms with road loss and regain.

Event Begin Date/Time	Event End Date/Time	Lane Lost Date/Time	Lane Regain Date/Time	Event Duration (Hours)	Lane Lost Duration (Hours)	Regain Time (Hours)	Project Maintenance Route	Project ID	Equipment
12/13/2020 10:00	12/13/2020 17:00	12/13/2020 13:00	12/13/2020 18:00	7	5	1	E JCT. TH 2 TO W JCT. TH 2	TP2J1971	Swenson
12/18/2020 7:00	12/18/2020 12:00	12/18/2020 8:00	12/18/2020 13:30	5	5.5	1.5	E JCT. TH 2 TO W JCT. TH 2	TP2J1971	Swenson
12/27/2020 18:00	12/28/2020 7:00	12/28/2020 3:00	12/28/2020 10:00	13	7	3	E JCT. TH 2 TO W JCT. TH 2	TP2J1971	Swenson Comparable 12/27; Swenson 12/28
1/23/2021 16:00	1/24/2021 4:00	1/23/2021 17:30	1/24/2021 8:00	12	14.5	4	N. JCT. TH 2 TO JCT. TH 72 AT BLACKDUC	TP2J0713	Henke Comparable
1/30/2021 13:00	1/31/2021 8:00	1/31/2021 2:00	1/31/2021 9:00	19	7	1	E JCT. TH 2 TO W JCT. TH 2	TP2J1971	Swenson
2/4/2021 0:00	2/4/2021 9:00	2/4/2021 3:00	2/4/2021 11:00	9	8	2	E JCT. TH 2 TO W JCT. TH 2	TP2J1971	Swenson
2/4/2021 1:00	2/4/2021 4:00	2/4/2021 2:00	2/4/2021 11:00	3	9	7	N. JCT. TH 2 TO JCT. TH 72 AT BLACKDUC	TP2J0713	Henke Comparable

Observations:

Qualifying events included three pieces of equipment: the Swenson spreader (5 instances), the Swenson comparable (1 instance), and the Henke comparable spreader (2 instances).

Since these were not comparable pieces of equipment on comparable routes on the same days, like-to-like calculations (amount of salt versus time to regain) cannot be determined.

However, observations can be made about the effectiveness of the Swenson spreader. These effectively served to regain roads on their own on five separate occasions, as shown in Table 6.2.

Table 6.2. Use of equipment during qualifying winter storms.

Work Item Date	Resource Name	Resource ID	Spreader	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project ID (Route)	Unit of Measure Name
12/13/2020	International 7500 Single	TM212504	Swenson	50	Equipment	Equipment	TP2J1971	Miles
12/13/2020	Salt	17416	Swenson	7	Material	Material	TP2J1971	Ton
12/18/2020	International 7500 Single	TM212504	Swenson	62	Equipment	Equipment	TP2J1971	Miles
12/18/2020	Salt	17416	Swenson	5	Material	Material	TP2J1971	Ton
12/28/2020	International 7500 Single	TM212504	Swenson	71	Equipment	Equipment	TP2J1971	Miles
12/28/2020	Salt	17416	Swenson	7	Material	Material	TP2J1971	Ton
1/31/2021	International 7500 Single	TM212504	Swenson	79	Equipment	Equipment	TP2J1971	Miles
1/31/2021	Salt	17416	Swenson	8	Material	Material	TP2J1971	Ton
2/4/2021	International 7500 Single	TM212504	Swenson	100	Equipment	Equipment	TP2J1971	Miles
2/4/2021	Salt	17416	Swenson	8.1	Material	Material	TP2J1971	Ton

A metric to consider for the Swenson and Henke spreaders (and hereafter in this analysis) is tons of salt used per mile. This is calculated for all five days of the Swenson spreader in Table 6.3.

Table 6.3. Swenson spreader tons of salt used per mile.

Date	Spreader	Tons of Salt Used Per Mile
12/13/2020	Swenson	0.14
12/18/2020	Swenson	0.08
12/28/2020	Swenson	0.10
1/31/2021	Swenson	0.10
2/4/2021	Swenson	0.08

This metric for the Swenson spreader ranged from 0.08 to 0.14 ton of salt used per mile, or an average of 0.10 tons per mile.

6.1.2 Beyond Regain

A possible alternative methodology is to look to winter weather days where the roads were never lost (and did not need to be regained). This expanded view may yield direct comparison days.

To this end, we sought to examine all days where both the Swenson and Swenson comparable were each used on its own on comparable routes. We similarly sought to examine all such days with the

Henke and Henke comparable. With no loss of the road, the assumption is that the weather is somewhat lighter, making it more likely that only one piece of road maintenance equipment would be needed.

There were no such days for the Swenson and its comparable; the Swenson comparable was seldom used on its own. However, in the December 1 to April 15 time frame, there were four such days where the Henke and Henke comparable could be compared: December 18, January 14, January 16 and April 13. These are detailed in Table 6.4.

Table 6.4. Use of comparable equipment during the same storms.

Work Item Date	Resource Name	Resource ID	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project ID	Unit of Measure Name
12/18/2020	International 7600 Tandem Axle (Henke)	TM216561	40	Equipment	Equipment	TP2J1972	Miles
12/18/2020	Salt	17416	0.6	Material	Material	TP2J1972	Ton
12/18/2020	Plow Truck (Henke Comp)	TM208556	169	Equipment	Equipment	TP2J0713	Miles
12/18/2020	Salt	17416	5.8	Material	Material	TP2J0713	Ton
1/14/2021	International 7600 Tandem Axle (Henke)	TM216561	30	Equipment	Equipment	TP2J1972	Miles
1/14/2021	Salt	17416	4	Material	Material	TP2J1972	Ton
1/14/2021	Plow Truck (Henke Comp)	TM208556	226	Equipment	Equipment	TP2J0713	Miles
1/14/2021	Plow Truck (Henke Comp)	TM208556	242	Equipment	Equipment	TP2J0713	Miles
1/14/2021	Salt	17416	2	Material	Material	TP2J0713	Ton
1/14/2021	Salt	17416	6.8	Material	Material	TP2J0713	Ton
1/16/2021	International 7600 Tandem Axle (Henke)	TM216561	30	Equipment	Equipment	TP2J1972	Miles
1/16/2021	Salt	17416	6	Material	Material	TP2J1972	Ton
1/16/2021	Plow Truck (Henke Comp)	TM208556	55	Equipment	Equipment	TP2J0713	Miles
1/16/2021	Salt	17416	13	Material	Material	TP2J0713	Ton
4/13/2021	International 7600 Tandem Axle (Henke)	TM216561	45	Equipment	Equipment	TP2J1972	Miles
4/13/2021	Salt	17416	5	Material	Material	TP2J1972	Ton
4/13/2021	Plow Truck (Henke Comp)	TM208556	200	Equipment	Equipment	TP2J0713	Miles
4/13/2021	Salt	17416	9	Material	Material	TP2J0713	Ton

From this, it is possible to calculate and compare salt consumption rates (tons of salt used per lane mile) on all four days for both pieces of equipment, as shown in Table 6.5.

Table 6.5. Tons of salt used per mile for comparable equipment during the same storms.

Date	Equipment	Tons of salt per mile
12/18/2020	Henke	0.015
12/18/2020	Henke Comparable	0.034
1/14/2021	Henke	0.133
1/14/2021	Henke Comparable	0.019
1/16/2021	Henke	0.200
1/16/2021	Henke Comparable	0.236
4/13/2021	Henke	0.111
4/13/2021	Henke Comparable	0.045

On December 18 and January 16, the Henke comparable used more salt per mile than the Henke (2.3 times more and 1.2 times more, respectively). On January 14 and April 13, the Henke used more salt than the Henke comparable (7 times more and 2.5 times more, respectively). A clear pattern has not yet emerged.

In all cases, the Henke comparable was used over a longer stretch of road, ranging from 1.8 times as long on January 16, to almost 16 times as long on January 14.

6.2 PLOW EQUIPMENT—SURVEY

6.2.1 Henke Two-Way Reversible Plow

The two-way reversible plow was shown to have performance issues at the start of the winter, with the operator noting poor/unacceptable performance. By November 2020, adjustments were made that included a change in blade type and the addition of brackets to change the plow angle. From November 26 to the end of the winter in April 2021, the operator reported that the two-way reversible plow was not having mechanical issues and was performing very well/better than traditional equipment.

6.2.2 Henke True-Float Wing Plow

The operator did not have any mechanical issues with the true-float wing plow, as reported over four days in December 2020. It performed very well/better than traditional equipment.

6.2.3 Henke Underbody Scraper

The operator did have mechanical issues with the underbody scraper, as reported over four days in December 2020. On all occasions, it was “hard to control pressure.” However, the operator reported that the underbody scraper performed acceptably/as well as traditional equipment.

6.3 FURTHER DATA ANALYSIS

Apples-to-apples comparisons of the slurry spreaders with their traditional counterparts proved to be difficult. (District 2's operational priority was always clearing the road, not making operational decisions in service to this study.) However, the efforts did reveal some important findings.

First, the Swenson spreader was up to the task of regaining roads that were lost to snow and ice for certain storms. (The Henke spreader may have been able to as well, but this cannot be extracted from the data.) For these events, the Swenson ranged from 0.08 to 0.14 ton of salt per mile, or an average of 0.10 tons per mile.

Second, the Henke spreader could be compared against like equipment for nonroad-loss events, and it was found that the Henke spreader's use of salt was on par with traditional equipment: sometimes more, sometimes less, with no clear pattern emerging. In this case, absence of data prevents the drawing of any conclusion on this point about the Swenson spreader. (The Swenson comparable equipment was rarely used on its own.)

6.4 INTERVIEWS

At the conclusion of Winter 2, investigators interviewed several staff members involved with the operation, maintenance and supervision of the equipment under evaluation.

Interview subjects included three operators/mechanics, two supervisors and one superintendent.

6.4.1 Interview Questions

Each interview subject was asked the following questions, provided in advance, via telephone interview.

> *As part of a three-year MnDOT research project to evaluate new pieces of winter maintenance equipment, we are conducting short phone interviews in July with District 2 staff who used, maintained or managed this equipment in the winter 2020-2021 season.*
>
> *The pieces of equipment under evaluation are:*
>
> - *Henke slurry spreader*
> - *Swenson slurry spreader*
> - *Henke underbody scraper*
> - *Henke true-float wing plow*
> - *Henke two-way reversible plow*
>
> *1. Which pieces of equipment did you work with and in what capacity?*
>
> *2. Did each piece of equipment meet its requirements?*
>
> - *What worked well?*

- *What challenges did you have?*
- *Did the equipment work as well as, better than or worse than traditional equipment designed for the same purpose?*

3. If this equipment gets passed to another MnDOT district, what advice would you give someone with the same role as yours?

4. Based on your experience in winter 2019-2020 and winter 2020-2021:

- *Would you recommend MnDOT continue to use this equipment?*
- *Would you recommend MnDOT purchase more of this equipment?*

6.4.2 Summary of Interview Responses

Detailed survey responses are compiled in Appendix G to this report. Together with the Winter 2 data analysis, the interviews showed that Winter 2 represented an important step forward in this project. After a first winter with significant equipment downtime as District 2 staff learned about and overcame idiosyncrasies of the different pieces of equipment, much more of the time was spent in Winter 2 with the equipment out on the roads in and near Bemidji.

It also can be concluded from the interview comments that the Henke spreader appeared to be more reliable than the Swenson spreader. The latter tended to frequently require attention and report various error codes, and was down more frequently.

Beyond this, both slurry spreaders continued to have their challenges. Some could be addressed mechanically (by adjusting the hydraulics) or operationally (by keeping the systems clear of sand to avoid bridging). Other issues, such as how the boxes were high off the ground and required ramps for loading, or how the trucks assigned to these spreaders were effectively tied up all winter for this one function, could not be as easily addressed.

CHAPTER 7: WINTER 3

7.1 OVERVIEW

The study of the underbody scraper, true-float wing plow, and two-way reversible plow concluded with Winter 2.

For the third and final winter of this project, MnDOT had planned to move the Henke and Swenson slurry spreaders to a different district in the state. This was intended to provide insights into how well a different district's maintenance shop is able to set up, run and maintain the new equipment based on the benefit of experience from District 2 in Winters 1 and 2.

The scope from the original research plan was to use the equipment in MnDOT's Metro District for winter 2021-2022. However, due to COVID-related staffing shortages, the district was unable to participate in this study.

MnDOT District 1, which includes Duluth, was identified as an alternative site for Winter 3 of this study, with a plan to proceed one year later, in winter 2022-2023. Due to difficulty in setting up and using the equipment, the TAP elected not to proceed with data collection and analysis, and to terminate field investigation.

7.2 PERSPECTIVES

A discussion among District 1 staff during a project TAP meeting, followed by informal interviews with selected staff members, captured the type and extent of issues that maintenance staff faced. Note that while photos are of the Henke equipment, the issues described here apply both to the Henke and Swenson equipment. Recommendations are presented in Chapter 8.

7.2.1 Setup

- Even with support and guidance provided by District 2, specialized vendor parts needed to set up the equipment in District 1 were on backlog, with delivery times estimated at several months. This proved to be a significant barrier to getting the equipment running.
- Setting up wiring was challenging, and the product vendors offered limited documentation and live support.

7.2.2 Configuration and Functionality

- The V-shaped slurry box equipment sits in a curved-bottom box, bringing the top of the equipment high off the ground, about 3 to 4 feet higher than typical for traditional equipment. This is the upper limit of where a salt loader can reach. Figure 7.1 shows that when the boom of the loader is at its maximum height, the bucket of the loader cannot be fully dropped to easily unload salt, and operators had to "shake" or "rattle" the bucket to empty it.

- The high-centered V shape also makes the truck top-heavy, a possible safety concern.
- Sliding the slurry box onto an existing truck box also added to the weight of the system. Based on the truck's weight limits, MnDOT determined that the maximum amount of materials that could be loaded was about 3,500 pounds of salt or sand, or about 1.5 cubic yards. This limited the routes for which the slurry spreader could be used.
- It was also noted that the fit of the slurry box in the existing box was a tight fit.
- Salt bridging occurred where salt was loaded into the slurry box, as shown in Figure 7.2. Salt bridging is an issue with many different types of equipment, but the height at which it happens with this slurry box equipment presents both a maintenance challenge and a worker safety concern.
- Additional functionality issues included issues with pumping liquid from the side tanks to the front and communication with the AVL.

Figure 7.1. Loading a slurry spreader.

Figure 7.2. Salt bridging on a slurry spreader.

CHAPTER 8: RECOMMENDATIONS

Consensus recommendations for continued use and future purchase of the equipment studies in this research project are based on data collection and analysis from Winter 2 and interview responses collected over all years of this study.

8.1 UNDERBODY SCRAPER, TRUE-FLOAT WING PLOW AND TWO-WAY REVERSIBLE PLOW

MnDOT participants generally agreed that MnDOT **should continue to use** and consider buying more of the Henke underbody scraper and the Henke true-float wing plow.

These performed as expected and presented few issues. Initial adjustments were needed to exert proper pressure on the underbody scraper to assure good ground contact and snow removal.

MnDOT participants also generally agreed that MnDOT **should continue using** and consider buying more of the Henke two-way reversible plows.

The main Winter 1 performance issue was that the windshield frequently became covered in snow and required multiple maintenance activities per shift. This issue was solved in Winter 2 with a combination of plow blade replacement and reconfiguration of the hardware.

8.2 SLURRY BOX

MnDOT participants **did not reach consensus** on whether to continue to use or buy more of the Henke slurry box and the Swenson slurry box.

8.2.1 After Winter 1

Early in the study, operators generally believed the difficulties with the spreaders outweighed potential benefits. They described overly complicated systems that had possible safety concerns, frequently did not work and were not an improvement over current equipment. The advertised benefit of being able to spread slurry over multiple lanes was not realized.

After Winter 1, managers had a more positive view of the potential equipment while acknowledging poor performance and noting that a full winter of proper operation was necessary to judge the spreaders.

8.2.2 After Winters 2 and 3

By the end of the study, after Winter 2 and then planned-but-not-executed Winter 3, operators and staff were more in agreement. This equipment was not viewed as workable for MnDOT as tested for this study (equipment to be slid into existing box truck). Documented concerns included:

- Equipment height, causing loading and safety concerns
- Equipment weight, reducing how much material could be used

- Difficulty in setup
- Equipment not operating as expected
- Difficulty in obtaining required vendor parts, particularly after COVID
- Challenges in getting vendor support, particularly after COVID

8.2.3 Alternative Configuration and Application

Several MnDOT staff members suggested that the type of slurry box equipment investigated in this study might work better in a different configuration: attached directly to the truck chassis in place of the existing box. This would yield multiple benefits:

- A lower loading height for easier access by a bucket loader
- A lower height for accessing and clearing bridged salt
- A lower vehicle weight, allowing for the use of more salt

However, such a configuration would negate the desirable “slide-in, slide-out” feature that in part attracted MnDOT to this equipment.

Another possible change would be the use of this equipment in an urban setting, where shorter routes would require less material. This would make the capacity limits of this equipment less of an issue.

APPENDIX A:
EQUIPMENT FACT SHEETS

Slurry Spreader
(Henke)

HENKE HXC CARTRIDGE SPREADER

The ONLY V-BOX spreader with a removable conveyor cartridge, the easiest to maintain, most cost-effect solution available.

HENKE CHANGES THE GAME WITH OUR EXCLUSIVE REMOVABLE/REPLACEABLE CONVEYOR CARTRIDGE

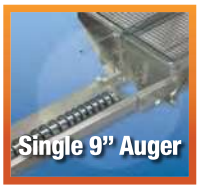
The replaceable cartridge in our innovative HXC Spreader is the easiest conveyor system on the market to service or repair.

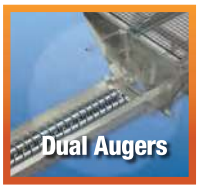
BEST ROI FOR V-BOX SPREADERS ON THE MARKET

The modular design of the removable cartridge reduces cost of ownership by providing longer service life of the main structure and hopper. Just replace a worn out cartridge conveyor vs. replacing the WHOLE unit.

FLEXIBILITY TO USE DIFFERENT CONVEYOR SYSTEMS IN 1 UNIT

Choose between a pintle chain, single 9" auger or dual augers. This gives you the control and versatility you need for use of specific materials and spreading applications.





SPECIFICATIONS
304 stainless steel construction
Available in 9' - 15' lengths
Fully replaceable conveyor system
Remote chain tensioning
Spinner deflectors are adjustable without tools
Unique telescoping discharge chute for even high-flow rates
Built-in hydraulic lockout systems on all auger spreaders
Spinner drive "shed" prevents clogging & fouling in the chute
Integrated safety features allow tool-free access for routine maintenance

WE GIVE YOU OPTIONS

- Spinners are available in poly or steel versions
- Adjustable Spinner Chutes are available with dumpover and tilt-up options
- Safety options- light bars, reflective tape
- Stationery or swing-up ladder
- Hopper vertical extension available for increased capactiy
- Top grates, rib mounted rollers, bumper guard, front and side spill shields

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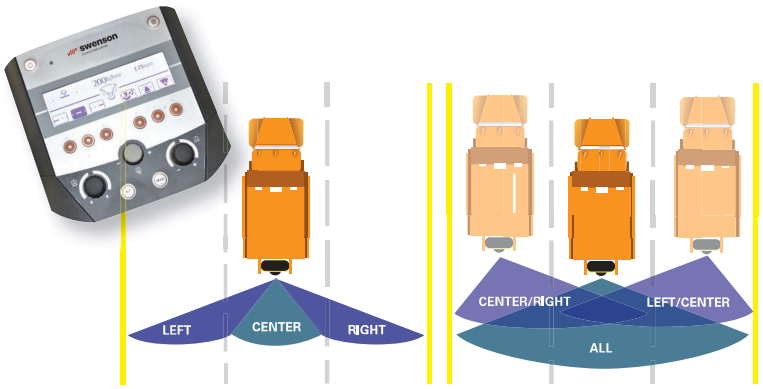
- Spread consistent amount of material despite changing truck speeds with automatic rate control on the advanced controller.
- Achieve desired output with patented dosage gate that accurately meters granular material.
- Create the optimal pre-wet ratio with a 26 gallon per minute pump that can output 65 gallons per cubic yard of salt.
- Throughly mix pre-wet liquid and granular material on the concave mixing disc with fluted hub.

Highlights

- Designed to fit trucks classes 6+ (20,000+ lbs GVW)
- Sensored hydraulic motors allow for accurate material output and spread patterns
- Dual augers improve output while preventing material bridging
- Corrosion and clog resistant poly chute for longer life and better performance
- CAN-bus controller is easy to operate allowing the driver to select 1 to 3 lanes of coverage with 6 different combinations with the touch of a button



Specifications

Size	10, 12, or 14 ft. lengths
Capacity	6.7, 8.1, or 11.2 cu yds.
Drive	Hydraulic
Conveyor	Chain or dual auger
Cab – Axle Length	10’ 84” CA 12’ 108” CT 14’ 120” CT
Weight Empty	Chain: 3,840, 4,300, or 4,840 lbs. Dual Auger: 4,010, 4,470, or 5,150 lbs.
Construction	12 gauge stainless steel
Spread Width	3 lanes with 6 different lane combinations
Safety Features	Auger safety interlock, spinner interlock
Warranty	1 year, 10 years on the poly idler
Accessories	Ladder, work lights, cab shields, tarp kit, vibrator

UNDER BODY SCRAPERS

ADD HARDCORE SCRAPING ACTION TO YOUR FLEET

A GREAT ALL-SEASON WORKHORSE – REMOVES HARD PACKED SNOW AND ICE; GREAT FOR GRAVEL & SHOULDER ROAD MAINTENANCE

Built strong, built to last, Henke's Under Body Scrapers will provide years of service with minimal maintenance. A 1" heat-treated carbon steel moldboard is available in two models – Power Reversing or Fixed Angle.

Henke Model	Lengths (ft)	Heights (in)	Actuating Cylinders	Reversing Cylinders	Mounting Options
Power Reversing	10, 11, 12	15.5, 17, 20	Two 3" bore with 2" nitrited rods	Two 4" bore with 2" nitrited rods	Four heavy duty legs, or Two heavy duty plates
Fixed Angle	10, 11, 12	15.5, 20	One or two 3" bore with 2" nitrited rods	N/A	Three or four heavy duty legs

POWER REVERSING UBS:

- Solid 2.5" hinge shaft and four (4) hinge-anchor points
- Hangerboard circle clamps 102 sq-in, with poly wear pads
- One piece circle, 1" thick solid steel with 5" center pin
- Crossover relief valve for reversing cylinders
- Down pressure relief valve for actuating cylinders
- ½" x 6" SAE 1084 high carbon steel cutting edge (standard)

HENKE'S UNDER BODY SCRAPERS SUPPLY ENOUGH FORCE TO REMOVE HARD PACKED SNOW AND ICE WITHOUT DAMAGING THE ROAD SURFACE

SEVERAL OPTIONS OF CUTTING EDGES AND WEAR GUARDS ARE AVAILABLE, PLUS THESE GREAT ADD-ONS:

- 12" bolt-on extensions adds extra swath (20" moldboard only)
- Manual reverse option available
- Remote grease line for 5" center pin
- Spiral greased grove hinged shaft (makes shaft removal easier)

BACKED WITH FIRST RATE SERVICE AND OUTSTANDING WARRANTY PROTECTION

888.682.9010
henkemfg.com

HENKE®
AN ALAMO GROUP COMPANY

TRUE FLOAT WINGS

POSTLESS PATROL WING ELIMINATES CHATTER

HENKE®

henkemfg.com

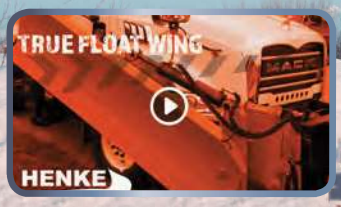
Henke's parallel lift link doesn't bind up like traditional "slide style" wings. The unique true float, non-trailing design reduces wing chatter and increases effectiveness at cutting through packed snow and ice.

- The MOST vertical float of all postless wings
- More durable than traditional slide style wings
- Available in full trip, trip edge, and non-trip models
- Truck hitch compatibility (front mount only):
  Non tilt, Manual tilt or Power tilt
- Multiple mounting locations:
  - Front-mount
  - Mid-mount with rear attachment mounted forward of tires, behind tires, or between tandems
- Moldboard heights:
  - Tapered (29" intake, 36" discharge)
  - Straight (31")

Mounting Locations	Benching Heights (in)	Trips	Lifts	Pushbeams
Front	14.5	Full Trip Trip Edge* Non Trip	Front** Rear	Spring Cushioned Single Hydraulic Adjustable Single Spring Cushioned Dual
Mid	12.5	Full Trip Trip Edge* Non Trip	Front** Rear	Spring Cushioned Single Hydraulic Adjustable Single Spring Cushioned Dual

*Add 5" to moldboard heights **Front lift is available with single pushbeam only

The ONLY TRUE-FLOAT, NON-TRAILING WING ON THE MARKET



Learn more about it in our video on YouTube.

AVAILABLE IN BOTH FRONT AND REAR LIFT

Front Lift Single Pushbeam
(shown with spring cushioned pushbeam)

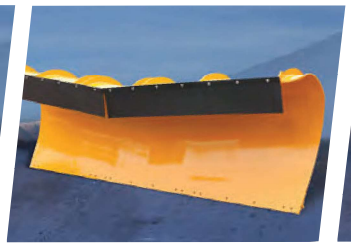
Rear Lift Single Pushbeam
(shown with hydraulic adjustable pushbeam)

Rear Lift Dual Pushbeam
(shown with spring cushioned pushbeam)

Two-Way Reversible Plow (Henke)

With **over 100 years of experience making snow plows**, Henke has developed a standardized plow line that gives you the flexibility to build the plow you need. By combining different options for height, width, profile, pushframe, trip, hitch, and running gear, you can easily create a highly customized "standard" plow.

- Henke's moldboards with chain style level lift (or optional sliding level lift) **keeps the plow level** while our **integral snow shield prevents snow from blowing over the top** of the moldboard.
- **Henke's Grade 50 Steel is 39% stronger** than A-36 Steel.
- Henke's **Road Safe pushframe provides maximum strength** and prevents bottom angle bending. **Cylinders are located above the pushframe for protection** against road debris and ease of maintenance.



From the urban core to the steepest mountain passes, Henke's Road Warrior Plow will conquer your toughest challenges

	SELECT:	STYLES	MATERIALS	LENGTHS (ft)	HEIGHTS
1	MOLDBOARDS	Straight Expressway Funnel/One-Way	Grade 50 Steel 304 Stainless Poly-Lined Steel	10 11 12	Varies by Style
		STYLES	**LENGTHS**	**NOTES**	
2	PUSHFRAMES	Road Safe* Tube Table** Parallel Lift**	Standard: 119.5" 6 Ribs Heavy Duty: 119.5", 8 Ribs	*Road Safe frame prevents bottom angle bending. Cylinders above frame. **Not available with all moldboard shapes and sizes.	
		STYLES	**DESCRIPTION**		
3	TRIPS (Not all trips are available with every moldboard size and pushframe selection)	ECT EST EXT SLT SSTE	External Compression - Spring Enclosed Springs - EST (Single) or DEST (Dual) Extension Spring - 6 Springs or 8 Springs Slotted Trip - Spring-in-Spring Square Spring Trip Edge		
4	LIFT SYSTEMS	Standard Lift: 2 Chain level lift design Sliding Level Lift: Improved Performance as plow is angled Parallel Lift: True level lifting as plow is angled and raised or lowered			
5	OPTIONS: *Many options are available. A few common ones are listed.*	Various Wear Components; Various Running Gear (Runner Shoes, Steel Wheels, Pneumatic Running Gear, Mushroom Shoes - standard or spring loaded) Single or Dual Mouse Ears; Mailbox Cut; Jack Stand; Rod Markers			

APPENDIX B:
WINTER 1 SURVEY

MnDOT Project "Evaluation of Slurry Box, Underbody Scraper, and Two-Way Reversible Plow"

Telephone Interview Questions for MnDOT Staff
Prepared by CTC & Associates for MnDOT Office of Maintenance
March 20, 2020

INTRODUCTION

Minnesota DOT's Maintenance Office is evaluating five pieces of winter maintenance equipment this winter and next winter:

- Henke Slurry Spreader
- Swenson Slurry Spreader
- Henke Underbody Scraper
- Henke True Float Wing
- Henke Two-Way Reversible Plow

Fact sheets for these pieces appear at the end of this PDF.

For the first winter (this current season), MnDOT is seeking input from maintenance staff about this equipment through this survey. For the second year of service, MnDOT will be collecting and analyzing field data.

Your answers will help the Maintenance Office understand the value of this equipment. It will also help set the data collection plan for next year.

Please review this survey to familiarize yourself with these questions but do not complete it. We will be scheduling and conducting phone interviews at the end of the winter and will cover these questions during those discussions.

1. Please provide your contact information

    - Name
    - Job Title
    - Location of primary office
    - Phone
    - Email

2. In the table below, please mark the appropriate cells with an "x" to indicate which pieces equipment you worked with and how.

	Initial Installation and Setup	Drove or Operated in the Field	Serviced or Maintained in the Shop	Managed Operators, Mechanic, or Facilities
Henke Slurry Spreader				
Swenson Slurry Spreader				
Henke Underbody Scraper				
Henke True Float Wing				
Henke Two-Way Reversible Plow				

For all remaining questions, please ignore any equipment you didn't work with or questions that don't apply to your role at MnDOT.

INSTALLATION AND SETUP

3. Please approximate how many hours of total labor time (including yourself and other staff) were required for **initial installation and setup**:

	Total hours	(check if N/A)
Henke Slurry Spreader		
Swenson Slurry Spreader		
Henke Underbody Scraper		
Henke True Float Wing		
Henke Two-Way Reversible Plow		

4. On a scale of 1-5, how **difficult** was initial installation and setup

	1 Very difficult	2 Somewhat difficult	3 Typical for new equipment	4 Somewhat easy	5 Very easy	(N/A)
Henke Slurry Spreader						
Swenson Slurry Spreader						
Henke Underbody Scraper						
Henke True Float Wing						
Henke Two-Way Reversible Plow						

5. Please describe any **technical difficulties** you encountered during initial installation and setup

	Comment	(N/A)
Henke Slurry Spreader		
Swenson Slurry Spreader		
Henke Underbody Scraper		
Henke True Float Wing		
Henke Two-Way Reversible Plow		

6. Please describe any **safety** concerns or events you encountered during initial installation and setup.

	Comment	(N/A)
Henke Slurry Spreader		
Swenson Slurry Spreader		
Henke Underbody Scraper		
Henke True Float Wing		
Henke Two-Way Reversible Plow		

7. On a scale of 1-5, how **helpful** was the vendor in providing support during initial installation and setup?

	1 Very unhelpful	2 Somewhat unhelpful	3 Typical for new equipment	4 Helpful	5 Very helpful	(N/A)
Henke Slurry Spreader						
Swenson Slurry Spreader						
Henke Underbody Scraper						
Henke True Float Wing						
Henke Two-Way Reversible Plow						

EQUIPMENT MAINTENANCE AND OPERATION

8. Mechanics/shop supervisors: For a typical storm, how much total labor (including yourself and other staff) were required for **shop maintenance**?

	Before storm (hours)	After storm (hours)	(N/A)
Henke Slurry Spreader			
Swenson Slurry Spreader			
Henke Underbody Scraper			
Henke True Float Wing			
Henke Two-Way Reversible Plow			

9. Mechanics: Please describe any **safety** concerns or events you encountered during regular shop maintenance.

	Comment	(N/A)
Henke Slurry Spreader		
Swenson Slurry Spreader		
Henke Underbody Scraper		
Henke True Float Wing		
Henke Two-Way Reversible Plow		

10. Drivers: On a scale of 1-5, how **difficult** was operation in the field?

	1 Very difficult	2 Somewhat difficult	3 Typical	4 Somewhat easy	5 Very easy	(N/A)
Henke Slurry Spreader						
Swenson Slurry Spreader						
Henke Underbody Scraper						
Henke True Float Wing						
Henke Two-Way Reversible Plow						

11. Drivers: During snow and ice operations, how much equipment **maintenance/adjustment was required (while on the road)**? This includes routine attention to the equipment and minor troubleshooting that did not require returning to the shop.

	Average maintenance activities per shift	Time required for maintenance per shift	Type of maintenance or technical difficulties	(N/A)
Henke Slurry Spreader				
Swenson Slurry Spreader				
Henke Underbody Scraper				
Henke True Float Wing				
Henke Two-Way Reversible Plow				
N/A				

12. Drivers: During snow and ice operations, please describe any **safety** concerns or events you encountered while operating or conducting maintenance/troubleshooting on the road.

	Comment	(N/A)
Henke Slurry Spreader		
Swenson Slurry Spreader		
Henke Underbody Scraper		
Henke True Float Wing		
Henke Two-Way Reversible Plow		

PERFORMANCE

13. Please describe how well you think this equipment worked. You may frame your answer in terms of total effectiveness, or how it worked compared to equipment traditionally used for the same purpose. (effectiveness, time savings, etc.)

	Comment	(N/A)
Henke Slurry Spreader		
Swenson Slurry Spreader		
Henke Underbody Scraper		
Henke True Float Wing		
Henke Two-Way Reversible Plow		

14. Please supply your thoughts about MnDOT's future use of this equipment.

	MnDOT should continue to use this equipment	MnDOT should consider acquiring more of this equipment
Henke Slurry Spreader	□ Yes □ No □ N/A or No Opinion	□ Yes □ No □ N/A or No Opinion
Swenson Slurry Spreader	□ Yes □ No □ N/A or No Opinion	□ Yes □ No □ N/A or No Opinion
Henke Underbody Scraper	□ Yes □ No □ N/A or No Opinion	□ Yes □ No □ N/A or No Opinion
Henke True Float Wing	□ Yes □ No □ N/A or No Opinion	□ Yes □ No □ N/A or No Opinion
Henke Two-Way Reversible Plow	□ Yes □ No □ N/A or No Opinion	□ Yes □ No □ N/A or No Opinion

DATA COLLECTION FOR WINTER OF 2020-2021

MnDOT wishes to collect data next winter to understand the effectiveness of this equipment with safety, the environment, and effectiveness/performance. Some additional metrics have been identified as possibilities:

Safety:

- Injuries installing / maintaining equipment (count)
- Crashes on road sections maintained with equipment (count)

Environment (for slurry spreaders):

- Bounce and Scatter (estimation)
- Salt Used (tons)
- Residual Salt on Road (estimation)

Performance:

- Accuracy (gallons or pounds per mile) (for slurry spreaders)
- Time to bare lane
- Passes to bare lane

15. Please provide your thoughts on **how these metrics can be measured and recorded**. What other metrics can be readily obtained in the field or from existing systems (MDSS, logbooks, MnDOT crash records)?

	Comment	(N/A)
Henke Slurry Spreader		
Swenson Slurry Spreader		
Henke Underbody Scraper		
Henke True Float Wing		
Henke Two-Way Reversible Plow		

16. What are the most efficient and effective ways to **compare this equipment with similarly-tasked existing equipment** (trucks with traditional slurry tanks; traditional plows) on parallel/comparable routes?

	Comment	(N/A)
Henke Slurry Spreader		
Swenson Slurry Spreader		
Henke Underbody Scraper		
Henke True Float Wing		
Henke Two-Way Reversible Plow		

APPENDIX C:
WINTER 1 DETAILED SURVEY RESULTS

Interview Subject Information

1. All survey participants were based in Bemidji in MnDOT District 2.

Operators and Mechanics (A-D)

A. Heavy Equipment Field Mechanic
B. Transportation Generalist
C. Transportation Generalist
D. Transportation Generalist

Supervisors (E-F)

E. Transportation Operations Supervisor II
F. Fleet Manager/Shop Supervisor

Superintendent (G)

G. Maintenance Superintendent

For convenience, respondents are referred to by letters A-G above throughout this summary.

2. Interviewees worked with the following pieces of equipment in the capacity indicated.

Equipment	Initial Installation and Setup	Drove or Operated in the Field	Serviced or Maintained in the Shop	Managed Operators, Mechanic, or Facilities
Henke Slurry Spreader	A, B, F	B	A	E, F, G
Swenson Slurry Spreader	A, B, F	B, C	A	E, F, G
Henke Underbody Scraper	A, F	C, D	A	E, F
Henke True Float Wing	F	D		E, F
Henke Two-Way Reversible Plow	A, F	D	A	E, F

Installation and Setup

3. Interviewees estimated hours of total labor time (including themselves and other staff) required for **initial installation and setup**:

Equipment	Total hours	Comment
Henke Slurry Spreader	A. 20 B. 8 for calibration	F. While this was installed by the vendor, some set up was required. (See question 5)
Swenson Slurry Spreader	A. 20 B. 30; took part in programming and calibration; there were a lot of problems getting actual output to match settings (issues between auger and belt system)	A. Incorrect preinstallation (See question 5)
Henke Underbody Scraper		A, F. Came preinstalled
Henke True Float Wing		A, F. Came preinstalled
Henke Two-Way Reversible Plow	A. 15 hours to remanufacture/retrofit what the vendor suppled	A, F. Came preinstalled

4. Interviewees indicated on a scale of 1-5 how **difficult** initial installation and setup was. More answers were provided for the slurry spreaders, with the Swenson slurry spreader noted as more difficult to set up. Managers generally viewed this equipment as easier to set up than operators and drivers.

Equipment	1 Very difficult	2 Somewhat difficult	3 Typical for new equipment	4 Somewhat easy	5 Very easy	Average
Henke Slurry Spreader	A		B, F ("3.5")		G	3.1
Swenson Slurry Spreader	A, B	F		G		2
Henke Underbody Scraper						
Henke True Float Wing						
Henke Two-Way Reversible Plow	A		F			2

5. Interviewees describe **technical difficulties** they encountered during initial installation and setup

Equipment	Comment
Henke Slurry Spreader	A. Henke and Swenson spreaders were both difficult, because our trucks have round boxes, and they are both made for a square box. They also sat a lot higher on our trucks than trucks that would be intended for these spreaders. (Compared to normal MnDOT equipment, a simple two pin and two hydraulic line configuration). In addition, the hydraulic flow in the truck was insufficient and had to be changed. B. By the end of the winter it still wasn't quite right. F. Because this worked off the Force America controller, let setup work was required than for the Swenson (see next item). Had to add a hydraulic circuit, which required programming. Also had one bad sensor/improper wiring that had to be fixed. G. It took an extra six weeks to get the right brackets. Once that was figured out, it was plug-and-play and works with MnDOT controllers. Very easy compared with Swenson.
Swenson Slurry Spreader	A. (See above comment.) Moreover, for the Swenson, one of the augers was put in backward at the factory. B. DICKEY-john powered by Force America, but Swenson wouldn't communicate with it, so a third system needed to be added. Couldn't pull data off of it like we could with other trucks. It was a nightmare; very disappointed with this system. F. Swenson comes with its own system, so MnDOT had to bypass the Force America standard controller. Had to do a fair amount of programming work and trial-and-error hydraulics matching. Flow and capacity were issues. Even after the backward installation was fixed, it still would jam occasionally, and it would have to be run in reverse to clear it. There seemed to be a lot of weight at the bottom of the vee. Supposed to sand 1/2, 1, 2 or 3 lanes; this added to its complexity. G. Installed fairly easily into box, but there were a lot of issues getting it to work. Sounded like there wasn't the right hydraulic flow to unit (6-7 gallons/minute provided, but 20+ needed). It took all winter to figure it out. "I think it's a great system, but there are some obstacles before we can truly evaluate it."
Henke Underbody Scraper	A. Had to move where the stops were. They were rubbing on the back of the truck. If we hadn't moved this, it would have torn the hydraulic hoses underneath.
Henke True Float Wing	
Henke Two-Way Reversible Plow	A. The way it came preconfigured, when it was hooked up with the blade in the air, the trailing edge dragged on the ground. It had to be reconfigured. F. Snow flying over the top of the plow might have been an issue related to installation. Many drivers tried to address this.

6. Interviewees did not encounter any **safety** concerns or events initial installation and setup. There were safety concerns, however, related to maintenance (question 9) and operation (question 12).

7. Interviewees indicated on a scale of 1-5 how **helpful** vendor were in providing support during initial installation and setup?

Equipment	1 Very unhelpful	2 Somewhat unhelpful	3 Typical for new equipment	4 Helpful	5 Very helpful	Average
Henke Slurry Spreader		A		F		3
Swenson Slurry Spreader	B	A	B ("Initially a 1, later a 3")		F	2
Henke Underbody Scraper		A (2.5)		F		3.2
Henke True Float Wing				F		4
Henke Two-Way Reversible Plow	A	F				1.5

Equipment	Comment
Henke Slurry Spreader	A. We had to call all of the vendors eventually. None came with the equipment, and we had to ask them to come and help (or "come get the equipment.") B. It was the Force America rep who helped with this one.
Swenson Slurry Spreader	B. The rep was very helpful once they figured out that they made a mistake in installation. Ended up sending a group three times. However, "I had to be there helping the whole time to provide help and supply tools."
Henke Underbody Scraper	A. We had to call the vendor; they gave suggestions to try, which worked.
Henke True Float Wing	
Henke Two-Way Reversible Plow	A. The vendor just kept sending us different things to try; they never did come to help us.

Maintenance and Operation

8. Interviewees (mechanics/shop supervisors only) indicated, for a typical storm, how much total labor was required for **shop maintenance**?

Equipment	Before storm (hours)	After storm (hours)	Comment
Henke Slurry Spreader	A. 2 F. 0.5	A. 2 F. 0.5	A. For all of the equipment, preparation and cleanup was pretty typical once it was working.
Swenson Slurry Spreader	A. 2 F. 2 to 3	A. 2 F. 2 to 3	
Henke Underbody Scraper	A. 2 F. 0.25	A. 2 F. 0.25	
Henke True Float Wing	F. 0.25	F. 0.25	
Henke Two-Way Reversible Plow	A. 2 F. 0.25	A. 2 F. 0.25	

9. Interviewees (mechanics) described **safety** concerns or events they encountered during regular shop maintenance.

Equipment	Comment
Henke Slurry Spreader	A. For both Henke and Swenson spreaders, workers need to go way up in the air (eight feet) on a ladder to do any work on these. Comparatively, they can access a regular spreader (chest height) from the ground. F. Negative: Climbing up on machine to work on it. Positive: Don't have to tilt box, things slide out. For the most part a little safer. For all equipment, not a lot of safety concerns compared to any other equipment
Swenson Slurry Spreader	A. It was necessary to use the loading ramp to load for the Swenson. We have one, but this isn't used to load any other trucks.
Henke Underbody Scraper	A. Accessible, typical of comparable equipment.
Henke True Float Wing	A. Accessible, typical of comparable equipment.
Henke Two-Way Reversible Plow	A. Accessible, typical of comparable equipment.

10. Drivers: On a scale of 1-5, how **difficult** was operation in the field?

Equipment	1 Very difficult	2 Somewhat difficult	3 Typical	4 Somewhat easy	5 Very easy	Average
Henke Slurry Spreader			B	E, F		3.7
Swenson Slurry Spreader	B, C	E	F			1.8
Henke Underbody Scraper					D, E, F	5
Henke True Float Wing					D, E, F	5
Henke Two-Way Reversible Plow	D		E	B	F	3.3

11. Interviewees (drivers) indicated how much equipment **maintenance/adjustment was required (while on the road)** during snow and ice operations. This includes routine attention to the equipment and minor troubleshooting that did not require returning to the shop.

Equipment	Average maintenance activities per shift	Time required for maintenance per shift	Type of maintenance or technical difficulties
Henke Slurry Spreader	B. 3-4 times, or maybe more.	B. 5 minutes each time. F. 30-45 minutes per shift	B. Troubleshooting it to get it to work. Could get salt to come out, but couldn't always get the brine to work with the pumps. Tried to prime it, etc., going through the checklist. Also, as installed, there was no dump option at the end of the event. Had to run it out as if you were spreading it. Dumping was an option, but by the time that part arrived, never had a chance to use it. C. Speed sensors gave a lot of trouble ("code 22"). They replaced them a few times. Sometimes brine wouldn't come on. Sometime augers wouldn't come on. Sometimes they'd come on and then turn off. F. The more they used this equipment, the less maintenance they did. Wanted to be sure to get material onto the road and not in the ditch.
Swenson Slurry Spreader	B. 3-4 times, or maybe more.	B. 5 minutes each time. F. 2-3 hours per shift	B. Again, troubleshooting. Getting salt to come out, looking in the manual based on the code that was displaying. Very vague on how to troubleshoot. Then it would suddenly work. Could only do one lane at a time. Spent a lot of time looking for the "sweet spot." Designed to do 3 lanes at a time, but since it went through DICKEY-john, then Force America, then Swenson, at each step the power lowered, so it didn't work as designed. Code 22 came up a lot. F. Lots of trouble with auger sticking. Ate up a lot of time, as did trying to figure out codes. There were sensor issues and electronics issues. For both this and the Henke slurry spreader, a camera would have done a lot of good.

Henke Underbody Scraper			D. Nothing out of the ordinary. E. Very few issues.
Henke True Float Wing			D. Nothing out of the ordinary. E. Very few issues.
Henke Two-Way Reversible Plow	B. 3 times F. 1 per shift	B. 30-45 minutes each time	B. Setting adjustments, not maintenance. Had to wait for someone to help make adjustment. D. Extreme amount of material on windshield. F. Snow coming over top of blade. Adjusting angle.

12. Interviewees (drivers) described **safety** concerns or events they encountered while operating or conducting maintenance/troubleshooting on the road during snow and ice operations.

Equipment	Comment
Henke Slurry Spreader	A. The Henke and Swenson slurry spreaders raise the center of gravity of the truck by three feet. If it goes in a ditch with a box in the back, it's not going to be good. B. If MnDOT goes with this, we are going backward in terms of safety. There is a little ladder to get up to see how material is in the box. (Before you could just look.) As a driver, I want to be loaded fully. So I have to climb up on the box. That's not safe. For a normal person, that's a really high step to get up on the ladder. 6-8 feet. There's no safety hold once you're up there. To store in the summer, there are legs. But those stay on in the winter. If a car rear-ended the trucks and hit those legs, it would be bad. (Even if you took off the legs, the brackets would still be there.) Legs and spreader stick out another 4 feet beyond what you can see. E. Need to go up on the ramp to load, which was a concern due to the height and at times the ramp would ice up. (Same concern for Swenson.)
Swenson Slurry Spreader	B. Same issue as Henke: Legs stick out the back, the ladder is too high. They're really the same. C. The way it's mounted and fastened with load binders with a few pegs in back, we had to shim it up. The whole thing would shift back and forth and side to side. And it's already top heavy, so we worried about going over—particularly with a quick move to avoid traffic. Guess that the weight of material and is grossly overweight for the specs on the truck. To load, need to use a loading ramp, so sometimes you're driving a loader up icy ramp. The spreader won't accepting anything into grate larger than a tennis ball. Need to stand on edge of box to clear it off to complete loading. Standing on the edge of the box to clear a blockage is a safety concern. Spinner never turns off even when the auger is off. That could be a safety issue. E. Need to go up on the ramp to load, which was a concern due to the height and at times the ramp would ice up. (Same concern for Henke.) Also can't see as well behind the spreader, such as other motorist or how much material is being applied.

	G. An operator on the Swenson noted that when they go to empty that, have to lift the chute and spinner mechanism, and it's quite heavy. Could be a workplace safety issue. Also might have a pinch point when lifting - could sever a finger there. Also, the auger hits a square chute—for emptying, need to get the spinner out of the way to auger straight on the ground.
Henke Underbody Scraper	A. There is a possibility of spilling on highway if the hoses had been allowed to rip
Henke True Float Wing	
Henke Two-Way Reversible Plow	B. Snow kicked back over plow - my windshield would be covered instantly. This happened when there was not even an inch of snow on the road. Top speed was 30 mph or else I couldn't see. Shouldn't have to get out to adjust plow during traffic. Never got it dialed in right. D. Unacceptable amount of material over the top.

Performance

13. Interviewees described how well they thought this equipment worked. They were instructed to frame their answers in terms of total effectiveness, or how the equipment worked compared to equipment traditionally used for the same purpose (effectiveness, time savings, etc.).

Equipment	Comment
Henke Slurry Spreader	A. The Henke and Swenson spreaders didn't work from the get go; they are too complicated. They might get halfway through a route before quitting Something would leak or quit, or ice would get in the wrong spot. There was no "manual" mode to fall back to. Believe it only covered one lane. Both Henke and Swenson: Tended to plug up; the fix to increase hydraulic flow made it harder to regulate material spread rate. B. Overall a better system than the Swenson. If something messes up, it's the operator rather than the computer (that's the problem with the Swenson). Henke connected directly to Force America and it worked (bypasses Dicky John). This is worse than what we have now. Can see the potential in certain areas, if these worked as operated and could throw this across three lanes. E. Should be fine once they have more experience with it. Seems easier to operate than the Swenson. F. Once we got it to operate correctly (all adjustments made), I wish we had another season to try it. Didn't get enough time. Liked a lot of the ideas behind it. Has promise. Better to prove it before changing to cities. If we go through battle again, won't get a good test. Sitting in their shed. If they do this to all their truck, have to do the hydraulic circuits, etc. Henke came up here and explained how it worked to the operators. Wish they had come up earlier. It is important to get MDSS and AVL working with both slurry systems.

	G. Had pretty decent success. Didn't get back to us and up-and-running until mid-Feb. Short window to run it. Operational it had minimal issues. Normal training of employees, but minimal issues. Were able to connect with our controller.
Swenson Slurry Spreader	A. Was supposed to put out enough material for three lanes, and didn't quite cover two. Both Henke and Swenson: Tended to plug up; the fix to increase hydraulic flow made it harder to regulate material spread rate. B. Horrible. Never worked right. Even in a perfect world, it doesn't work in our area. It doesn't pinpoint where the material goes. This scatters out. On the crown of the road, we put the liquid in the crown and let it run down. Just not ideal in our area of the state (2-lane roads): When a car drives over it, it puts it in the ditch where it won't do any good. C. Putting out 20 gal/lane mile makes mud. Need to spin quickly to get material off the spinner. Flings it too far on a cold day with lake-type ice. Broadcasts it too far; it doesn't get concentrated in one area so it can work. (With a tailgate spinner, can slough it off to get it working.) This isn't right for our conditions. This slurry machine isn't for us. It was terrible. Maybe a good fertilizer spreader. Also the spinner is in the middle, so you can't see it coming off. In a tailgate spreader, it's on the side. In theory can do three lanes at once, but you're just dumping salt, and you're not putting it exactly where you want—you're just broadcasting it everywhere. Couldn't use pretreated salt with brine and beet juice because it caused bridging; had to use untreated salt. E. Old way of applying material with salt and brine was much quicker. F. Performance was terrible. Don't attribute to piece of equipment, but instead to getting this to work with our system. In the Swenson, had to use their controller—the issue is that it doesn't connect with MDSS/AVL portion, and eliminated Force America and tracking. By the end of the winter, got it working - the spreader functionality, but not the controller. Collecting data will be an obstacle. Swenson says they think they can get it working. There are other priorities. It is important to get MDSS and AVL working with both slurry systems. "Swenson may shine in the end."
Henke Underbody Scraper	A. Didn't hear anything positive or negative; it worked. C. Better clearance. D. Worked very well. E. If they had more time with equipment, then I believe they would be at least as well received as the traditional equipment.
Henke True Float Wing	A. Didn't hear anything positive or negative; it worked. C. Good control. D. Worked very well. E. If they had more time with equipment, then I believe they would be at least as well received as the traditional equipment.
Henke Two-Way Reversible Plow	A. As a result of being light, it didn't plow as well. The weight of the truck and plow is all there is to get pressure against the ground.

	B. Not good at all. Poor safety throwing snow in your windshield to where the wipers quit working. It's coming over the guard and around the end of the blade. Traditional blades wouldn't do that except for certain events. The Henke did this for less than an inch of snow. There are three settings: titled forward, middle, or titled back. Was frequently changing positions on trucks, and none of them worked. C. Very poor. D. Junk. E. Prefer poly (traditional) plows to steel plows (Henke). Poly plows are more expensive as well. F. Flying snow during operation.

14. Interviewees supplied their thoughts about MnDOT's future use of this equipment, whether MnDOT should continue to use the equipment (yes/no), and whether MnDOT should acquire more of the same equipment (yes/no).

Equipment	MnDOT should continue to use this equipment
Henke Slurry Spreader	**2 Yes** (E, F) **2 No** (A, B) G. I believe the technology is what we need. I'd like to see it work for a whole season before making this determination.
Swenson Slurry Spreader	**2 Yes** (F, G) **3 No** (A, B, C) C. Let someone try in the Twin Cities. A few degrees might make a big difference. E. I think they should let other areas try this equipment to see if they have the same experiences. G. Yes, let's use the one we currently have in full operation.
Henke Underbody Scraper	**4 Yes** (A, D, E, F) **0 No**
Henke True Float Wing	**4 Yes** (A, D, E, F) **0 No**
Henke Two-Way Reversible Plow	**1 Yes** (F) **3 No** (A, B, D) F. Yes, to see if we can work things out.

Equipment	MnDOT should consider acquiring more of this equipment
Henke Slurry Spreader	**2 Yes** (E, G) **2 No** (A, B) A. However, if you would put it in the correct truck from the get go, then possibly more interested B. Absolutely not E. Yes, once they have more experience with equipment F. Jury is still out. A lot of promise/possibility if we get them working correctly. G. Would be nice to test 4 to 5 of these. This is set up for our systems.

Swenson Slurry Spreader	**0 Yes** **3 No** (A, B, C) A. However, if you would put it in the correct truck from the get go, then possibly more interested B. Absolutely not C. I don't see the purpose. They're more expensive and they don't work. E. Not until they get the bugs worked out. F. Jury is still out. A lot of promise/possibility if we get them working correctly. G. Wouldn't buy another one until this one is fully operational.
Henke Underbody Scraper	**4 Yes** (A, D, E, F) **0 No** F. Jury is still out, but from what I've seen, yes.
Henke True Float Wing	**3 Yes** (D, E, F) **1 No** (A) A. No because it's lighter and won't hold up in the long run.
Henke Two-Way Reversible Plow	**0 Yes** **5 No** (A, B, D, E, F) B. Perhaps if they made modifications, but if they don't work, it's pointless. Like the way it's a plain blade (2-way) rather than with a high-sitting snow release. Like that it's compact for maneuverability. F. Not at this time

Data Collection for Winter 2

It was explained to interviewees that MnDOT wishes to collect data in winter 2020-2021 to understand the effectiveness of this equipment with safety, the environment, and effectiveness/performance. Some additional metrics have been identified as possibilities:

Safety:

- Injuries installing / maintaining equipment (count)
- Crashes on road sections maintained with equipment (count)

Environment (for slurry spreaders):

- Bounce and Scatter (estimation)
- Salt Used (tons)
- Residual Salt on Road (estimation)

Performance:

- Accuracy (gallons or pounds per mile) (for slurry spreaders)
- Time to bare lane
- Passes to bare lane

15. and **16.** Interviewees provided thoughts on **how these metrics can be measured and recorded**. They were asked to consider other metrics that can be readily obtained in the field or from existing systems (MDSS, logbooks, MnDOT crash records). They also provided thoughts on the most efficient and

effective ways to **compare this equipment with similarly-tasked existing equipment** (trucks with traditional slurry tanks; traditional plows) on parallel/comparable routes.

Henke and Swenson Slurry Spreaders

A. Cost: Once a vehicle is in service, it gets its own number where labor is charged. Would expect a truck with a Henke or Swenson spreader to have it all winter and could track labor time by truck number. Use the M5 state system for tracking.

   Labor: Measure extra labor.

   Geometry: Measure extra height, center of gravity, weight.

B. Hard to answer. "Had such a short time with it, and it never performed right. If they send to another district, need to spend all that time and manpower to do it."

   Measure when your event started, when you lost control of road, when you regained control of road (when you have wheel tracks), and end of event. This is all on the operator - not on the MDSS. Operator will enter this information on the time sheet (RCA).

C. Measure how much material you used and where you put it (how much went on the road, in the ditch)

D. The more information you can collect automatically, such as through MDSS, the better. Would like to see the work load on the operators minimized.

   Work Management System (WMS) is a subsystem to the RCA system. Can collect bare lane information from RCA. RCA is populated by operators entering information, such as start of the storm, when they lost bare lane, time to bare lane, and end of the storm, into WMS. Gayle Tedemen (Crookston Office) collects data from these systems to run reports for management in District 2. Each district has one of these positions.

F. Environment, output: Can measure with AVL system. Time to bare lane should be reported during every storm. Compare with trucks we have now. Time or number of passes.

   Gallons/mile: Have a meter (as do other style we have now), so we can measure.

   Injuries: Don't expect to have many either way. More of a look at the process. Taking tanks in and out. Maybe have to measure opinions.

   Labor: Compare labor hours

   Time: Removing slurry systems to use trucks for other things. Compare time of tanks versus these systems (using cranes). Should be able to measure that quite easily.

   Stressed the importance of "apples to apples" comparison. Can't comparing an open stretch of road with a wooded stretch of road due to factors like wind on an open road and a tendency toward compaction on a wooded road.

G. MDSS and the shift reports to tracking material usage on similar routes. Compare our traditional units and the Henke or the Swenson. The Henke use MDSS/AVL (operators take the numbers and punch them in when they record their time); on the Swenson use what the operators are telling us. In both cases, the operators enter them in through time sheet. If they don't have MDSS, then they calibrate loader bucket and count scoops of material. It's an estimate and not perfect—AVL is closer.

   One thing that gets overlooked is crash data on sections of roads. Our traffic office tracks this. If it goes to similar sections of roads (e.g., North-South or East-West, with crash data). Think the crash data would be favorable. Michelle in D2 is who we would go to. If it goes to Metro, that's another person.

   Use MDSS to run reports, ideally EOS (automatically generated from AVL) over RCA (drawn from time sheets).

   Unless it's a two-lane route, will have other trucks servicing that route. Will need to figure out how to calculate that out. Assume that will happen in an urban area.

   Might also have vehicles from other jurisdictions crossing routes? Mostly it's minimal.

   Time to bare lane: MDSS is working on a pilot (partially covered, covered, then bare). Think Road Weather tech group could give info. Traditionally drivers put in when it gets covered and when it's bare. Want to be sure we have people take this very seriously.

They have a button to mark for bare lanes. Not sure it's connected with system. Instead, put in time sheet. Put when event started, when it became covered, and became bare. Drivers make a mental note of when this happens and put it in RCA. Through 511, might be able to take driver guesswork out of this. Think that bare lane and crash data will coincide and should support each other. Salt use: How much was used, how much stayed on the road? Did some testing on a dry day. Think more stays on the road w liquid, but how do you test on a snow-and-ice environment. We use Beet Heat with high sugars - sticks to your hand. Works really well. Not adding much melting capacity, but keeping salt where we want it. Should be able to turn spreaders down. (70% brine, 30% beet heat on Swenson; Henke was 100% brine) Even when we don't use a lot of material, they all look white. Cold weather emphasizes whiteness. Comparable routes: Need to make sure they're both using the same chemical so it the comparison doesn't skew. Even though they may use 3 different products. Also regarding comparable routes, do under the same supervisor and make sure drivers aren't getting different instruction. Other things to try to get comparable: Wind areas. Routes with similar terrain. Traffic counts. Prefer a non-windy road. The residue on these machines will negatively affect a windy route. Same subarea ideally (and if not that, then the same district.) Conditions can be very different in the same city.
Henke Underbody Scraper
F. Extra foot that unbolts and bolts back on can reach further on roadway. Possibly measure how this affects the number of passes.
Henke True Float Wing
F. Compare time to clear against traditional wing.
Henke Two-Way Reversible Plow
B. Test with different blades; not safe as currently configured.

Additional Comments

A. The slurry systems sounded like a novel idea, but they just didn't work. Hope we never get stuck with these. When it doesn't work, we shouldn't be told to "make it work."

   The slurry systems would be better than nothing. But we have all the equipment in our trucks, and we're adding to it. However, if we had a truck that was set up for it, it would make more sense.

   As a mechanic who comes in for each storm, I had to provide an abundance of labor. It was not worth it.

   Equipment that's build lighter is not going to last and will break down.

B. People who are resistant to change are less likely to succeed with new equipment.

APPENDIX D:
WINTER 2 PLOW EQUIPMENT SURVEY FORM

Henke UNDERBODY SCRAPER

Vehicle No. __________________________ **Page ___**

Operator Initials	Date	Mechanical/ operational issues?	If "Yes," please explain in a sentence	How well did the equipment perform?
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):

(Contact: Tony Bowe, Bemidji Fleet Manager/Shop Supervisor, anthony.bowe@state.mn.us)

Henke TRUE-FLOAT WING PLOW

Vehicle No. __________________________ **Page ___**

Operator Initials	**Date**	**Mechanical/ operational issues?**	**If "Yes," please explain in a sentence**	**How well did the equipment perform?**
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):

(Contact: Tony Bowe, Bemidji Fleet Manager/Shop Supervisor, anthony.bowe@state.mn.us)

Henke TWO-WAY REVERSIBLE PLOW

Vehicle No. __________________________ **Page ___**

Operator Initials	Date	Mechanical/ operational issues?	If "Yes," please explain in a sentence	How well did the equipment perform?
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):
		☐ Yes ☐ No		☐ Very well / better than traditional equipment ☐ Acceptably / as well as traditional equipment ☐ Poorly / not acceptable Comments (optional):

(Contact: Tony Bowe, Bemidji Fleet Manager/Shop Supervisor, anthony.bowe@state.mn.us)

APPENDIX E:
WINTER 2 USE AND COST DATA

Work Item Date	Fiscal Month	Month Abbr	Fiscal Month Name	Resource Name	Resource ID	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project Id	District Name	Estimated Project Full Cost	Estimated Direct Cost	Source Type Code	Unit Of Measure Code	Unit Of Measure Name	RCA Timesheet Work Item Id
12/1/2020	2021 / 06	Dec	December	Ronning, Mark	1191899	2	Labor	Regular	TP2J1972	D2-Bemidji	$123.59	$81.59	2415	HR	Hours	47059326
12/7/2020	2021 / 06	Dec	December	Ronning, Mark	1191899	3	Labor	Regular	TP2J1972	D2-Bemidji	$185.39	$122.38	2415	HR	Hours	47115053
12/9/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	$361.65	$238.73	2415	HR	Hours	47125489
12/9/2020	2021 / 06	Dec	December	Brekke, Jordan	1208535	8	Labor	Regular	TP2J1971	D2-Bemidji	$304.64	$201.10	2415	HR	Hours	47123672
12/9/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	8	Labor	Regular	TP2J1971	D2-Bemidji	$361.65	$238.73	2415	HR	Hours	47129683
12/9/2020	2021 / 06	Dec	December	Chevrolet 3500hd 2wd Crew Cab	TM215832	62	Equipment	Equipment	TP2J0713	D2-Bemidji	$90.68	$72.54	2408	M	Miles	47130037
12/9/2020	2021 / 06	Dec	December	Erickson, Ryan	1183737	8	Labor	Regular	TP2J1971	D2-Bemidji	$377.40	$251.92	2415	HR	Hours	47138322
12/9/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	3	Labor	Regular	TP2J0713	D2-Bemidji	$104.94	$69.27	2408	HR	Hours	47130037
12/9/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	4	Labor	Regular	TP2J1971	D2-Bemidji	$180.82	$119.37	2415	HR	Hours	47123744
12/9/2020	2021 / 06	Dec	December	Reese, Dustin	1149297	8	Labor	Regular	TP2J1971	D2-Bemidji	$357.39	$238.73	2415	HR	Hours	47125509
12/10/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J1972	D2-Bemidji	$69.96	$46.18	2415	HR	Hours	47130047
12/11/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	2	Labor	Regular	TP2J0024	D2-Bemidji	$90.41	$59.68	2406	HR	Hours	47134502
12/11/2020	2021 / 06	Dec	December	Brine	0	40	Material	Material	TP2J0024	D2-Bemidji	$9.43	$0.00	2406	GA	Gallon	47134502
12/11/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	35	Equipment	Equipment	TP2J0024	D2-Bemidji	$256.81	$205.45	2406	M	Miles	47134502
12/11/2020	2021 / 06	Dec	December	Salt	17416	1.5	Material	Material	TP2J0024	D2-Bemidji	$160.40	$0.00	2406	26	Ton	47134502
12/13/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	3.5	Labor	Comp at 1.5 times	TP2J1971	D2-Bemidji	$294.89	$0.00	2406	HR	Hours	47138350
12/13/2020	2021 / 06	Dec	December	Brine	0	50	Material	Material	TP2J0711	D2-Bemidji	$11.79	$0.00	2406	GA	Gallon	47141356
12/13/2020	2021 / 06	Dec	December	Brine	0	50	Material	Material	TP2J1972	D2-Bemidji	$11.79	$0.00	2406	GA	Gallon	47141348
12/13/2020	2021 / 06	Dec	December	Brine	0	200	Material	Material	TP2J1971	D2-Bemidji	$47.14	$0.00	2406	GA	Gallon	47138350
12/13/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	2	Labor	Comp at 1.5 times	TP2J0711	D2-Bemidji	$168.49	$0.00	2406	HR	Hours	47141356
12/13/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	2	Labor	Comp at 1.5 times	TP2J1972	D2-Bemidji	$168.49	$0.00	2406	HR	Hours	47141348
12/13/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	4	Labor	Overtime	TP2J0024	D2-Bemidji	$206.76	$179.03	2406	HR	Hours	47142473
12/13/2020	2021 / 06	Dec	December	Gonzales, Pablo	1009410	4	Labor	Comp at 1.5 times	TP2J0024	D2-Bemidji	$363.81	$0.00	2406	HR	Hours	47138928
12/13/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	4	Labor	Overtime	TP2J0713	D2-Bemidji	$184.21	$159.50	2406	HR	Hours	47142180
12/13/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	50	Equipment	Equipment	TP2J1971	D2-Bemidji	$366.88	$293.50	2406	M	Miles	47138350
12/13/2020	2021 / 06	Dec	December	International 7500 Single	TM212505	100	Equipment	Equipment	TP2J0024	D2-Bemidji	$733.75	$587.00	2406	M	Miles	47138928
12/13/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM217553	73	Equipment	Equipment	TP2J0024	D2-Bemidji	$501.88	$401.50	2406	M	Miles	47142473
12/13/2020	2021 / 06	Dec	December	Plow Truck	TM203572	25	Equipment	Equipment	TP2J0711	D2-Bemidji	$171.88	$137.50	2406	M	Miles	47141356
12/13/2020	2021 / 06	Dec	December	Plow Truck	TM203572	45	Equipment	Equipment	TP2J1972	D2-Bemidji	$309.38	$247.50	2406	M	Miles	47141348
12/13/2020	2021 / 06	Dec	December	Salt	17416	1	Material	Material	TP2J0024	D2-Bemidji	$106.93	$0.00	2406	26	Ton	47138928
12/13/2020	2021 / 06	Dec	December	Salt	17416	3	Material	Material	TP2J0711	D2-Bemidji	$320.80	$0.00	2406	26	Ton	47141356
12/13/2020	2021 / 06	Dec	December	Salt	17416	3	Material	Material	TP2J1972	D2-Bemidji	$320.80	$0.00	2406	26	Ton	47141348
12/13/2020	2021 / 06	Dec	December	Salt	17416	5.25	Material	Material	TP2J0024	D2-Bemidji	$561.40	$0.00	2406	26	Ton	47142473
12/13/2020	2021 / 06	Dec	December	Salt	17416	6	Material	Material	TP2J0713	D2-Bemidji	$641.60	$0.00	2406	26	Ton	47142180
12/13/2020	2021 / 06	Dec	December	Salt	17416	7	Material	Material	TP2J1971	D2-Bemidji	$748.53	$0.00	2406	26	Ton	47138350
12/13/2020	2021 / 06	Dec	December	Sterling Lt9511	TM202563	120	Equipment	Equipment	TP2J0713	D2-Bemidji	$825.00	$660.00	2406	M	Miles	47142180
12/14/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	$180.82	$119.37	2410	HR	Hours	47142687
12/14/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	$180.82	$119.37	2415	HR	Hours	47142717
12/14/2020	2021 / 06	Dec	December	Brine	0	100	Material	Material	TP2J0713	D2-Bemidji	$23.57	$0.00	2406	GA	Gallon	47142248
12/14/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	6.5	Labor	Regular	TP2J1972	D2-Bemidji	$293.84	$193.97	2415	HR	Hours	47141360
12/14/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	$361.65	$238.73	2415	HR	Hours	47142482
12/14/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$322.17	$212.68	2406	HR	Hours	47142248
12/14/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	35	Equipment	Equipment	TP2J1971	D2-Bemidji	$256.81	$205.45	2410	M	Miles	47142687
12/14/2020	2021 / 06	Dec	December	John Deere 772g Motor Grader	TM217308	4	Equipment	Equipment	TP2J1971	D2-Bemidji	$494.65	$395.72	2415	HR	Hours	47142482
12/14/2020	2021 / 06	Dec	December	Plow Truck	TM208556	94	Equipment	Equipment	TP2J0713	D2-Bemidji	$646.25	$517.00	2406	M	Miles	47142248
12/14/2020	2021 / 06	Dec	December	S&I Winter Mix	30895	1.12	Material	Material	TP2J0713	D2-Bemidji	$33.37	$0.00	2406	26	Ton	47142248
12/14/2020	2021 / 06	Dec	December	Salt	17416	0.34	Material	Material	TP2J0713	D2-Bemidji	$36.36	$0.00	2406	26	Ton	47142248
12/14/2020	2021 / 06	Dec	December	Salt	17416	1	Material	Material	TP2J1971	D2-Bemidji	$106.93	$0.00	2410	26	Ton	47142687
12/15/2020	2021 / 06	Dec	December	Erickson, Ryan	1183737	4	Labor	Regular	TP2J0713	D2-Bemidji	$188.70	$125.96	2415	HR	Hours	47148666
12/15/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1972	D2-Bemidji	$361.65	$238.73	2415	HR	Hours	47148761
12/15/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$322.17	$212.68	2415	HR	Hours	47148229
12/15/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM217553	150	Equipment	Equipment	TP2J1972	D2-Bemidji	$1,031.25	$825.00	2415	M	Miles	47148761
12/16/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	$361.65	$238.73	2415	HR	Hours	47155547
12/16/2020	2021 / 06	Dec	December	International 7600 Tandem	TM211555	9	Equipment	Equipment	TP2J1971	D2-Bemidji	$61.88	$49.50	2408	M	Miles	47168437
12/16/2020	2021 / 06	Dec	December	Vleck, Alan	1168832	8	Labor	Regular	TP2J1971	D2-Bemidji	$361.65	$238.73	2408	HR	Hours	47168437
12/17/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	5	Labor	Regular	TP2J1971	D2-Bemidji	$226.03	$149.21	2415	HR	Hours	47162061
12/18/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	7	Labor	Regular	TP2J1971	D2-Bemidji	$316.44	$208.89	2406	HR	Hours	47180544
12/18/2020	2021 / 06	Dec	December	Brine	0	10	Material	Material	TP2J0024	D2-Bemidji	$2.36	$0.00	2406	GA	Gallon	47183952
12/18/2020	2021 / 06	Dec	December	Brine	0	10	Material	Material	TP2J1972	D2-Bemidji	$2.36	$0.00	2406	GA	Gallon	47211150
12/18/2020	2021 / 06	Dec	December	Brine	0	100	Material	Material	TP2J0713	D2-Bemidji	$23.57	$0.00	2406	GA	Gallon	47180434
12/18/2020	2021 / 06	Dec	December	Cl33 Plow Truck	TM205503	15	Equipment	Equipment	TP2J0024	D2-Bemidji	$110.06	$88.05	2406	M	Miles	47183952
12/18/2020	2021 / 06	Dec	December	Delaney, Bryan	1197230	4.5	Labor	Regular	TP2J0024	D2-Bemidji	$161.48	$129.37	2406	HR	Hours	47179500
12/18/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	0.5	Labor	Regular	TP2J0024	D2-Bemidji	$17.49	$11.55	2406	HR	Hours	47183952
12/18/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	2	Labor	Regular	TP2J1972	D2-Bemidji	$90.41	$59.68	2406	HR	Hours	47211150
12/18/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$322.17	$212.68	2406	HR	Hours	47180434
12/18/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	62	Equipment	Equipment	TP2J1971	D2-Bemidji	$454.93	$363.94	2406	M	Miles	47180544
12/18/2020	2021 / 06	Dec	December	International 7500 Single	TM212505	91	Equipment	Equipment	TP2J0024	D2-Bemidji	$667.71	$534.17	2406	M	Miles	47179500
12/18/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM216561	40	Equipment	Equipment	TP2J1972	D2-Bemidji	$275.00	$220.00	2406	M	Miles	47211150
12/18/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM217553	100	Equipment	Equipment	TP2J0024	D2-Bemidji	$687.50	$550.00	2406	M	Miles	47179427
12/18/2020	2021 / 06	Dec	December	Plow Truck	TM208556	169	Equipment	Equipment	TP2J0713	D2-Bemidji	$1,161.88	$929.50	2406	M	Miles	47180434
12/18/2020	2021 / 06	Dec	December	Reese, Dustin	1149297	8	Labor	Regular	TP2J0024	D2-Bemidji	$357.39	$238.73	2406	HR	Hours	47179427
12/18/2020	2021 / 06	Dec	December	Salt	17416	0.5	Material	Material	TP2J0024	D2-Bemidji	$53.47	$0.00	2406	26	Ton	47183952
12/18/2020	2021 / 06	Dec	December	Salt	17416	0.6	Material	Material	TP2J1972	D2-Bemidji	$64.16	$0.00	2406	26	Ton	47211150
12/18/2020	2021 / 06	Dec	December	Salt	17416	2	Material	Material	TP2J0024	D2-Bemidji	$213.87	$0.00	2406	26	Ton	47179427
12/18/2020	2021 / 06	Dec	December	Salt	17416	5	Material	Material	TP2J1971	D2-Bemidji	$534.66	$0.00	2406	26	Ton	47180544
12/18/2020	2021 / 06	Dec	December	Salt	17416	5.8	Material	Material	TP2J0713	D2-Bemidji	$620.21	$0.00	2406	26	Ton	47180434
12/18/2020	2021 / 06	Dec	December	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	$361.65	$238.73	2415	HR	Hours	47168447
12/21/2020	2021 / 06	Dec	December	Bellefy, Dale	1060028	8	Labor	Regular	TP2J1971	D2-Bemidji	$272.01	$179.56	2406	HR	Hours	47189868
12/21/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	1	Labor	Regular	TP2J1972	D2-Bemidji	$45.21	$29.84	2406	HR	Hours	47193090
12/21/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	6	Labor	Regular	TP2J1971	D2-Bemidji	$271.24	$179.05	2406	HR	Hours	47192874
12/21/2020	2021 / 06	Dec	December	Brine	0	20	Material	Material	TP2J1972	D2-Bemidji	$4.71	$0.00	2406	GA	Gallon	47211245
12/21/2020	2021 / 06	Dec	December	Brine	0	25	Material	Material	TP2J0024	D2-Bemidji	$5.89	$0.00	2406	GA	Gallon	47214025
12/21/2020	2021 / 06	Dec	December	Brine	0	100	Material	Material	TP2J1971	D2-Bemidji	$23.57	$0.00	2406	GA	Gallon	47192874
12/21/2020	2021 / 06	Dec	December	Brine	0	120	Material	Material	TP2J0713	D2-Bemidji	$28.28	$0.00	2406	GA	Gallon	47207582
12/21/2020	2021 / 06	Dec	December	Cl33 Plow Truck	TM205503	10	Equipment	Equipment	TP2J0711	D2-Bemidji	$73.38	$58.70	2406	M	Miles	47213817
12/21/2020	2021 / 06	Dec	December	Cl33 Plow Truck	TM205503	20	Equipment	Equipment	TP2J0713	D2-Bemidji	$146.75	$117.40	2406	M	Miles	47213927
12/21/2020	2021 / 06	Dec	December	Cl33 Plow Truck	TM205503	60	Equipment	Equipment	TP2J0024	D2-Bemidji	$440.25	$352.20	2406	M	Miles	47214025
12/21/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	2	Labor	Regular	TP2J1972	D2-Bemidji	$90.41	$59.68	2406	HR	Hours	47211245
12/21/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$322.17	$212.68	2406	HR	Hours	47207582
12/21/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	5	Equipment	Equipment	TP2J1972	D2-Bemidji	$36.69	$29.35	2406	M	Miles	47193090
12/21/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	70	Equipment	Equipment	TP2J1971	D2-Bemidji	$513.63	$410.90	2406	M	Miles	47192874
12/21/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM216561	40	Equipment	Equipment	TP2J1972	D2-Bemidji	$275.00	$220.00	2406	M	Miles	47211245
12/21/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM217553	200	Equipment	Equipment	TP2J0024	D2-Bemidji	$1,375.00	$1,100.00	2406	M	Miles	47190457
12/21/2020	2021 / 06	Dec	December	Johnson, Thomas	356616	1	Labor	Regular	TP2J0711	D2-Bemidji	$55.99	$36.96	2406	HR	Hours	47213817
12/21/2020	2021 / 06	Dec	December	Johnson, Thomas	356616	1	Labor	Regular	TP2J0713	D2-Bemidji	$55.99	$36.96	2406	HR	Hours	47213927
12/21/2020	2021 / 06	Dec	December	Johnson, Thomas	356616	3	Labor	Regular	TP2J0024	D2-Bemidji	$167.97	$110.88	2406	HR	Hours	47214025
12/21/2020	2021 / 06	Dec	December	Plow Truck	TM203572	60	Equipment	Equipment	TP2J1971	D2-Bemidji	$412.50	$330.00	2406	M	Miles	47189868
12/21/2020	2021 / 06	Dec	December	Plow Truck	TM208556	196	Equipment	Equipment	TP2J0713	D2-Bemidji	$1,347.50	$1,078.00	2406	M	Miles	47207582
12/21/2020	2021 / 06	Dec	December	Reese, Dustin	1149297	8	Labor	Regular	TP2J0024	D2-Bemidji	$357.39	$238.73	2406	HR	Hours	47190457
12/21/2020	2021 / 06	Dec	December	Salt	17416	1	Material	Material	TP2J0713	D2-Bemidji	$106.93	$0.00	2406	26	Ton	47213927
12/21/2020	2021 / 06	Dec	December	Salt	17416	2	Material	Material	TP2J0024	D2-Bemidji	$213.87	$0.00	2406	26	Ton	47214025
12/21/2020	2021 / 06	Dec	December	Salt	17416	2	Material	Material	TP2J1972	D2-Bemidji	$213.87	$0.00	2406	26	Ton	47211245
12/21/2020	2021 / 06	Dec	December	Salt	17416	5	Material	Material	TP2J1971	D2-Bemidji	$534.66	$0.00	2406	26	Ton	47192874
12/21/2020	2021 / 06	Dec	December	Salt	17416	11.23	Material	Material	TP2J0713	D2-Bemidji	$1,200.85	$0.00	2406	26	Ton	47207582
12/22/2020	2021 / 06	Dec	December	Bellefy, Dale	1060028	8	Labor	Regular	TP2J1971	D2-Bemidji	$272.01	$179.56	2410	HR	Hours	47190414
12/22/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	$361.65	$238.73	2415	HR	Hours	47193343
12/22/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$322.17	$212.68	2415	HR	Hours	47207714
12/22/2020	2021 / 06	Dec	December	Plow Truck	TM208556	120	Equipment	Equipment	TP2J0713	D2-Bemidji	$825.00	$660.00	2415	M	Miles	47207714
12/22/2020	2021 / 06	Dec	December	Reese, Dustin	1149297	8	Labor	Regular	TP2J0024	D2-Bemidji	$357.39	$238.73	2415	HR	Hours	47190513
12/22/2020	2021 / 06	Dec	December	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	$361.65	$238.73	2415	HR	Hours	47189020
12/23/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	$510.84	$337.22	2406	HR	Hours	47232757
12/23/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	4	Labor	Regular	TP2J0024	D2-Bemidji	$139.92	$92.36	2406	HR	Hours	47250437

Work Item Date	Fiscal Month	Month Abbr	Fiscal Month Name	Resource Name	Resource ID	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project Id	District Name	Estimated Project Full Cost	Estimated Direct Cost	Source Type Code	Unit Of Measure Code	Unit Of Measure Name	RCA Timesheet Work Item Id
12/23/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	4	Labor	Regular	TP2J1971	D2-Bemidji	$139.92	$92.36	2406	HR	Hours	47250445
12/23/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	3	Labor	Overtime	TP2J1972	D2-Bemidji	$154.32	$133.62	2406	HR	Hours	47269498
12/23/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	$510.84	$337.22	2406	HR	Hours	47269486
12/23/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	1.5	Labor	Overtime	TP2J0713	D2-Bemidji	$69.03	$59.77	2406	HR	Hours	47235763
12/23/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$376.22	$248.35	2406	HR	Hours	47235762
12/23/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	130	Equipment	Equipment	TP2J1971	D2-Bemidji	$953.88	$763.10	2406	M	Miles	47232757
12/23/2020	2021 / 06	Dec	December	International 7500 Single	TM212505	94	Equipment	Equipment	TP2J0024	D2-Bemidji	$689.73	$551.78	2406	M	Miles	47250437
12/23/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM216561	10	Equipment	Equipment	TP2J0711	D2-Bemidji	$68.75	$55.00	2406	M	Miles	47241414
12/23/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM216561	20	Equipment	Equipment	TP2J0713	D2-Bemidji	$137.50	$110.00	2406	M	Miles	47241406
12/23/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM216561	65	Equipment	Equipment	TP2J0024	D2-Bemidji	$446.88	$357.50	2406	M	Miles	47241433
12/23/2020	2021 / 06	Dec	December	John Deere 772g Motor Grader	TM217308	3	Equipment	Equipment	TP2J1972	D2-Bemidji	$370.99	$296.79	2406	HR	Hours	47269498
12/23/2020	2021 / 06	Dec	December	John Deere 772g Motor Grader	TM217308	8	Equipment	Equipment	TP2J1971	D2-Bemidji	$989.30	$791.44	2406	HR	Hours	47269486
12/23/2020	2021 / 06	Dec	December	Johnson, Thomas	356616	1	Labor	Regular	TP2J0711	D2-Bemidji	$74.64	$49.28	2406	HR	Hours	47241414
12/23/2020	2021 / 06	Dec	December	Johnson, Thomas	356616	2	Labor	Regular	TP2J0713	D2-Bemidji	$149.29	$98.55	2406	HR	Hours	47241406
12/23/2020	2021 / 06	Dec	December	Johnson, Thomas	356616	4	Labor	Regular	TP2J0024	D2-Bemidji	$298.58	$197.10	2406	HR	Hours	47241433
12/23/2020	2021 / 06	Dec	December	Larson, Todd	1012600	6	Labor	Regular	TP2J0711	D2-Bemidji	$383.31	$253.03	2406	HR	Hours	47242548
12/23/2020	2021 / 06	Dec	December	Mistic, Brett	1164990	7	Labor	Regular	TP2J0024	D2-Bemidji	$334.82	$264.54	2406	HR	Hours	47242651
12/23/2020	2021 / 06	Dec	December	Plow Truck	TM203572	50	Equipment	Equipment	TP2J1971	D2-Bemidji	$343.75	$275.00	2406	M	Miles	47250445
12/23/2020	2021 / 06	Dec	December	Plow Truck	TM207570	70	Equipment	Equipment	TP2J0711	D2-Bemidji	$481.25	$385.00	2406	M	Miles	47242548
12/23/2020	2021 / 06	Dec	December	Plow Truck	TM208556	0	Equipment	Equipment	TP2J0713	D2-Bemidji	$0.00	$0.00	2406	M	Miles	47235763
12/23/2020	2021 / 06	Dec	December	Plow Truck	TM208556	280	Equipment	Equipment	TP2J0713	D2-Bemidji	$1,925.00	$1,540.00	2406	M	Miles	47235762
12/23/2020	2021 / 06	Dec	December	Plow Truck - Single Axle	TM219512	20	Equipment	Equipment	TP2J0024	D2-Bemidji	$146.75	$117.40	2406	M	Miles	47232392
12/23/2020	2021 / 06	Dec	December	Salt	17416	4	Material	Material	TP2J1971	D2-Bemidji	$427.73	$0.00	2406	26	Ton	47232757
12/23/2020	2021 / 06	Dec	December	Solberg, Jason	1176324	1	Labor	Regular	TP2J0024	D2-Bemidji	$67.27	$44.54	2406	HR	Hours	47232392
12/24/2020	2021 / 06	Dec	December	Bellefy, Dale	1060028	3	Labor	Regular	TP2J0024	D2-Bemidji	$101.40	$67.34	2415	HR	Hours	47236891
12/24/2020	2021 / 06	Dec	December	Bellefy, Dale	1060028	5	Labor	Regular	TP2J0024	D2-Bemidji	$169.01	$112.23	2410	HR	Hours	47236883
12/24/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	4	Labor	Regular	TP2J1971	D2-Bemidji	$255.42	$168.61	2410	HR	Hours	47269538
12/24/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$376.22	$248.35	2406	HR	Hours	47235765
12/24/2020	2021 / 06	Dec	December	International 7500 Single	TM212505	50	Equipment	Equipment	TP2J0024	D2-Bemidji	$366.88	$293.50	2415	M	Miles	47236891
12/24/2020	2021 / 06	Dec	December	John Deere 772g Motor Grader	TM217308	4	Equipment	Equipment	TP2J1971	D2-Bemidji	$494.65	$395.72	2410	HR	Hours	47269538
12/24/2020	2021 / 06	Dec	December	Plow Truck	TM208556	70	Equipment	Equipment	TP2J0713	D2-Bemidji	$481.25	$385.00	2406	M	Miles	47235765
12/27/2020	2021 / 06	Dec	December	International 7500 Single	TM212505	30	Equipment	Equipment	TP2J1971	D2-Bemidji	$220.13	$176.10	2406	M	Miles	47242585
12/27/2020	2021 / 06	Dec	December	Larson, Todd	1012600	2	Labor	Overtime	TP2J1971	D2-Bemidji	$102.96	$89.15	2406	HR	Hours	47242585
12/27/2020	2021 / 06	Dec	December	Salt	17416	1	Material	Material	TP2J1971	D2-Bemidji	$106.93	$0.00	2406	26	Ton	47242585
12/28/2020	2021 / 06	Dec	December	Bellefy, Dale	1060028	4	Labor	Regular	TP2J0024	D2-Bemidji	$135.20	$89.78	2406	HR	Hours	47246710
12/28/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	7	Labor	Regular	TP2J1971	D2-Bemidji	$446.98	$295.06	2406	HR	Hours	47246714
12/28/2020	2021 / 06	Dec	December	Brine	0	20	Material	Material	TP2J0713	D2-Bemidji	$4.71	$0.00	2406	GA	Gallon	47255783
12/28/2020	2021 / 06	Dec	December	Brine	0	50	Material	Material	TP2J1972	D2-Bemidji	$11.79	$0.00	2406	GA	Gallon	47247132
12/28/2020	2021 / 06	Dec	December	Brine	0	205	Material	Material	TP2J1971	D2-Bemidji	$48.32	$0.00	2406	GA	Gallon	47246714
12/28/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	4	Labor	Regular	TP2J1972	D2-Bemidji	$208.84	$137.86	2406	HR	Hours	47247132
12/28/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	5	Labor	Regular	TP2J0713	D2-Bemidji	$235.14	$155.22	2406	HR	Hours	47255783
12/28/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	71	Equipment	Equipment	TP2J1971	D2-Bemidji	$520.96	$416.77	2406	M	Miles	47246714
12/28/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM216561	45	Equipment	Equipment	TP2J1972	D2-Bemidji	$309.38	$247.50	2406	M	Miles	47247132
12/28/2020	2021 / 06	Dec	December	Plow Truck	TM208556	174	Equipment	Equipment	TP2J0713	D2-Bemidji	$1,196.25	$957.00	2406	M	Miles	47255783
12/28/2020	2021 / 06	Dec	December	Reese, Dustin	1149297	4	Labor	Regular	TP2J0024	D2-Bemidji	$255.43	$168.62	2415	HR	Hours	47264151
12/28/2020	2021 / 06	Dec	December	S&I Winter Mix	30895	2	Material	Material	TP2J1972	D2-Bemidji	$59.59	$0.00	2406	26	Ton	47247132
12/28/2020	2021 / 06	Dec	December	S&I Winter Mix	30895	2.02	Material	Material	TP2J0713	D2-Bemidji	$60.19	$0.00	2406	26	Ton	47255783
12/28/2020	2021 / 06	Dec	December	Salt	17416	7	Material	Material	TP2J1971	D2-Bemidji	$748.53	$0.00	2406	26	Ton	47246714
12/29/2020	2021 / 06	Dec	December	Anderson, Robert	1106148	0.5	Labor	Comp at 1.5 times	TP2J0713	D2-Bemidji	$49.82	$0.00	2406	HR	Hours	47268083
12/29/2020	2021 / 06	Dec	December	Anderson, Robert	1106148	8	Labor	Regular	TP2J0713	D2-Bemidji	$478.64	$333.65	2406	HR	Hours	47268082
12/29/2020	2021 / 06	Dec	December	Bannor, Ryan	1153657	1.5	Labor	Comp at 1.5 times	TP2J1971	D2-Bemidji	$138.00	$0.00	2406	HR	Hours	47269004
12/29/2020	2021 / 06	Dec	December	Bannor, Ryan	1153657	8	Labor	Regular	TP2J1971	D2-Bemidji	$390.82	$302.31	2406	HR	Hours	47268976
12/29/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	$510.84	$337.22	2415	HR	Hours	47257590
12/29/2020	2021 / 06	Dec	December	Brine	0	20	Material	Material	TP2J1971	D2-Bemidji	$4.71	$0.00	2406	GA	Gallon	47275928
12/29/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	8	Labor	Regular	TP2J1972	D2-Bemidji	$417.68	$275.73	2415	HR	Hours	47260414
12/29/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	1	Labor	Regular	TP2J0024	D2-Bemidji	$34.98	$23.09	2406	HR	Hours	47275930
12/29/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	2	Labor	Overtime	TP2J0024	D2-Bemidji	$80.00	$69.27	2406	HR	Hours	47275931
12/29/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	3	Labor	Regular	TP2J1972	D2-Bemidji	$104.94	$69.27	2406	HR	Hours	47275929
12/29/2020	2021 / 06	Dec	December	Fredrickson, Troy	1208509	4	Labor	Regular	TP2J1971	D2-Bemidji	$139.92	$92.36	2406	HR	Hours	47275928
12/29/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$376.22	$248.35	2415	HR	Hours	47255799
12/29/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	0	Equipment	Equipment	TP2J0024	D2-Bemidji	$0.00	$0.00	2406	M	Miles	47275931
12/29/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	50	Equipment	Equipment	TP2J1971	D2-Bemidji	$366.88	$293.50	2406	M	Miles	47275928
12/29/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	50	Equipment	Equipment	TP2J1972	D2-Bemidji	$366.88	$293.50	2406	M	Miles	47275929
12/29/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	57	Equipment	Equipment	TP2J0024	D2-Bemidji	$418.24	$334.59	2406	M	Miles	47275930
12/29/2020	2021 / 06	Dec	December	Larson, Todd	1012600	3	Labor	Regular	TP2J0711	D2-Bemidji	$191.66	$126.52	2406	HR	Hours	47278996
12/29/2020	2021 / 06	Dec	December	Plow Truck	TM203572	160	Equipment	Equipment	TP2J1971	D2-Bemidji	$1,100.00	$880.00	2406	M	Miles	47268976
12/29/2020	2021 / 06	Dec	December	Plow Truck	TM207570	40	Equipment	Equipment	TP2J0711	D2-Bemidji	$275.00	$220.00	2406	M	Miles	47278996
12/29/2020	2021 / 06	Dec	December	Plow Truck	TM208556	0	Equipment	Equipment	TP2J0713	D2-Bemidji	$0.00	$0.00	2406	M	Miles	47268083
12/29/2020	2021 / 06	Dec	December	Plow Truck	TM208556	280	Equipment	Equipment	TP2J0713	D2-Bemidji	$1,925.00	$1,540.00	2406	M	Miles	47268082
12/29/2020	2021 / 06	Dec	December	Salt	17416	1	Material	Material	TP2J1971	D2-Bemidji	$106.93	$0.00	2406	26	Ton	47275928
12/30/2020	2021 / 06	Dec	December	Anderson, Robert	1106148	3	Labor	Regular	TP2J0713	D2-Bemidji	$179.49	$125.12	2406	HR	Hours	47268136
12/30/2020	2021 / 06	Dec	December	Bellefy, Dale	1060028	4	Labor	Regular	TP2J0024	D2-Bemidji	$135.20	$89.78	2406	HR	Hours	47261213
12/30/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	7	Labor	Regular	TP2J1971	D2-Bemidji	$446.98	$295.06	2406	HR	Hours	47260447
12/30/2020	2021 / 06	Dec	December	Brine	0	100	Material	Material	TP2J0713	D2-Bemidji	$23.57	$0.00	2406	GA	Gallon	47260432
12/30/2020	2021 / 06	Dec	December	Brine	0	100	Material	Material	TP2J1972	D2-Bemidji	$23.57	$0.00	2406	GA	Gallon	47260419
12/30/2020	2021 / 06	Dec	December	Brine	0	120	Material	Material	TP2J0024	D2-Bemidji	$28.28	$0.00	2406	GA	Gallon	47274517
12/30/2020	2021 / 06	Dec	December	Brine	0	200	Material	Material	TP2J1971	D2-Bemidji	$47.14	$0.00	2406	GA	Gallon	47260447
12/30/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	4	Labor	Regular	TP2J0713	D2-Bemidji	$208.84	$137.86	2406	HR	Hours	47260432
12/30/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	4	Labor	Regular	TP2J1972	D2-Bemidji	$208.84	$137.86	2406	HR	Hours	47260419
12/30/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	1.5	Labor	Regular	TP2J0024	D2-Bemidji	$95.78	$63.23	2406	HR	Hours	47269595
12/30/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	1.5	Labor	Regular	TP2J1972	D2-Bemidji	$95.78	$63.23	2406	HR	Hours	47269590
12/30/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	5	Labor	Regular	TP2J1971	D2-Bemidji	$319.28	$210.76	2406	HR	Hours	47269572
12/30/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	$376.22	$248.35	2406	HR	Hours	47269729
12/30/2020	2021 / 06	Dec	December	International 7500 Single	TM212504	80	Equipment	Equipment	TP2J1971	D2-Bemidji	$587.00	$469.60	2406	M	Miles	47260447
12/30/2020	2021 / 06	Dec	December	International 7500 Single	TM212505	84	Equipment	Equipment	TP2J0024	D2-Bemidji	$616.35	$493.08	2406	M	Miles	47274517
12/30/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM216561	38	Equipment	Equipment	TP2J0713	D2-Bemidji	$261.25	$209.00	2406	M	Miles	47260432
12/30/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM216561	45	Equipment	Equipment	TP2J1972	D2-Bemidji	$309.38	$247.50	2406	M	Miles	47260419
12/30/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM217553	165	Equipment	Equipment	TP2J0024	D2-Bemidji	$1,134.38	$907.50	2410	M	Miles	47264207
12/30/2020	2021 / 06	Dec	December	John Deere 772g Motor Grader	TM217308	1	Equipment	Equipment	TP2J0024	D2-Bemidji	$123.66	$98.93	2406	HR	Hours	47269595
12/30/2020	2021 / 06	Dec	December	John Deere 772g Motor Grader	TM217308	1	Equipment	Equipment	TP2J1972	D2-Bemidji	$123.66	$98.93	2406	HR	Hours	47269590
12/30/2020	2021 / 06	Dec	December	John Deere 772g Motor Grader	TM217308	5	Equipment	Equipment	TP2J1971	D2-Bemidji	$618.31	$494.65	2406	HR	Hours	47269572
12/30/2020	2021 / 06	Dec	December	Mellema, Michael	1156970	8	Labor	Regular	TP2J0024	D2-Bemidji	$550.53	$364.12	2406	HR	Hours	47274517
12/30/2020	2021 / 06	Dec	December	Plow Truck	TM208556	80	Equipment	Equipment	TP2J0713	D2-Bemidji	$550.00	$440.00	2406	M	Miles	47268136
12/30/2020	2021 / 06	Dec	December	Plow Truck	TM208556	291	Equipment	Equipment	TP2J0713	D2-Bemidji	$2,000.63	$1,600.50	2406	M	Miles	47269729
12/30/2020	2021 / 06	Dec	December	Reese, Dustin	1149297	8	Labor	Regular	TP2J0024	D2-Bemidji	$510.86	$337.23	2410	HR	Hours	47264207
12/30/2020	2021 / 06	Dec	December	Salt	17416	2	Material	Material	TP2J0713	D2-Bemidji	$213.87	$0.00	2406	26	Ton	47268136
12/30/2020	2021 / 06	Dec	December	Salt	17416	4	Material	Material	TP2J0713	D2-Bemidji	$427.73	$0.00	2406	26	Ton	47260432
12/30/2020	2021 / 06	Dec	December	Salt	17416	4.5	Material	Material	TP2J1972	D2-Bemidji	$481.20	$0.00	2406	26	Ton	47260419
12/30/2020	2021 / 06	Dec	December	Salt	17416	5.2	Material	Material	TP2J0024	D2-Bemidji	$556.05	$0.00	2406	26	Ton	47274517
12/30/2020	2021 / 06	Dec	December	Salt	17416	5.21	Material	Material	TP2J0713	D2-Bemidji	$557.12	$0.00	2406	26	Ton	47269729
12/30/2020	2021 / 06	Dec	December	Salt	17416	8	Material	Material	TP2J0024	D2-Bemidji	$855.46	$0.00	2410	26	Ton	47264207
12/30/2020	2021 / 06	Dec	December	Salt	17416	10	Material	Material	TP2J1971	D2-Bemidji	$1,069.33	$0.00	2406	26	Ton	47260447
12/31/2020	2021 / 06	Dec	December	Bellefy, Dale	1060028	8	Labor	Regular	TP2J1971	D2-Bemidji	$270.41	$179.56	2410	HR	Hours	47269773
12/31/2020	2021 / 06	Dec	December	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	$510.84	$337.22	2410	HR	Hours	47290403
12/31/2020	2021 / 06	Dec	December	Brekke, Jordan	1208535	3	Labor	Regular	TP2J1971	D2-Bemidji	$135.25	$89.28	2406	HR	Hours	47269851
12/31/2020	2021 / 06	Dec	December	Brekke, Jordan	1208535	5	Labor	Regular	TP2J1971	D2-Bemidji	$225.42	$148.81	2410	HR	Hours	47269833
12/31/2020	2021 / 06	Dec	December	Burnham, Justin	1164802	8	Labor	Regular	TP2J1971	D2-Bemidji	$417.68	$275.73	2410	HR	Hours	47269714
12/31/2020	2021 / 06	Dec	December	Chevrolet 3500hd 2wd Crew Cab	TM215832	15	Equipment	Equipment	TP2J1971	D2-Bemidji	$21.94	$17.55	2410	M	Miles	47290403
12/31/2020	2021 / 06	Dec	December	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	$510.84	$337.22	2410	HR	Hours	47269604
12/31/2020	2021 / 06	Dec	December	Fy10 Cl35 Plow Truck	TM210554	50	Equipment	Equipment	TP2J1971	D2-Bemidji	$343.75	$275.00	2410	M	Miles	47269773
12/31/2020	2021 / 06	Dec	December	Hannem, Brady	1200011	8	Labor	Regular	TP2J1971	D2-Bemidji	$376.22	$248.35	2410	HR	Hours	47269733
12/31/2020	2021 / 06	Dec	December	International 7600 Tandem	TM211555	100	Equipment	Equipment	TP2J1971	D2-Bemidji	$687.50	$550.00	2410	M	Miles	47269680

Work Item Date	Fiscal Month	Month Abbr	Fiscal Month Name	Resource Name	Resource ID	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project Id	District Name	Estimated Project Full Cost	Estimated Direct Cost	Source Type Code	Unit Of Measure Code	Unit Of Measure Name	RCA Timesheet Work Item Id
12/31/2020	2021 / 06	Dec	December	International 7600 Tandem Axle	TM217553	45	Equipment	Equipment	TP2J1971	D2-Bemidji	$309.38	$247.50	2406	M	Miles	47269851
12/31/2020	2021 / 06	Dec	December	John Deere 6170r Tractor	TM214338	7	Equipment	Equipment	TP2J1971	D2-Bemidji	$689.94	$551.95	2410	HR	Hours	47269714
12/31/2020	2021 / 06	Dec	December	John Deere 772g Motor Grader	TM217308	8	Equipment	Equipment	TP2J1971	D2-Bemidji	$989.30	$791.44	2410	HR	Hours	47269604
12/31/2020	2021 / 06	Dec	December	Mathiowetz, Paul	1208763	8	Labor	Regular	TP2J1971	D2-Bemidji	$306.43	$202.28	2410	HR	Hours	47269680
12/31/2020	2021 / 06	Dec	December	Plow Truck	TM207570	90	Equipment	Equipment	TP2J1971	D2-Bemidji	$618.75	$495.00	2410	M	Miles	47269833
12/31/2020	2021 / 06	Dec	December	Plow Truck	TM208556	170	Equipment	Equipment	TP2J1971	D2-Bemidji	$1,168.75	$935.00	2410	M	Miles	47269733
12/31/2020	2021 / 06	Dec	December	Pronovost P1040trc Snowblow	TM214420	7	Equipment	Equipment	TP2J1971	D2-Bemidji	$776.48	$621.18	2410	HR	Hours	47269714
12/31/2020	2021 / 06	Dec	December	Salt	17416	0.5	Material	Material	TP2J1971	D2-Bemidji	$53.47	$0.00	2406	26	Ton	47269851
1/4/2021	2021 / 07	Jan	January	Bellefy, Dale	1060028	8	Labor	Regular	TP2J1971	D2-Bemidji	270.40875	179.56	2410	HR	Hours	47290150
1/4/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	6	Labor	Regular	TP2J1971	D2-Bemidji	383.1267857	252.9117857	2410	HR	Hours	47290523
1/4/2021	2021 / 07	Jan	January	Brekke, Jordan	1208535	8	Labor	Regular	TP2J1971	D2-Bemidji	360.6742857	238.0885714	2410	HR	Hours	47289909
1/4/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	8	Labor	Regular	TP2J1971	D2-Bemidji	417.6833333	275.725	2410	HR	Hours	47289867
1/4/2021	2021 / 07	Jan	January	Chevrolet 3500hd 2wd Crew Cab	TM215832	15	Equipment	Equipment	TP2J1971	D2-Bemidji	21.9375	17.55	2410	M	Miles	47290523
1/4/2021	2021 / 07	Jan	January	Erickson, Ryan	1183737	8	Labor	Regular	TP2J1971	D2-Bemidji	437.6649057	288.9132075	2410	HR	Hours	47299527
1/4/2021	2021 / 07	Jan	January	Felling X55 Side Dump Trailer	TM213118	8	Equipment	Equipment	TP2J1971	D2-Bemidji	141.5	113.2	2410	HR	Hours	47299952
1/4/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	510.84	337.2207407	2415	HR	Hours	47289736
1/4/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J1971	D2-Bemidji	376.2216393	248.3540984	2410	HR	Hours	47299952
1/4/2021	2021 / 07	Jan	January	International 7600 Tandem	TM211555	52	Equipment	Equipment	TP2J1971	D2-Bemidji	357.5	286	2410	M	Miles	47289909
1/4/2021	2021 / 07	Jan	January	Intl 7600 Tandem Plow Truck	TM215562	111	Equipment	Equipment	TP2J1971	D2-Bemidji	763.125	610.5	2410	M	Miles	47290043
1/4/2021	2021 / 07	Jan	January	John Deere 6170r Tractor	TM214338	7	Equipment	Equipment	TP2J1971	D2-Bemidji	689.9375	551.95	2410	HR	Hours	47289867
1/4/2021	2021 / 07	Jan	January	John Deere 772g Motor Grader	TM217308	6	Equipment	Equipment	TP2J1971	D2-Bemidji	741.975	593.58	2415	HR	Hours	47289736
1/4/2021	2021 / 07	Jan	January	Mathiowetz, Paul	1208763	8	Labor	Regular	TP2J1971	D2-Bemidji	306.42625	202.27875	2410	HR	Hours	47290043
1/4/2021	2021 / 07	Jan	January	Plow Truck	TM203572	35	Equipment	Equipment	TP2J1971	D2-Bemidji	240.625	192.5	2410	M	Miles	47290150
1/4/2021	2021 / 07	Jan	January	Plow Truck	TM208556	50	Equipment	Equipment	TP2J1971	D2-Bemidji	343.75	275	2410	M	Miles	47299527
1/4/2021	2021 / 07	Jan	January	Pronovost P1040trc Snowblow	TM214420	7	Equipment	Equipment	TP2J1971	D2-Bemidji	776.475	621.18	2410	HR	Hours	47289867
1/4/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	8	Labor	Regular	TP2J1971	D2-Bemidji	510.8616667	337.2316667	2410	HR	Hours	47290482
1/4/2021	2021 / 07	Jan	January	Used Otr Tractor	TM205166	50	Equipment	Equipment	TP2J1971	D2-Bemidji	146.875	117.5	2410	M	Miles	47299952
1/4/2021	2021 / 07	Jan	January	Volvo L90g Wheel Loader	TM215522	8	Equipment	Equipment	TP2J1971	D2-Bemidji	816.6	653.28	2410	HR	Hours	47290482
1/5/2021	2021 / 07	Jan	January	Bellefy, Dale	1060028	8	Labor	Regular	TP2J1971	D2-Bemidji	270.40875	179.56	2410	HR	Hours	47299805
1/5/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.8357143	337.2157143	2410	HR	Hours	47299367
1/5/2021	2021 / 07	Jan	January	Brekke, Jordan	1208535	8	Labor	Regular	TP2J1971	D2-Bemidji	360.6742857	238.0885714	2410	HR	Hours	47298759
1/5/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	8	Labor	Regular	TP2J1971	D2-Bemidji	417.6833333	275.725	2410	HR	Hours	47298476
1/5/2021	2021 / 07	Jan	January	Chevrolet 3500hd 2wd Crew Cab	TM215832	20	Equipment	Equipment	TP2J1971	D2-Bemidji	29.25	23.4	2410	M	Miles	47299367
1/5/2021	2021 / 07	Jan	January	Felling X55 Side Dump Trailer	TM213118	8	Equipment	Equipment	TP2J1971	D2-Bemidji	141.5	113.2	2410	HR	Hours	47300391
1/5/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1972	D2-Bemidji	510.84	337.2207407	2415	HR	Hours	47298749
1/5/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J1971	D2-Bemidji	376.2216393	248.3540984	2410	HR	Hours	47300391
1/5/2021	2021 / 07	Jan	January	International 7600 Tandem	TM211555	50	Equipment	Equipment	TP2J1971	D2-Bemidji	343.75	275	2410	M	Miles	47298459
1/5/2021	2021 / 07	Jan	January	John Deere 6170r Tractor	TM214338	7	Equipment	Equipment	TP2J1971	D2-Bemidji	689.9375	551.95	2410	HR	Hours	47298476
1/5/2021	2021 / 07	Jan	January	John Deere 772g Motor Grader	TM217308	6	Equipment	Equipment	TP2J1972	D2-Bemidji	741.975	593.58	2415	HR	Hours	47298749
1/5/2021	2021 / 07	Jan	January	Mathiowetz, Paul	1208763	8	Labor	Regular	TP2J1971	D2-Bemidji	306.42625	202.27875	2410	HR	Hours	47298459
1/5/2021	2021 / 07	Jan	January	Mecl, Glen	1214500	8	Labor	Regular	TP2J1971	D2-Bemidji	272.0075	179.55875	2410	HR	Hours	47315511
1/5/2021	2021 / 07	Jan	January	Plow Truck	TM203572	50	Equipment	Equipment	TP2J1971	D2-Bemidji	343.75	275	2410	M	Miles	47299805
1/5/2021	2021 / 07	Jan	January	Plow Truck	TM203574	160	Equipment	Equipment	TP2J1971	D2-Bemidji	1100	880	2410	M	Miles	47315511
1/5/2021	2021 / 07	Jan	January	Plow Truck	TM207570	50	Equipment	Equipment	TP2J1971	D2-Bemidji	343.75	275	2410	M	Miles	47298759
1/5/2021	2021 / 07	Jan	January	Pronovost P1040trc Snowblow	TM214420	7	Equipment	Equipment	TP2J1971	D2-Bemidji	776.475	621.18	2410	HR	Hours	47298476
1/5/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	8	Labor	Regular	TP2J1971	D2-Bemidji	510.8616667	337.2316667	2410	HR	Hours	47298946
1/5/2021	2021 / 07	Jan	January	Sterling Lt9511	TM204564	84	Equipment	Equipment	TP2J1971	D2-Bemidji	577.5	462	2410	M	Miles	47317567
1/5/2021	2021 / 07	Jan	January	Ufford, Steven	1066146	8	Labor	Regular	TP2J1971	D2-Bemidji	511.0092308	337.32	2410	HR	Hours	47317567
1/5/2021	2021 / 07	Jan	January	Used Otr Tractor	TM205166	50	Equipment	Equipment	TP2J1971	D2-Bemidji	146.875	117.5	2410	M	Miles	47300391
1/5/2021	2021 / 07	Jan	January	Volvo L90g Wheel Loader	TM215522	8	Equipment	Equipment	TP2J1971	D2-Bemidji	816.6	653.28	2410	HR	Hours	47298946
1/6/2021	2021 / 07	Jan	January	Bellefy, Dale	1060028	8	Labor	Regular	TP2J1971	D2-Bemidji	272.0055556	179.5588889	2410	HR	Hours	47332719
1/6/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	5	Labor	Regular	TP2J1972	D2-Bemidji	319.2701389	210.7576389	2410	HR	Hours	47332622
1/6/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	8	Labor	Regular	TP2J1971	D2-Bemidji	417.6822222	275.7244444	2410	HR	Hours	47332765
1/6/2021	2021 / 07	Jan	January	Erickson, Ryan	1183737	8	Labor	Regular	TP2J1972	D2-Bemidji	434.8262069	288.9131034	2410	HR	Hours	47360310
1/6/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	510.8747541	337.2393443	2410	HR	Hours	47332691
1/6/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J1972	D2-Bemidji	376.2188889	248.3533333	2410	HR	Hours	47332583
1/6/2021	2021 / 07	Jan	January	John Deere 6170r Tractor	TM214338	7	Equipment	Equipment	TP2J1971	D2-Bemidji	689.9375	551.95	2410	HR	Hours	47332765
1/6/2021	2021 / 07	Jan	January	John Deere 772g Motor Grader	TM217308	2	Equipment	Equipment	TP2J1971	D2-Bemidji	247.325	197.86	2410	HR	Hours	47332691
1/6/2021	2021 / 07	Jan	January	Mathiowetz, Paul	1208763	5	Labor	Regular	TP2J1972	D2-Bemidji	191.5111111	126.4229167	2410	HR	Hours	47332510
1/6/2021	2021 / 07	Jan	January	Plow Truck	TM203572	90	Equipment	Equipment	TP2J1971	D2-Bemidji	618.75	495	2410	M	Miles	47332719
1/6/2021	2021 / 07	Jan	January	Plow Truck	TM208556	50	Equipment	Equipment	TP2J1972	D2-Bemidji	343.75	275	2410	M	Miles	47360310
1/6/2021	2021 / 07	Jan	January	Pronovost P1040trc Snowblow	TM214420	7	Equipment	Equipment	TP2J1971	D2-Bemidji	776.475	621.18	2410	HR	Hours	47332765
1/6/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	8	Labor	Regular	TP2J1971	D2-Bemidji	510.8561702	337.2289362	2410	HR	Hours	47332362
1/6/2021	2021 / 07	Jan	January	Used Otr Tractor	TM205166	120	Equipment	Equipment	TP2J1972	D2-Bemidji	352.5	282	2410	M	Miles	47332583
1/6/2021	2021 / 07	Jan	January	Volvo L90g Wheel Loader	TM215522	8	Equipment	Equipment	TP2J1971	D2-Bemidji	816.6	653.28	2410	HR	Hours	47325362
1/7/2021	2021 / 07	Jan	January	John Deere 6170r Tractor	TM214338	6	Equipment	Equipment	TP2J1971	D2-Bemidji	591.375	473.1	2410	HR	Hours	47334089
1/7/2021	2021 / 07	Jan	January	Pronovost P1040trc Snowblow	TM214420	6	Equipment	Equipment	TP2J1971	D2-Bemidji	665.55	532.44	2410	HR	Hours	47334089
1/7/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	8	Labor	Regular	TP2J1971	D2-Bemidji	510.8561702	337.2289362	2410	HR	Hours	47356221
1/7/2021	2021 / 07	Jan	January	Vleck, Alan	1168832	8	Labor	Regular	TP2J1971	D2-Bemidji	509.9655556	336.6411111	2410	HR	Hours	47334089
1/7/2021	2021 / 07	Jan	January	Volvo L90g Wheel Loader	TM215522	8	Equipment	Equipment	TP2J1971	D2-Bemidji	816.6	653.28	2410	HR	Hours	47356221
1/8/2021	2021 / 07	Jan	January	Brine	0	60	Material	Material	TP2J0713	D2-Bemidji	14.14	0	2406	GA	Gallon	47342043
1/8/2021	2021 / 07	Jan	January	Mathiowetz, Paul	1208763	4	Labor	Regular	TP2J0713	D2-Bemidji	153.2088889	101.1383333	2406	HR	Hours	47342043
1/8/2021	2021 / 07	Jan	January	Plow Truck - Single Axle	TM219512	80	Equipment	Equipment	TP2J0713	D2-Bemidji	587	469.6	2406	M	Miles	47342043
1/8/2021	2021 / 07	Jan	January	Salt	17416	2	Material	Material	TP2J0713	D2-Bemidji	213.87	0	2406	26	Ton	47342043
1/9/2021	2021 / 07	Jan	January	Larson, Todd	1012600	2.25	Labor	Overtime	TP2J0024	D2-Bemidji	125.163	108.378	2406	HR	Hours	47352648
1/9/2021	2021 / 07	Jan	January	Plow Truck - Single Axle	TM219512	60	Equipment	Equipment	TP2J0024	D2-Bemidji	440.25	352.2	2406	M	Miles	47352648
1/9/2021	2021 / 07	Jan	January	Salt	17416	1	Material	Material	TP2J0024	D2-Bemidji	106.93	0	2406	26	Ton	47352648
1/11/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	4	Labor	Regular	TP2J1971	D2-Bemidji	255.437377	168.6196721	2410	HR	Hours	47350699
1/12/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1972	D2-Bemidji	510.8747541	337.2393443	2415	HR	Hours	47356719
1/12/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	376.2188889	248.3533333	2415	HR	Hours	47356769
1/14/2021	2021 / 07	Jan	January	Bannor, Ryan	1153657	1.5	Labor	Comp at 1.5 times	TP2J0713	D2-Bemidji	138	0	2406	HR	Hours	47376796
1/14/2021	2021 / 07	Jan	January	Bannor, Ryan	1153657	8	Labor	Regular	TP2J0713	D2-Bemidji	381.2244444	302.3122222	2406	HR	Hours	47376786
1/14/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	7	Labor	Regular	TP2J1971	D2-Bemidji	446.9781944	295.0606944	2406	HR	Hours	47370135
1/14/2021	2021 / 07	Jan	January	Brine	0	20	Material	Material	TP2J0711	D2-Bemidji	4.71	0	2406	GA	Gallon	47369438
1/14/2021	2021 / 07	Jan	January	Brine	0	30	Material	Material	TP2J1972	D2-Bemidji	7.07	0	2406	GA	Gallon	47369427
1/14/2021	2021 / 07	Jan	January	Brine	0	100	Material	Material	TP2J0024	D2-Bemidji	23.57	0	2406	GA	Gallon	47369070
1/14/2021	2021 / 07	Jan	January	Brine	0	100	Material	Material	TP2J0024	D2-Bemidji	23.57	0	2406	GA	Gallon	47385070
1/14/2021	2021 / 07	Jan	January	Brine	0	120	Material	Material	TP2J0713	D2-Bemidji	28.28	0	2406	GA	Gallon	47379267
1/14/2021	2021 / 07	Jan	January	Brine	0	120	Material	Material	TP2J1971	D2-Bemidji	28.28	0	2406	GA	Gallon	47384778
1/14/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	4	Labor	Regular	TP2J0711	D2-Bemidji	208.8411111	137.8622222	2406	HR	Hours	47369438
1/14/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	4	Labor	Regular	TP2J1972	D2-Bemidji	208.8411111	137.8622222	2406	HR	Hours	47369427
1/14/2021	2021 / 07	Jan	January	Cl33 Plow Truck	TM205503	123	Equipment	Equipment	TP2J0024	D2-Bemidji	902.5125	722.01	2406	M	Miles	47369070
1/14/2021	2021 / 07	Jan	January	Erickson, Ryan	1183737	1	Labor	Regular	TP2J0024	D2-Bemidji	54.35327586	36.11413793	2406	HR	Hours	47377830
1/14/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	1.5	Labor	Overtime	TP2J1971	D2-Bemidji	60	51.95	2406	HR	Hours	47384779
1/14/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	8	Labor	Regular	TP2J1971	D2-Bemidji	279.84	184.7266667	2406	HR	Hours	47384778
1/14/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	8	Labor	Regular	TP2J0024	D2-Bemidji	510.8747541	337.2393443	2406	HR	Hours	47369070
1/14/2021	2021 / 07	Jan	January	Fy10 Cl35 Plow Truck	TM210554	40	Equipment	Equipment	TP2J0024	D2-Bemidji	275	220	2406	M	Miles	47385070
1/14/2021	2021 / 07	Jan	January	Glen, Matthew	1212314	1.5	Labor	Overtime	TP2J0713	D2-Bemidji	73.47	70.49454545	2406	HR	Hours	47403939
1/14/2021	2021 / 07	Jan	January	Glen, Matthew	1212314	8	Labor	Regular	TP2J0713	D2-Bemidji	362.9777778	287.8433333	2406	HR	Hours	47403617
1/14/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	376.2188889	248.3533333	2406	HR	Hours	47379267
1/14/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	30	Equipment	Equipment	TP2J1972	D2-Bemidji	206.25	165	2406	M	Miles	47369427
1/14/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	45	Equipment	Equipment	TP2J0711	D2-Bemidji	309.375	247.5	2406	M	Miles	47369438
1/14/2021	2021 / 07	Jan	January	Intl 7600 Tandem Plow Truck	TM215562	30	Equipment	Equipment	TP2J0024	D2-Bemidji	206.25	165	2406	M	Miles	47377830
1/14/2021	2021 / 07	Jan	January	Larson, Todd	1012600	4	Labor	Regular	TP2J0711	D2-Bemidji	270.0522222	178.2638889	2406	HR	Hours	47375797
1/14/2021	2021 / 07	Jan	January	Mistic, Brett	1164990	2	Labor	Overtime	TP2J0024	D2-Bemidji	114.83	99.43	2406	HR	Hours	47376752
1/14/2021	2021 / 07	Jan	January	Mistic, Brett	1164990	8	Labor	Regular	TP2J0024	D2-Bemidji	381.2655556	302.3444444	2406	HR	Hours	47376728
1/14/2021	2021 / 07	Jan	January	Plow Truck	TM207509	0	Equipment	Equipment	TP2J1971	D2-Bemidji	0	0	2406	M	Miles	47384779
1/14/2021	2021 / 07	Jan	January	Plow Truck	TM207509	125	Equipment	Equipment	TP2J1971	D2-Bemidji	917.1875	733.75	2406	M	Miles	47384778
1/14/2021	2021 / 07	Jan	January	Plow Truck	TM207570	40	Equipment	Equipment	TP2J0711	D2-Bemidji	275	220	2406	M	Miles	47375797
1/14/2021	2021 / 07	Jan	January	Plow Truck	TM208556	226	Equipment	Equipment	TP2J0713	D2-Bemidji	1553.75	1243	2406	M	Miles	47379267
1/14/2021	2021 / 07	Jan	January	Plow Truck	TM208556	242	Equipment	Equipment	TP2J0713	D2-Bemidji	1663.75	1331	2406	M	Miles	47376786
1/14/2021	2021 / 07	Jan	January	Ronning, Mark	1191899	2	Labor	Comp at 1.5 times	TP2J0024	D2-Bemidji	167.21	0	2406	HR	Hours	47385070

Work Item Date	Fiscal Month	Month Abbr	Fiscal Month Name	Resource Name	Resource ID	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project Id	District Name	Estimated Project Full Cost	Estimated Direct Cost	Source Type Code	Unit Of Measure Code	Unit Of Measure Name	RCA Timesheet Work Item Id
1/14/2021	2021 / 07	Jan	January	Salt	17416	1	Material	Material	TP2J0711	D2-Bemidji	106.93	0	2406	26	Ton	47375797
1/14/2021	2021 / 07	Jan	January	Salt	17416	2	Material	Material	TP2J0713	D2-Bemidji	213.87	0	2406	26	Ton	47376786
1/14/2021	2021 / 07	Jan	January	Salt	17416	2.5	Material	Material	TP2J0024	D2-Bemidji	267.33	0	2406	26	Ton	47385070
1/14/2021	2021 / 07	Jan	January	Salt	17416	4	Material	Material	TP2J1972	D2-Bemidji	427.73	0	2406	26	Ton	47369427
1/14/2021	2021 / 07	Jan	January	Salt	17416	5	Material	Material	TP2J0711	D2-Bemidji	534.66	0	2406	26	Ton	47369438
1/14/2021	2021 / 07	Jan	January	Salt	17416	6	Material	Material	TP2J1971	D2-Bemidji	641.6	0	2406	26	Ton	47384778
1/14/2021	2021 / 07	Jan	January	Salt	17416	6.8	Material	Material	TP2J0713	D2-Bemidji	727.14	0	2406	26	Ton	47379267
1/14/2021	2021 / 07	Jan	January	Salt	17416	7.2	Material	Material	TP2J1971	D2-Bemidji	769.92	0	2406	26	Ton	47370135
1/14/2021	2021 / 07	Jan	January	Salt	17416	24	Material	Material	TP2J0024	D2-Bemidji	2566.38	0	2406	26	Ton	47369070
1/14/2021	2021 / 07	Jan	January	Sterling Lt9511 Tandem Axle	TM200052	60	Equipment	Equipment	TP2J1971	D2-Bemidji	412.5	330	2406	M	Miles	47370135
1/15/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	7	Labor	Regular	TP2J1971	D2-Bemidji	446.9781944	295.0606944	2406	HR	Hours	47380598
1/15/2021	2021 / 07	Jan	January	Brine	0	50	Material	Material	TP2J0024	D2-Bemidji	11.79	0	2406	GA	Gallon	47378996
1/15/2021	2021 / 07	Jan	January	Brine	0	60	Material	Material	TP2J0024	D2-Bemidji	14.14	0	2406	GA	Gallon	47429015
1/15/2021	2021 / 07	Jan	January	Brine	0	75	Material	Material	TP2J1971	D2-Bemidji	17.68	0	2406	GA	Gallon	47380598
1/15/2021	2021 / 07	Jan	January	Brine	0	80	Material	Material	TP2J0713	D2-Bemidji	18.86	0	2406	GA	Gallon	47429019
1/15/2021	2021 / 07	Jan	January	Brine	0	100	Material	Material	TP2J0711	D2-Bemidji	23.57	0	2406	GA	Gallon	47378828
1/15/2021	2021 / 07	Jan	January	Brine	0	100	Material	Material	TP2J1972	D2-Bemidji	23.57	0	2406	GA	Gallon	47378796
1/15/2021	2021 / 07	Jan	January	Brine	0	120	Material	Material	TP2J0713	D2-Bemidji	28.28	0	2406	GA	Gallon	47379242
1/15/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	4	Labor	Regular	TP2J0711	D2-Bemidji	208.8411111	137.8622222	2406	HR	Hours	47378828
1/15/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	4	Labor	Regular	TP2J1972	D2-Bemidji	208.8411111	137.8622222	2406	HR	Hours	47378796
1/15/2021	2021 / 07	Jan	January	Cl33 Plow Truck	TM205503	100	Equipment	Equipment	TP2J0024	D2-Bemidji	733.75	587	2406	M	Miles	47378996
1/15/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J0024	D2-Bemidji	69.96	46.18166667	2406	HR	Hours	47429015
1/15/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J0713	D2-Bemidji	69.96	46.18166667	2406	HR	Hours	47429019
1/15/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	6	Labor	Regular	TP2J0024	D2-Bemidji	383.1560656	252.9295082	2406	HR	Hours	47378996
1/15/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	376.2188889	248.3533333	2406	HR	Hours	47379242
1/15/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	25	Equipment	Equipment	TP2J0711	D2-Bemidji	171.875	137.5	2406	M	Miles	47378828
1/15/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	25	Equipment	Equipment	TP2J1972	D2-Bemidji	171.875	137.5	2406	M	Miles	47378796
1/15/2021	2021 / 07	Jan	January	Plow Truck	TM207509	45	Equipment	Equipment	TP2J0024	D2-Bemidji	330.1875	264.15	2406	M	Miles	47429015
1/15/2021	2021 / 07	Jan	January	Plow Truck	TM207509	60	Equipment	Equipment	TP2J0713	D2-Bemidji	440.25	352.2	2406	M	Miles	47429019
1/15/2021	2021 / 07	Jan	January	Plow Truck	TM207509	60	Equipment	Equipment	TP2J1971	D2-Bemidji	440.25	352.2	2406	M	Miles	47380598
1/15/2021	2021 / 07	Jan	January	Plow Truck	TM208556	223	Equipment	Equipment	TP2J0713	D2-Bemidji	1533.125	1226.5	2406	M	Miles	47379242
1/15/2021	2021 / 07	Jan	January	Salt	17416	5	Material	Material	TP2J0024	D2-Bemidji	534.66	0	2406	26	Ton	47429015
1/15/2021	2021 / 07	Jan	January	Salt	17416	5	Material	Material	TP2J1972	D2-Bemidji	534.66	0	2406	26	Ton	47378796
1/15/2021	2021 / 07	Jan	January	Salt	17416	6	Material	Material	TP2J0711	D2-Bemidji	641.6	0	2406	26	Ton	47378828
1/15/2021	2021 / 07	Jan	January	Salt	17416	7.3	Material	Material	TP2J1971	D2-Bemidji	780.61	0	2406	26	Ton	47380598
1/15/2021	2021 / 07	Jan	January	Salt	17416	8.2	Material	Material	TP2J0713	D2-Bemidji	876.85	0	2406	26	Ton	47429019
1/15/2021	2021 / 07	Jan	January	Salt	17416	12	Material	Material	TP2J0024	D2-Bemidji	1283.19	0	2406	26	Ton	47378996
1/15/2021	2021 / 07	Jan	January	Salt	17416	19.42	Material	Material	TP2J0713	D2-Bemidji	2076.63	0	2406	26	Ton	47379242
1/16/2021	2021 / 07	Jan	January	Brine	0	100	Material	Material	TP2J0711	D2-Bemidji	23.57	0	2406	GA	Gallon	47395690
1/16/2021	2021 / 07	Jan	January	Brine	0	100	Material	Material	TP2J1972	D2-Bemidji	23.57	0	2406	GA	Gallon	47395632
1/16/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	1.5	Labor	Comp at 1.5 times	TP2J0711	D2-Bemidji	127.9414286	0	2406	HR	Hours	47395690
1/16/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	2	Labor	Comp at 1.5 times	TP2J1972	D2-Bemidji	170.5885714	0	2406	HR	Hours	47395632
1/16/2021	2021 / 07	Jan	January	Cl33 Plow Truck	TM205503	70	Equipment	Equipment	TP2J1971	D2-Bemidji	513.625	410.9	2406	M	Miles	47407722
1/16/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	4	Labor	Overtime	TP2J1971	D2-Bemidji	205.79	178.19	2406	HR	Hours	47407722
1/16/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	20	Equipment	Equipment	TP2J0711	D2-Bemidji	137.5	110	2406	M	Miles	47395690
1/16/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	30	Equipment	Equipment	TP2J1972	D2-Bemidji	206.25	165	2406	M	Miles	47395632
1/16/2021	2021 / 07	Jan	January	Larson, Todd	1012600	4.25	Labor	Overtime	TP2J0024	D2-Bemidji	236.419	204.714	2406	HR	Hours	47394125
1/16/2021	2021 / 07	Jan	January	Plow Truck	TM207509	80	Equipment	Equipment	TP2J0024	D2-Bemidji	587	469.6	2406	M	Miles	47394125
1/16/2021	2021 / 07	Jan	January	Plow Truck	TM208556	55	Equipment	Equipment	TP2J0713	D2-Bemidji	378.125	302.5	2406	M	Miles	47396670
1/16/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	3	Labor	Overtime	TP2J0713	D2-Bemidji	154.335	133.635	2406	HR	Hours	47396670
1/16/2021	2021 / 07	Jan	January	Salt	17416	4	Material	Material	TP2J0024	D2-Bemidji	427.73	0	2406	26	Ton	47394125
1/16/2021	2021 / 07	Jan	January	Salt	17416	5	Material	Material	TP2J0711	D2-Bemidji	534.66	0	2406	26	Ton	47395690
1/16/2021	2021 / 07	Jan	January	Salt	17416	6	Material	Material	TP2J1972	D2-Bemidji	641.6	0	2406	26	Ton	47395632
1/16/2021	2021 / 07	Jan	January	Salt	17416	10	Material	Material	TP2J1971	D2-Bemidji	1069.33	0	2406	26	Ton	47407722
1/16/2021	2021 / 07	Jan	January	Salt	17416	13	Material	Material	TP2J0713	D2-Bemidji	1390.12	0	2406	26	Ton	47396670
1/19/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	4	Labor	Regular	TP2J0024	D2-Bemidji	255.4161111	168.6061111	2406	HR	Hours	47415186
1/19/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	255.4161111	168.6061111	2406	HR	Hours	47415173
1/19/2021	2021 / 07	Jan	January	Chevrolet 3500hd 2wd Crew Cab	TM215832	20	Equipment	Equipment	TP2J1972	D2-Bemidji	29.25	23.4	2415	M	Miles	47429106
1/19/2021	2021 / 07	Jan	January	Erickson, Ryan	1183737	4	Labor	Regular	TP2J0024	D2-Bemidji	217.4131034	144.4565517	2415	HR	Hours	47410919
1/19/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J1972	D2-Bemidji	69.96	46.18166667	2415	HR	Hours	47429106
1/19/2021	2021 / 07	Jan	January	International 7500 Single	TM212504	50	Equipment	Equipment	TP2J0024	D2-Bemidji	366.875	293.5	2406	M	Miles	47415186
1/19/2021	2021 / 07	Jan	January	International 7500 Single	TM212504	50	Equipment	Equipment	TP2J1971	D2-Bemidji	366.875	293.5	2406	M	Miles	47415173
1/19/2021	2021 / 07	Jan	January	Ronning, Mark	1191899	2	Labor	Regular	TP2J1972	D2-Bemidji	125.2054135	82.65082707	2415	HR	Hours	47429170
1/19/2021	2021 / 07	Jan	January	Salt	17416	3	Material	Material	TP2J0024	D2-Bemidji	320.8	0	2406	26	Ton	47415186
1/19/2021	2021 / 07	Jan	January	Salt	17416	3	Material	Material	TP2J1971	D2-Bemidji	320.8	0	2406	26	Ton	47415173
1/20/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.829	337.208	2415	HR	Hours	47438933
1/20/2021	2021 / 07	Jan	January	Brine	0	10	Material	Material	TP2J0713	D2-Bemidji	2.36	0	2406	GA	Gallon	47445317
1/20/2021	2021 / 07	Jan	January	Brine	0	20	Material	Material	TP2J0024	D2-Bemidji	4.71	0	2406	GA	Gallon	47445316
1/20/2021	2021 / 07	Jan	January	Brine	0	30	Material	Material	TP2J1972	D2-Bemidji	7.07	0	2406	GA	Gallon	47445314
1/20/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	8	Labor	Regular	TP2J1972	D2-Bemidji	417.6840876	275.7232117	2415	HR	Hours	47438906
1/20/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	1	Labor	Regular	TP2J0713	D2-Bemidji	34.97925	23.09075	2406	HR	Hours	47445317
1/20/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J0024	D2-Bemidji	69.9585	46.1815	2406	HR	Hours	47445316
1/20/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J1972	D2-Bemidji	69.9585	46.1815	2406	HR	Hours	47445314
1/20/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	511.2461745	337.4872483	2410	HR	Hours	47438909
1/20/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	465.8622222	307.53	2415	HR	Hours	47438969
1/20/2021	2021 / 07	Jan	January	John Deere 772g Motor Grader	TM217308	5	Equipment	Equipment	TP2J1971	D2-Bemidji	618.3125	494.65	2410	HR	Hours	47438909
1/20/2021	2021 / 07	Jan	January	Plow Truck	TM207509	24	Equipment	Equipment	TP2J0713	D2-Bemidji	176.1	140.88	2406	M	Miles	47445317
1/20/2021	2021 / 07	Jan	January	Plow Truck	TM207509	45	Equipment	Equipment	TP2J0024	D2-Bemidji	330.1875	264.15	2406	M	Miles	47445316
1/20/2021	2021 / 07	Jan	January	Plow Truck	TM207509	45	Equipment	Equipment	TP2J1972	D2-Bemidji	330.1875	264.15	2406	M	Miles	47445314
1/20/2021	2021 / 07	Jan	January	S&I Winter Mix	30895	1	Material	Material	TP2J0713	D2-Bemidji	29.8	0	2406	26	Ton	47445317
1/20/2021	2021 / 07	Jan	January	S&I Winter Mix	30895	2	Material	Material	TP2J0024	D2-Bemidji	59.59	0	2406	26	Ton	47445316
1/20/2021	2021 / 07	Jan	January	S&I Winter Mix	30895	2	Material	Material	TP2J1972	D2-Bemidji	59.59	0	2406	26	Ton	47445314
1/20/2021	2021 / 07	Jan	January	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.9461818	336.6283636	2415	HR	Hours	47430447
1/21/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	7	Labor	Regular	TP2J1971	D2-Bemidji	446.975375	295.057	2406	HR	Hours	47444027
1/21/2021	2021 / 07	Jan	January	Brine	0	200	Material	Material	TP2J1971	D2-Bemidji	47.14	0	2406	GA	Gallon	47444027
1/21/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	2	Labor	Regular	TP2J1971	D2-Bemidji	104.4210219	68.93080292	2415	HR	Hours	47444079
1/21/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	6	Labor	Regular	TP2J0024	D2-Bemidji	209.8755	138.5445	2415	HR	Hours	47445319
1/21/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	4.5	Labor	Regular	TP2J1971	D2-Bemidji	287.5759732	189.8365772	2410	HR	Hours	47443059
1/21/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	465.8622222	307.53	2406	HR	Hours	47444116
1/21/2021	2021 / 07	Jan	January	International 7500 Single	TM212504	52	Equipment	Equipment	TP2J1971	D2-Bemidji	381.55	305.24	2406	M	Miles	47444027
1/21/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM217553	105	Equipment	Equipment	TP2J0024	D2-Bemidji	721.875	577.5	2406	M	Miles	47443715
1/21/2021	2021 / 07	Jan	January	Plow Truck	TM208556	99	Equipment	Equipment	TP2J0713	D2-Bemidji	680.625	544.5	2406	M	Miles	47444116
1/21/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	8	Labor	Regular	TP2J0024	D2-Bemidji	510.721	337.142	2406	HR	Hours	47443715
1/21/2021	2021 / 07	Jan	January	Ronning, Mark	1191899	4	Labor	Regular	TP2J0024	D2-Bemidji	250.4091275	165.3014765	2415	HR	Hours	47472448
1/21/2021	2021 / 07	Jan	January	Salt	17416	2.5	Material	Material	TP2J0024	D2-Bemidji	267.33	0	2406	26	Ton	47443715
1/21/2021	2021 / 07	Jan	January	Salt	17416	2.58	Material	Material	TP2J0713	D2-Bemidji	275.89	0	2406	26	Ton	47444116
1/21/2021	2021 / 07	Jan	January	Salt	17416	6	Material	Material	TP2J1971	D2-Bemidji	641.6	0	2406	26	Ton	47444027
1/21/2021	2021 / 07	Jan	January	Volvo L90g Wheel Loader	TM215522	1	Equipment	Equipment	TP2J1971	D2-Bemidji	102.075	81.66	2410	HR	Hours	47443059
1/22/2021	2021 / 07	Jan	January	Brekke, Jordan	1208535	8	Labor	Regular	TP2J1971	D2-Bemidji	360.6755556	238.0877778	2410	HR	Hours	47450256
1/22/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	511.2461745	337.4872483	2415	HR	Hours	47449901
1/22/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J1971	D2-Bemidji	465.8622222	307.53	2410	HR	Hours	47459176
1/22/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	8	Labor	Regular	TP2J0024	D2-Bemidji	510.721	337.142	2415	HR	Hours	47450331
1/23/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	3	Labor	Comp at 1.5 times	TP2J1971	D2-Bemidji	255.9082759	0	2406	HR	Hours	47453793
1/23/2021	2021 / 07	Jan	January	Brine	0	330	Material	Material	TP2J1971	D2-Bemidji	77.78	0	2406	GA	Gallon	47459282
1/23/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	2	Labor	Comp at 1.5 times	TP2J1971	D2-Bemidji	170.6070588	0	2406	HR	Hours	47459282
1/23/2021	2021 / 07	Jan	January	Cl33 Plow Truck	TM205503	91	Equipment	Equipment	TP2J0024	D2-Bemidji	667.7125	534.17	2406	M	Miles	47453249
1/23/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	4	Labor	Overtime	TP2J0024	D2-Bemidji	206.0195122	178.3921951	2406	HR	Hours	47453249
1/23/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	3.5	Labor	Overtime	TP2J0713	D2-Bemidji	160.1107407	138.6388889	2406	HR	Hours	47459241
1/23/2021	2021 / 07	Jan	January	International 7500 Single	TM212504	30	Equipment	Equipment	TP2J1971	D2-Bemidji	220.125	176.1	2406	M	Miles	47453793
1/23/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	50	Equipment	Equipment	TP2J1971	D2-Bemidji	343.75	275	2406	M	Miles	47459282
1/23/2021	2021 / 07	Jan	January	Larson, Todd	1012600	1.5	Labor	Overtime	TP2J0024	D2-Bemidji	83.47058824	72.27794118	2406	HR	Hours	47453510
1/23/2021	2021 / 07	Jan	January	Larson, Todd	1012600	3	Labor	Overtime	TP2J1971	D2-Bemidji	166.9411765	144.5558824	2406	HR	Hours	47453492

Work Item Date	Fiscal Month	Month Abbr	Fiscal Month Name	Resource Name	Resource ID	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project Id	District Name	Estimated Project Full Cost	Estimated Direct Cost	Source Type Code	Unit Of Measure Code	Unit Of Measure Name	RCA Timesheet Work Item Id
1/23/2021	2021 / 07	Jan	January	Plow Truck	TM207509	30	Equipment	Equipment	TP2J1971	D2-Bemidji	220.125	176.1	2406	M	Miles	47453492
1/23/2021	2021 / 07	Jan	January	Plow Truck	TM207509	50	Equipment	Equipment	TP2J0024	D2-Bemidji	366.875	293.5	2406	M	Miles	47453510
1/23/2021	2021 / 07	Jan	January	Plow Truck	TM208556	160	Equipment	Equipment	TP2J0713	D2-Bemidji	1100	880	2406	M	Miles	47459241
1/23/2021	2021 / 07	Jan	January	Salt	17416	1	Material	Material	TP2J0024	D2-Bemidji	106.93	0	2406	26	Ton	47453510
1/23/2021	2021 / 07	Jan	January	Salt	17416	2	Material	Material	TP2J0713	D2-Bemidji	213.87	0	2406	26	Ton	47459241
1/23/2021	2021 / 07	Jan	January	Salt	17416	3	Material	Material	TP2J0024	D2-Bemidji	320.8	0	2406	26	Ton	47453249
1/23/2021	2021 / 07	Jan	January	Salt	17416	3.5	Material	Material	TP2J1971	D2-Bemidji	374.26	0	2406	26	Ton	47459282
1/23/2021	2021 / 07	Jan	January	Salt	17416	4	Material	Material	TP2J1971	D2-Bemidji	427.73	0	2406	26	Ton	47453492
1/23/2021	2021 / 07	Jan	January	Salt	17416	6	Material	Material	TP2J1971	D2-Bemidji	641.6	0	2406	26	Ton	47453793
1/24/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	3.5	Labor	Comp at 1.5 times	TP2J1971	D2-Bemidji	298.5596552	0	2406	HR	Hours	47453856
1/24/2021	2021 / 07	Jan	January	Brine	0	50	Material	Material	TP2J0024	D2-Bemidji	11.79	0	2406	GA	Gallon	47454682
1/24/2021	2021 / 07	Jan	January	Brine	0	120	Material	Material	TP2J0713	D2-Bemidji	28.28	0	2406	GA	Gallon	47459274
1/24/2021	2021 / 07	Jan	January	Brine	0	200	Material	Material	TP2J0711	D2-Bemidji	47.14	0	2406	GA	Gallon	47459350
1/24/2021	2021 / 07	Jan	January	Brine	0	200	Material	Material	TP2J1972	D2-Bemidji	47.14	0	2406	GA	Gallon	47459337
1/24/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	2	Labor	Comp at 1.5 times	TP2J1972	D2-Bemidji	170.6070588	0	2406	HR	Hours	47459337
1/24/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	3	Labor	Comp at 1.5 times	TP2J0711	D2-Bemidji	255.9105882	0	2406	HR	Hours	47459350
1/24/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	5	Labor	Overtime	TP2J0713	D2-Bemidji	228.7296296	198.0555556	2406	HR	Hours	47459274
1/24/2021	2021 / 07	Jan	January	International 7500 Single	TM212504	50	Equipment	Equipment	TP2J1971	D2-Bemidji	366.875	293.5	2406	M	Miles	47453856
1/24/2021	2021 / 07	Jan	January	International 7500 Single	TM212505	60	Equipment	Equipment	TP2J0024	D2-Bemidji	440.25	352.2	2406	M	Miles	47454682
1/24/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	55	Equipment	Equipment	TP2J1972	D2-Bemidji	378.125	302.5	2406	M	Miles	47459337
1/24/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM216561	65	Equipment	Equipment	TP2J0711	D2-Bemidji	446.875	357.5	2406	M	Miles	47459350
1/24/2021	2021 / 07	Jan	January	Larson, Todd	1012600	1.5	Labor	Overtime	TP2J0713	D2-Bemidji	83.47058824	72.27794118	2406	HR	Hours	47453572
1/24/2021	2021 / 07	Jan	January	Larson, Todd	1012600	5	Labor	Overtime	TP2J0024	D2-Bemidji	278.2352941	240.9264706	2406	HR	Hours	47453562
1/24/2021	2021 / 07	Jan	January	O'Brien, Kelly	136908	3	Labor	Comp at 1.5 times	TP2J0024	D2-Bemidji	276	0	2406	HR	Hours	47454682
1/24/2021	2021 / 07	Jan	January	Plow Truck	TM207509	30	Equipment	Equipment	TP2J0713	D2-Bemidji	220.125	176.1	2406	M	Miles	47453572
1/24/2021	2021 / 07	Jan	January	Plow Truck	TM207509	120	Equipment	Equipment	TP2J0024	D2-Bemidji	880.5	704.4	2406	M	Miles	47453562
1/24/2021	2021 / 07	Jan	January	Plow Truck	TM208556	147	Equipment	Equipment	TP2J0713	D2-Bemidji	1010.625	808.5	2406	M	Miles	47459274
1/24/2021	2021 / 07	Jan	January	S&I Winter Mix	30895	1	Material	Material	TP2J0713	D2-Bemidji	29.8	0	2406	26	Ton	47453572
1/24/2021	2021 / 07	Jan	January	S&I Winter Mix	30895	1.6	Material	Material	TP2J0024	D2-Bemidji	47.67	0	2406	26	Ton	47454682
1/24/2021	2021 / 07	Jan	January	S&I Winter Mix	30895	3	Material	Material	TP2J0024	D2-Bemidji	89.38	0	2406	26	Ton	47453562
1/24/2021	2021 / 07	Jan	January	Salt	17416	1	Material	Material	TP2J0713	D2-Bemidji	106.93	0	2406	26	Ton	47453572
1/24/2021	2021 / 07	Jan	January	Salt	17416	1.6	Material	Material	TP2J0024	D2-Bemidji	171.09	0	2406	26	Ton	47454682
1/24/2021	2021 / 07	Jan	January	Salt	17416	3	Material	Material	TP2J0024	D2-Bemidji	320.8	0	2406	26	Ton	47453562
1/24/2021	2021 / 07	Jan	January	Salt	17416	7	Material	Material	TP2J0711	D2-Bemidji	748.53	0	2406	26	Ton	47459350
1/24/2021	2021 / 07	Jan	January	Salt	17416	7.5	Material	Material	TP2J1972	D2-Bemidji	802	0	2406	26	Ton	47459337
1/24/2021	2021 / 07	Jan	January	Salt	17416	9.1	Material	Material	TP2J1971	D2-Bemidji	973.09	0	2406	26	Ton	47453856
1/24/2021	2021 / 07	Jan	January	Salt	17416	13.5	Material	Material	TP2J0713	D2-Bemidji	1443.59	0	2406	26	Ton	47459274
1/25/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	255.4145	168.604	2415	HR	Hours	47459379
1/25/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	255.4145	168.604	2415	HR	Hours	47459400
1/25/2021	2021 / 07	Jan	January	Brine	0	50	Material	Material	TP2J0713	D2-Bemidji	11.79	0	2406	GA	Gallon	47459287
1/25/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	4	Labor	Regular	TP2J0024	D2-Bemidji	139.917	92.363	2410	HR	Hours	47481772
1/25/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	2	Labor	Regular	TP2J1971	D2-Bemidji	127.8115436	84.37181208	2410	HR	Hours	47465934
1/25/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	465.8622222	307.53	2406	HR	Hours	47459287
1/25/2021	2021 / 07	Jan	January	International 7500 Single	TM212505	18	Equipment	Equipment	TP2J0024	D2-Bemidji	132.075	105.66	2410	M	Miles	47481772
1/25/2021	2021 / 07	Jan	January	Plow Truck	TM207509	25	Equipment	Equipment	TP2J1971	D2-Bemidji	183.4375	146.75	2410	M	Miles	47459379
1/25/2021	2021 / 07	Jan	January	Plow Truck	TM208556	110	Equipment	Equipment	TP2J0713	D2-Bemidji	756.25	605	2406	M	Miles	47459287
1/25/2021	2021 / 07	Jan	January	Salt	17416	2	Material	Material	TP2J1971	D2-Bemidji	213.87	0	2410	26	Ton	47459379
1/25/2021	2021 / 07	Jan	January	Salt	17416	2.09	Material	Material	TP2J0713	D2-Bemidji	223.49	0	2406	26	Ton	47459287
1/26/2021	2021 / 07	Jan	January	Bellefy, Dale	1060028	8	Labor	Regular	TP2J1971	D2-Bemidji	270.083	179.56	2410	HR	Hours	47466773
1/26/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.829	337.208	2410	HR	Hours	47472734
1/26/2021	2021 / 07	Jan	January	Brekke, Jordan	1208535	8	Labor	Regular	TP2J1971	D2-Bemidji	360.6755556	238.0877778	2410	HR	Hours	47472782
1/26/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	8	Labor	Regular	TP2J1971	D2-Bemidji	417.6840876	275.7232117	2410	HR	Hours	47473300
1/26/2021	2021 / 07	Jan	January	Chevrolet 3500hd 2wd Crew Cab	TM215832	25	Equipment	Equipment	TP2J1971	D2-Bemidji	36.5625	29.25	2410	M	Miles	47472734
1/26/2021	2021 / 07	Jan	January	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J0024	D2-Bemidji	69.9585	46.1815	2415	HR	Hours	47481775
1/26/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J1971	D2-Bemidji	465.8622222	307.53	2410	HR	Hours	47473214
1/26/2021	2021 / 07	Jan	January	International 7600 Tandem	TM211555	50	Equipment	Equipment	TP2J1971	D2-Bemidji	343.75	275	2410	M	Miles	47473308
1/26/2021	2021 / 07	Jan	January	Mathiowetz, Paul	1208763	8	Labor	Regular	TP2J1971	D2-Bemidji	306.423	202.276	2410	HR	Hours	47473308
1/26/2021	2021 / 07	Jan	January	Plow Truck	TM203572	54	Equipment	Equipment	TP2J1971	D2-Bemidji	371.25	297	2410	M	Miles	47466773
1/26/2021	2021 / 07	Jan	January	Plow Truck	TM207570	50	Equipment	Equipment	TP2J1971	D2-Bemidji	343.75	275	2410	M	Miles	47472782
1/26/2021	2021 / 07	Jan	January	Plow Truck	TM208556	120	Equipment	Equipment	TP2J1971	D2-Bemidji	825	660	2410	M	Miles	47473214
1/26/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	8	Labor	Regular	TP2J1971	D2-Bemidji	510.721	337.142	2410	HR	Hours	47462393
1/26/2021	2021 / 07	Jan	January	Volvo L90g Wheel Loader	TM215522	8	Equipment	Equipment	TP2J1971	D2-Bemidji	816.6	653.28	2410	HR	Hours	47462393
1/27/2021	2021 / 07	Jan	January	Bellefy, Dale	1060028	4	Labor	Regular	TP2J1971	D2-Bemidji	135.0415	89.78	2410	HR	Hours	47472730
1/27/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	255.4145	168.604	2410	HR	Hours	47472743
1/27/2021	2021 / 07	Jan	January	Burnham, Justin	1164802	8	Labor	Regular	TP2J1971	D2-Bemidji	417.6840876	275.7232117	2410	HR	Hours	47473301
1/27/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	4	Labor	Regular	TP2J1971	D2-Bemidji	255.3605	168.571	2410	HR	Hours	47475983
1/27/2021	2021 / 07	Jan	January	Volvo L90g Wheel Loader	TM215522	4	Equipment	Equipment	TP2J1971	D2-Bemidji	408.3	326.64	2410	HR	Hours	47475983
1/29/2021	2021 / 07	Jan	January	Ford F350 4wd Supercab	TM220255	50	Equipment	Equipment	TP2J1971	D2-Bemidji	62.5	50	2410	M	Miles	47488647
1/29/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	8	Labor	Regular	TP2J1971	D2-Bemidji	465.8622222	307.53	2410	HR	Hours	47488647
1/29/2021	2021 / 07	Jan	January	Reese, Dustin	1149297	8	Labor	Regular	TP2J1971	D2-Bemidji	510.721	337.142	2410	HR	Hours	47486688
1/29/2021	2021 / 07	Jan	January	Ventrac 4500z Tractor	TM219118	8	Equipment	Equipment	TP2J1971	D2-Bemidji	615.4	492.32	2410	HR	Hours	47488647
1/30/2021	2021 / 07	Jan	January	Brine	0	25	Material	Material	TP2J0024	D2-Bemidji	5.89	0	2406	GA	Gallon	47496004
1/30/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	1	Labor	Overtime	TP2J0024	D2-Bemidji	51.50487805	44.59804878	2406	HR	Hours	47496004
1/30/2021	2021 / 07	Jan	January	Intl 7600 Tandem Plow Truck	TM215562	25	Equipment	Equipment	TP2J0024	D2-Bemidji	171.875	137.5	2406	M	Miles	47496004
1/30/2021	2021 / 07	Jan	January	Salt	17416	2	Material	Material	TP2J0024	D2-Bemidji	213.87	0	2406	26	Ton	47496004
1/31/2021	2021 / 07	Jan	January	Beet Heet	Z1614	135	Material	Material	TP2J0024	D2-Bemidji	287.55	0	2406	GA	Gallon	47495640
1/31/2021	2021 / 07	Jan	January	Bitker, Steven	1135962	5	Labor	Comp at 1.5 times	TP2J1971	D2-Bemidji	426.5137931	0	2406	HR	Hours	47494934
1/31/2021	2021 / 07	Jan	January	Brine	0	75	Material	Material	TP2J0024	D2-Bemidji	17.68	0	2406	GA	Gallon	47496167
1/31/2021	2021 / 07	Jan	January	Brine	0	133	Material	Material	TP2J0711	D2-Bemidji	31.35	0	2406	GA	Gallon	47495676
1/31/2021	2021 / 07	Jan	January	Brine	0	133	Material	Material	TP2J1972	D2-Bemidji	31.35	0	2406	GA	Gallon	47495664
1/31/2021	2021 / 07	Jan	January	Brine	0	160	Material	Material	TP2J0713	D2-Bemidji	37.71	0	2406	GA	Gallon	47513053
1/31/2021	2021 / 07	Jan	January	Brine	0	200	Material	Material	TP2J1971	D2-Bemidji	47.14	0	2406	GA	Gallon	47494934
1/31/2021	2021 / 07	Jan	January	Brine	0	266	Material	Material	TP2J0024	D2-Bemidji	62.7	0	2406	GA	Gallon	47495640
1/31/2021	2021 / 07	Jan	January	CI33 Plow Truck	TM205503	100	Equipment	Equipment	TP2J0024	D2-Bemidji	733.75	587	2406	M	Miles	47496167
1/31/2021	2021 / 07	Jan	January	Erickson, Ryan	1183737	1	Labor	Comp at 1.5 times	TP2J0711	D2-Bemidji	88.35666667	0	2406	HR	Hours	47495676
1/31/2021	2021 / 07	Jan	January	Erickson, Ryan	1183737	1	Labor	Comp at 1.5 times	TP2J1972	D2-Bemidji	88.35666667	0	2406	HR	Hours	47495664
1/31/2021	2021 / 07	Jan	January	Erickson, Ryan	1183737	3	Labor	Comp at 1.5 times	TP2J0024	D2-Bemidji	265.07	0	2406	HR	Hours	47495640
1/31/2021	2021 / 07	Jan	January	Frenzel, Christopher	607258	4	Labor	Overtime	TP2J0024	D2-Bemidji	206.0195122	178.3921951	2406	HR	Hours	47496167
1/31/2021	2021 / 07	Jan	January	Hannem, Brady	1200011	5	Labor	Overtime	TP2J0713	D2-Bemidji	228.7296296	198.0555556	2406	HR	Hours	47513053
1/31/2021	2021 / 07	Jan	January	International 7500 Single	TM212504	79	Equipment	Equipment	TP2J1971	D2-Bemidji	579.6625	463.73	2406	M	Miles	47494934
1/31/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM217553	29	Equipment	Equipment	TP2J0711	D2-Bemidji	199.375	159.5	2406	M	Miles	47495676
1/31/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM217553	29	Equipment	Equipment	TP2J1972	D2-Bemidji	199.375	159.5	2406	M	Miles	47495664
1/31/2021	2021 / 07	Jan	January	International 7600 Tandem Axle	TM217553	58	Equipment	Equipment	TP2J0024	D2-Bemidji	398.75	319	2406	M	Miles	47495640
1/31/2021	2021 / 07	Jan	January	Plow Truck	TM208556	147	Equipment	Equipment	TP2J0713	D2-Bemidji	1010.625	808.5	2406	M	Miles	47513053
1/31/2021	2021 / 07	Jan	January	Salt	17416	3.9	Material	Material	TP2J0711	D2-Bemidji	417.04	0	2406	26	Ton	47495676
1/31/2021	2021 / 07	Jan	January	Salt	17416	3.9	Material	Material	TP2J1972	D2-Bemidji	417.04	0	2406	26	Ton	47495664
1/31/2021	2021 / 07	Jan	January	Salt	17416	6.8	Material	Material	TP2J0024	D2-Bemidji	727.14	0	2406	26	Ton	47495640
1/31/2021	2021 / 07	Jan	January	Salt	17416	8	Material	Material	TP2J1971	D2-Bemidji	855.46	0	2406	26	Ton	47494934
1/31/2021	2021 / 07	Jan	January	Salt	17416	8.14	Material	Material	TP2J0713	D2-Bemidji	870.43	0	2406	26	Ton	47513053
1/31/2021	2021 / 07	Jan	January	Salt	17416	8.5	Material	Material	TP2J0024	D2-Bemidji	908.93	0	2406	26	Ton	47496167
2/1/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	255.4145	168.604	2410	HR	Hours	47514049
2/1/2021	2021 / 08	Feb	February	Burnham, Justin	1164802	5	Labor	Regular	TP2J1972	D2-Bemidji	261.0525547	172.3270073	2410	HR	Hours	47512444
2/1/2021	2021 / 08	Feb	February	International 7500 Single	TM212504	22	Equipment	Equipment	TP2J1971	D2-Bemidji	161.425	129.14	2410	M	Miles	47514049
2/1/2021	2021 / 08	Feb	February	International 7600 Tandem Axle	TM216561	45	Equipment	Equipment	TP2J1972	D2-Bemidji	309.375	247.5	2410	M	Miles	47512444
2/1/2021	2021 / 08	Feb	February	International 7600 Tandem Axle	TM217553	130	Equipment	Equipment	TP2J0024	D2-Bemidji	893.75	715	2410	M	Miles	47500858
2/1/2021	2021 / 08	Feb	February	Reese, Dustin	1149297	8	Labor	Regular	TP2J0024	D2-Bemidji	510.721	337.142	2410	HR	Hours	47500858
2/1/2021	2021 / 08	Feb	February	Salt	17416	0.5	Material	Material	TP2J1971	D2-Bemidji	53.47	0	2410	26	Ton	47514049
2/2/2021	2021 / 08	Feb	February	Vleck, Alan	1168832	7.5	Labor	Regular	TP2J0024	D2-Bemidji	478.0745455	315.5890909	2415	HR	Hours	47508833
2/4/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	0.5	Labor	Regular	TP2J1972	D2-Bemidji	31.9268125	21.0755	2406	HR	Hours	47567235
2/4/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	7	Labor	Regular	TP2J1971	D2-Bemidji	446.975375	295.057	2406	HR	Hours	47567202
2/4/2021	2021 / 08	Feb	February	Brine	0	10	Material	Material	TP2J1972	D2-Bemidji	2.36	0	2406	GA	Gallon	47567235
2/4/2021	2021 / 08	Feb	February	Brine	0	30	Material	Material	TP2J0024	D2-Bemidji	7.07	0	2406	GA	Gallon	47592054

Work Item Date	Fiscal Month	Month Abbr	Fiscal Month Name	Resource Name	Resource ID	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project Id	District Name	Estimated Project Full Cost	Estimated Direct Cost	Source Type Code	Unit Of Measure Code	Unit Of Measure Name	RCA Timesheet Work Item Id
2/4/2021	2021 / 08	Feb	February	Brine	0	160	Material	Material	TP2J0713	D2-Bemidji	37.71	0	2406	GA	Gallon	47556420
2/4/2021	2021 / 08	Feb	February	Brine	0	200	Material	Material	TP2J0024	D2-Bemidji	47.14	0	2406	GA	Gallon	47569244
2/4/2021	2021 / 08	Feb	February	Brine	0	200	Material	Material	TP2J1971	D2-Bemidji	47.14	0	2406	GA	Gallon	47567202
2/4/2021	2021 / 08	Feb	February	Brine	0	250	Material	Material	TP2J0024	D2-Bemidji	58.93	0	2406	GA	Gallon	47566939
2/4/2021	2021 / 08	Feb	February	Brine	0	500	Material	Material	TP2J1972	D2-Bemidji	117.85	0	2406	GA	Gallon	47566927
2/4/2021	2021 / 08	Feb	February	Burnham, Justin	1164802	4	Labor	Regular	TP2J0024	D2-Bemidji	208.8420438	137.8616058	2406	HR	Hours	47566939
2/4/2021	2021 / 08	Feb	February	Burnham, Justin	1164802	4	Labor	Regular	TP2J1972	D2-Bemidji	208.8420438	137.8616058	2406	HR	Hours	47566927
2/4/2021	2021 / 08	Feb	February	Frenzel, Christopher	607258	8	Labor	Regular	TP2J0024	D2-Bemidji	511.2461745	337.4872483	2406	HR	Hours	47569244
2/4/2021	2021 / 08	Feb	February	Hannem, Brady	1200011	5.5	Labor	Regular	TP2J0713	D2-Bemidji	320.2802778	211.426875	2406	HR	Hours	47556420
2/4/2021	2021 / 08	Feb	February	International 7500 Single	TM212504	10	Equipment	Equipment	TP2J1972	D2-Bemidji	73.375	58.7	2406	M	Miles	47567235
2/4/2021	2021 / 08	Feb	February	International 7500 Single	TM212504	100	Equipment	Equipment	TP2J1971	D2-Bemidji	733.75	587	2406	M	Miles	47567202
2/4/2021	2021 / 08	Feb	February	International 7500 Single	TM212505	212	Equipment	Equipment	TP2J0024	D2-Bemidji	1555.55	1244.44	2406	M	Miles	47592054
2/4/2021	2021 / 08	Feb	February	International 7600 Tandem Axle	TM216561	100	Equipment	Equipment	TP2J1972	D2-Bemidji	687.5	550	2406	M	Miles	47566927
2/4/2021	2021 / 08	Feb	February	International 7600 Tandem Axle	TM216561	106	Equipment	Equipment	TP2J0024	D2-Bemidji	728.75	583	2406	M	Miles	47566939
2/4/2021	2021 / 08	Feb	February	International 7600 Tandem Axle	TM217553	205	Equipment	Equipment	TP2J0024	D2-Bemidji	1409.375	1127.5	2406	M	Miles	47569244
2/4/2021	2021 / 08	Feb	February	Peterson, Alex	1027287	8	Labor	Regular	TP2J0024	D2-Bemidji	371.661	302.336	2406	HR	Hours	47592054
2/4/2021	2021 / 08	Feb	February	Plow Truck	TM208556	140	Equipment	Equipment	TP2J0713	D2-Bemidji	962.5	770	2406	M	Miles	47556420
2/4/2021	2021 / 08	Feb	February	S&I Winter Mix	30895	1	Material	Material	TP2J0024	D2-Bemidji	29.8	0	2406	26	Ton	47592054
2/4/2021	2021 / 08	Feb	February	S&I Winter Mix	30895	13	Material	Material	TP2J0713	D2-Bemidji	387.33	0	2406	26	Ton	47556420
2/4/2021	2021 / 08	Feb	February	Salt	17416	1.1	Material	Material	TP2J1972	D2-Bemidji	117.63	0	2406	26	Ton	47567235
2/4/2021	2021 / 08	Feb	February	Salt	17416	1.2	Material	Material	TP2J1972	D2-Bemidji	128.32	0	2406	26	Ton	47566927
2/4/2021	2021 / 08	Feb	February	Salt	17416	1.23	Material	Material	TP2J0024	D2-Bemidji	131.53	0	2406	26	Ton	47566939
2/4/2021	2021 / 08	Feb	February	Salt	17416	4	Material	Material	TP2J0024	D2-Bemidji	427.73	0	2406	26	Ton	47569244
2/4/2021	2021 / 08	Feb	February	Salt	17416	8.1	Material	Material	TP2J1971	D2-Bemidji	866.15	0	2406	26	Ton	47567202
2/5/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.829	337.208	2410	HR	Hours	47567271
2/5/2021	2021 / 08	Feb	February	Burnham, Justin	1164802	8	Labor	Regular	TP2J1972	D2-Bemidji	417.6840876	275.7232117	2415	HR	Hours	47566941
2/5/2021	2021 / 08	Feb	February	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	465.8622222	307.53	2415	HR	Hours	47566991
2/5/2021	2021 / 08	Feb	February	International 7500 Single	TM212504	68	Equipment	Equipment	TP2J1971	D2-Bemidji	498.95	399.16	2410	M	Miles	47567271
2/5/2021	2021 / 08	Feb	February	Salt	17416	2.2	Material	Material	TP2J1971	D2-Bemidji	235.25	0	2410	26	Ton	47567271
2/8/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.829	337.208	2415	HR	Hours	47574021
2/8/2021	2021 / 08	Feb	February	Burnham, Justin	1164802	8	Labor	Regular	TP2J0711	D2-Bemidji	417.6840876	275.7232117	2415	HR	Hours	47651273
2/8/2021	2021 / 08	Feb	February	Frenzel, Christopher	607258	2.5	Labor	Regular	TP2J0024	D2-Bemidji	159.7644295	105.4647651	2410	HR	Hours	47580490
2/8/2021	2021 / 08	Feb	February	Hannem, Brady	1200011	6.5	Labor	Regular	TP2J0713	D2-Bemidji	378.5130556	249.868125	2415	HR	Hours	47583305
2/8/2021	2021 / 08	Feb	February	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.9461818	336.6283636	2415	HR	Hours	47568886
2/9/2021	2021 / 08	Feb	February	Bellefy, Dale	1060028	4	Labor	Regular	TP2J0713	D2-Bemidji	135.0415	89.78	2410	HR	Hours	47580945
2/9/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	4	Labor	Regular	TP2J0713	D2-Bemidji	255.4145	168.604	2410	HR	Hours	47580805
2/9/2021	2021 / 08	Feb	February	Chevrolet 3500hd 2wd Crew Cab	TM215832	10	Equipment	Equipment	TP2J0713	D2-Bemidji	14.625	11.7	2410	M	Miles	47580805
2/9/2021	2021 / 08	Feb	February	Frenzel, Christopher	607258	6	Labor	Regular	TP2J0024	D2-Bemidji	383.4346309	253.1154362	2410	HR	Hours	47580501
2/9/2021	2021 / 08	Feb	February	John Deere 772g Motor Grader	TM217308	4	Equipment	Equipment	TP2J0024	D2-Bemidji	494.65	395.72	2410	HR	Hours	47580501
2/9/2021	2021 / 08	Feb	February	Reese, Dustin	1149297	4	Labor	Regular	TP2J0713	D2-Bemidji	255.3605	168.571	2410	HR	Hours	47580440
2/10/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.829	337.208	2415	HR	Hours	47587527
2/10/2021	2021 / 08	Feb	February	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	511.2461745	337.4872483	2410	HR	Hours	47587194
2/10/2021	2021 / 08	Feb	February	Hannem, Brady	1200011	6	Labor	Regular	TP2J0713	D2-Bemidji	349.3966667	230.6475	2415	HR	Hours	47585897
2/10/2021	2021 / 08	Feb	February	Reese, Dustin	1149297	6.5	Labor	Regular	TP2J0713	D2-Bemidji	414.9608125	273.927875	2415	HR	Hours	47585876
2/10/2021	2021 / 08	Feb	February	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.9461818	336.6283636	2415	HR	Hours	47582467
2/11/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	252.405625	168.605	2415	HR	Hours	47594384
2/16/2021	2021 / 08	Feb	February	Erickson, Ryan	1183737	4	Labor	Regular	TP2J0024	D2-Bemidji	218.4274074	144.1896296	2415	HR	Hours	47617194
2/23/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.8290446	337.2086624	2415	HR	Hours	47680962
2/23/2021	2021 / 08	Feb	February	International 7600 Tandem Axle	TM217553	62	Equipment	Equipment	TP2J0024	D2-Bemidji	426.25	341	2406	M	Miles	47683161
2/23/2021	2021 / 08	Feb	February	Mistic, Brett	1164990	1	Labor	Regular	TP2J0024	D2-Bemidji	46.59934211	37.79171053	2406	HR	Hours	47695435
2/23/2021	2021 / 08	Feb	February	Salt	17416	1.6	Material	Material	TP2J0024	D2-Bemidji	171.09	0	2406	26	Ton	47683161
2/23/2021	2021 / 08	Feb	February	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.9633333	336.64	2406	HR	Hours	47683161
2/25/2021	2021 / 08	Feb	February	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.8290446	337.2086624	2406	HR	Hours	47692784
2/25/2021	2021 / 08	Feb	February	Brine	0	100	Material	Material	TP2J1972	D2-Bemidji	23.57	0	2406	GA	Gallon	47761516
2/25/2021	2021 / 08	Feb	February	Brine	0	240	Material	Material	TP2J1971	D2-Bemidji	56.57	0	2406	GA	Gallon	47692784
2/25/2021	2021 / 08	Feb	February	Burnham, Justin	1164802	4	Labor	Regular	TP2J0711	D2-Bemidji	208.8411268	137.8619718	2406	HR	Hours	47761527
2/25/2021	2021 / 08	Feb	February	Burnham, Justin	1164802	4	Labor	Regular	TP2J1972	D2-Bemidji	208.8411268	137.8619718	2406	HR	Hours	47761516
2/25/2021	2021 / 08	Feb	February	Frenzel, Christopher	607258	6.5	Labor	Regular	TP2J1971	D2-Bemidji	414.9776429	273.9378571	2406	HR	Hours	47707863
2/25/2021	2021 / 08	Feb	February	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	466.4693333	307.9271111	2406	HR	Hours	47691572
2/25/2021	2021 / 08	Feb	February	International 7500 Single	TM212504 - SWENSON	60	Equipment	Equipment	TP2J1971	D2-Bemidji	440.25	352.2	2406	M	Miles	47692784
2/25/2021	2021 / 08	Feb	February	International 7600 Tandem Axle	TM216561 - Henke	35	Equipment	Equipment	TP2J0711	D2-Bemidji	240.625	192.5	2406	M	Miles	47761527
2/25/2021	2021 / 08	Feb	February	International 7600 Tandem Axle	TM216561 - Henke	65	Equipment	Equipment	TP2J1972	D2-Bemidji	446.875	357.5	2406	M	Miles	47761516
2/25/2021	2021 / 08	Feb	February	John Deere 772g Motor Grader	TM217308	6	Equipment	Equipment	TP2J1971	D2-Bemidji	741.975	593.58	2406	HR	Hours	47707863
2/25/2021	2021 / 08	Feb	February	Salt	17416	0.5	Material	Material	TP2J0713	D2-Bemidji	53.47	0	2406	26	Ton	47691572
2/25/2021	2021 / 08	Feb	February	Salt	17416	1.5	Material	Material	TP2J1972	D2-Bemidji	160.4	0	2406	26	Ton	47761516
2/25/2021	2021 / 08	Feb	February	Salt	17416	8.5	Material	Material	TP2J1971	D2-Bemidji	908.93	0	2406	26	Ton	47692784
2/25/2021	2021 / 08	Feb	February	Sterling Lt9511 Tandem Axle	TM200052	100	Equipment	Equipment	TP2J0713	D2-Bemidji	687.5	550	2406	M	Miles	47691572
3/9/2021	2021 / 09	Mar	March	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.974	336.647	2415	HR	Hours	47785646
3/10/2021	2021 / 09	Mar	March	Glen, Matthew	1212314	2.5	Labor	Overtime	TP2J0713	D2-Bemidji	135.68	117.48	2406	HR	Hours	47800620
3/10/2021	2021 / 09	Mar	March	Glen, Matthew	1212314	8	Labor	Regular	TP2J0713	D2-Bemidji	362.9611111	287.83	2406	HR	Hours	47800583
3/10/2021	2021 / 09	Mar	March	Gonzales, Pablo	1009410	3	Labor	Regular	TP2J0024	D2-Bemidji	206.6716216	136.4306757	2406	HR	Hours	47840118
3/10/2021	2021 / 09	Mar	March	International 7500 Single	TM212505	50	Equipment	Equipment	TP2J0024	D2-Bemidji	366.875	293.5	2406	M	Miles	47840118
3/11/2021	2021 / 09	Mar	March	Bitker, Steven	1135962	1	Labor	Regular	TP2J1972	D2-Bemidji	63.853625	42.151375	2406	HR	Hours	47807884
3/11/2021	2021 / 09	Mar	March	Bitker, Steven	1135962	2	Labor	Regular	TP2J0713	D2-Bemidji	127.0725	84.30275	2406	HR	Hours	47807821
3/11/2021	2021 / 09	Mar	March	Bitker, Steven	1135962	5	Labor	Regular	TP2J1971	D2-Bemidji	319.268125	210.756875	2406	HR	Hours	47807781
3/11/2021	2021 / 09	Mar	March	Brine	0	20	Material	Material	TP2J1972	D2-Bemidji	4.71	0	2406	GA	Gallon	47807884
3/11/2021	2021 / 09	Mar	March	Brine	0	50	Material	Material	TP2J1972	D2-Bemidji	11.79	0	2410	GA	Gallon	47806376
3/11/2021	2021 / 09	Mar	March	Brine	0	55	Material	Material	TP2J0713	D2-Bemidji	12.96	0	2406	GA	Gallon	47807821
3/11/2021	2021 / 09	Mar	March	Brine	0	180	Material	Material	TP2J1971	D2-Bemidji	42.43	0	2406	GA	Gallon	47807781
3/11/2021	2021 / 09	Mar	March	Durgin, Ryan	351871	5	Labor	Regular	TP2J0713	D2-Bemidji	235.685625	188.98	2406	HR	Hours	47815711
3/11/2021	2021 / 09	Mar	March	Fredrickson, Troy	1208509	1	Labor	Regular	TP2J0024	D2-Bemidji	34.97909677	23.09070968	2410	HR	Hours	47806377
3/11/2021	2021 / 09	Mar	March	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J1972	D2-Bemidji	69.95819355	46.18141935	2410	HR	Hours	47806376
3/11/2021	2021 / 09	Mar	March	Frenzel, Christopher	607258	2	Labor	Regular	TP2J0713	D2-Bemidji	125.0832432	84.28837838	2406	HR	Hours	47812759
3/11/2021	2021 / 09	Mar	March	Frenzel, Christopher	607258	2	Labor	Regular	TP2J1971	D2-Bemidji	125.0832432	84.28837838	2406	HR	Hours	47812748
3/11/2021	2021 / 09	Mar	March	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	466.4702158	307.9286331	2406	HR	Hours	47835184
3/11/2021	2021 / 09	Mar	March	International 7500 Single	TM212504	11	Equipment	Equipment	TP2J1972	D2-Bemidji	80.7125	64.57	2406	M	Miles	47807884
3/11/2021	2021 / 09	Mar	March	International 7500 Single	TM212504	25	Equipment	Equipment	TP2J0713	D2-Bemidji	183.4375	146.75	2406	M	Miles	47807821
3/11/2021	2021 / 09	Mar	March	International 7500 Single	TM212504	90	Equipment	Equipment	TP2J1971	D2-Bemidji	660.375	528.3	2406	M	Miles	47807781
3/11/2021	2021 / 09	Mar	March	International 7500 Single	TM212505	20	Equipment	Equipment	TP2J0024	D2-Bemidji	146.75	117.4	2410	M	Miles	47806377
3/11/2021	2021 / 09	Mar	March	International 7500 Single	TM212505	35	Equipment	Equipment	TP2J1972	D2-Bemidji	256.8125	205.45	2410	M	Miles	47806376
3/11/2021	2021 / 09	Mar	March	John Deere 772g Motor Grader	TM217308	2	Equipment	Equipment	TP2J0713	D2-Bemidji	247.325	197.86	2406	HR	Hours	47812759
3/11/2021	2021 / 09	Mar	March	John Deere 772g Motor Grader	TM217308	2	Equipment	Equipment	TP2J1971	D2-Bemidji	247.325	197.86	2406	HR	Hours	47812748
3/11/2021	2021 / 09	Mar	March	Plow Truck	TM208556	120	Equipment	Equipment	TP2J0713	D2-Bemidji	825	660	2406	M	Miles	47835184
3/11/2021	2021 / 09	Mar	March	Salt	17416	3.6	Material	Material	TP2J1972	D2-Bemidji	384.96	0	2406	26	Ton	47807884
3/11/2021	2021 / 09	Mar	March	Salt	17416	5.4	Material	Material	TP2J0713	D2-Bemidji	577.44	0	2406	26	Ton	47807821
3/11/2021	2021 / 09	Mar	March	Salt	17416	5.8	Material	Material	TP2J1971	D2-Bemidji	620.21	0	2406	26	Ton	47807781
3/11/2021	2021 / 09	Mar	March	Salt	17416	10	Material	Material	TP2J0713	D2-Bemidji	1069.33	0	2406	26	Ton	47835184
3/12/2021	2021 / 09	Mar	March	Bitker, Steven	1135962	8	Labor	Regular	TP2J1971	D2-Bemidji	510.829	337.211	2415	HR	Hours	47813034
3/12/2021	2021 / 09	Mar	March	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	500.332973	337.1535135	2415	HR	Hours	47812816
3/12/2021	2021 / 09	Mar	March	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.974	336.647	2415	HR	Hours	47806801
3/15/2021	2021 / 09	Mar	March	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.974	336.647	2415	HR	Hours	47815567
3/16/2021	2021 / 09	Mar	March	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J1972	D2-Bemidji	69.95819355	46.18141935	2415	HR	Hours	47864720
3/22/2021	2021 / 09	Mar	March	Brekke, Jordan	1208535	8	Labor	Regular	TP2J1971	D2-Bemidji	347.084	238.091	2415	HR	Hours	47890155
3/22/2021	2021 / 09	Mar	March	Dodge Grand Caravan	TM218215	35	Equipment	Equipment	TP2J1971	D2-Bemidji	27.125	21.7	2415	M	Miles	47890274
3/22/2021	2021 / 09	Mar	March	Fredrickson, Troy	1208509	2	Labor	Regular	TP2J1971	D2-Bemidji	69.9595	46.18175	2415	HR	Hours	47891704
3/22/2021	2021 / 09	Mar	March	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	510.7685714	337.1842857	2415	HR	Hours	47890274
3/22/2021	2021 / 09	Mar	March	Hannem, Brady	1200011	8	Labor	Regular	TP2J1971	D2-Bemidji	466.5130375	307.9535836	2415	HR	Hours	47890346
3/24/2021	2021 / 09	Mar	March	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	510.7685714	337.1842857	2415	HR	Hours	47921790
3/26/2021	2021 / 09	Mar	March	Hannem, Brady	1200011	4	Labor	Regular	TP2J0713	D2-Bemidji	233.2565188	153.9767918	2402	HR	Hours	47939507
3/26/2021	2021 / 09	Mar	March	Vleck, Alan	1168832	4	Labor	Regular	TP2J0024	D2-Bemidji	254.9805882	168.3188235	2415	HR	Hours	47921726
4/1/2021	2021 / 10	Apr	April	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	252.404375	168.60375	2415	HR	Hours	47983272
4/8/2021	2021 / 10	Apr	April	Bitker, Steven	1135962	4	Labor	Regular	TP2J1971	D2-Bemidji	252.404375	168.60375	2415	HR	Hours	48013510

Work Item Date	Fiscal Month	Month Abbr	Fiscal Month Name	Resource Name	Resource ID	Resource Consumption Quantity	Cost Type Name	Cost Subtype Name	Project Id	District Name	Estimated Project Full Cost	Estimated Direct Cost	Source Type Code	Unit Of Measure Code	Unit Of Measure Name	RCA Timesheet Work Item Id
4/12/2021	2021 / 10	Apr	April	Brekke, Jordan	1208535	8	Labor	Regular	TP2J1971	D2-Bemidji	343.686	238.092	2415	HR	Hours	48034226
4/12/2021	2021 / 10	Apr	April	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	510.74	337.1557143	2415	HR	Hours	48034314
4/12/2021	2021 / 10	Apr	April	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.9825	336.655	2415	HR	Hours	48059382
4/13/2021	2021 / 10	Apr	April	Brine	0	100	Material	Material	TP2J1971	D2-Bemidji	23.57	0	2406	GA	Gallon	48074976
4/13/2021	2021 / 10	Apr	April	Brine	0	120	Material	Material	TP2J0713	D2-Bemidji	28.28	0	2406	GA	Gallon	48076083
4/13/2021	2021 / 10	Apr	April	Burnham, Justin	1164802	4	Labor	Regular	TP2J1971	D2-Bemidji	204.8315924	137.8619108	2406	HR	Hours	48076585
4/13/2021	2021 / 10	Apr	April	Burnham, Justin	1164802	4	Labor	Regular	TP2J1972	D2-Bemidji	204.8315924	137.8619108	2406	HR	Hours	48076563
4/13/2021	2021 / 10	Apr	April	Frenzel, Christopher	607258	8	Labor	Regular	TP2J1971	D2-Bemidji	510.74	337.1557143	2406	HR	Hours	48074976
4/13/2021	2021 / 10	Apr	April	Gonzales, Pablo	1009410	3	Labor	Regular	TP2J0024	D2-Bemidji	206.673986	136.4307692	2410	HR	Hours	48077766
4/13/2021	2021 / 10	Apr	April	Hannem, Brady	1200011	1	Labor	Overtime	TP2J0713	D2-Bemidji	45.81	39.67	2406	HR	Hours	48076084
4/13/2021	2021 / 10	Apr	April	Hannem, Brady	1200011	8	Labor	Regular	TP2J0713	D2-Bemidji	466.4944444	307.9455556	2406	HR	Hours	48076083
4/13/2021	2021 / 10	Apr	April	International 7500 Single	TM212505	50	Equipment	Equipment	TP2J0024	D2-Bemidji	366.875	293.5	2410	M	Miles	48077766
4/13/2021	2021 / 10	Apr	April	International 7600 Tandem Axle	TM216561	45	Equipment	Equipment	TP2J1972	D2-Bemidji	309.375	247.5	2406	M	Miles	48076563
4/13/2021	2021 / 10	Apr	April	International 7600 Tandem Axle	TM216561	50	Equipment	Equipment	TP2J1971	D2-Bemidji	343.75	275	2406	M	Miles	48076585
4/13/2021	2021 / 10	Apr	April	International 7600 Tandem Axle	TM217553	337	Equipment	Equipment	TP2J0024	D2-Bemidji	2316.875	1853.5	2406	M	Miles	48059401
4/13/2021	2021 / 10	Apr	April	International 7600 Tandem Axle	TM217553	337	Equipment	Equipment	TP2J0024	D2-Bemidji	2316.875	1853.5	2406	M	Miles	48059426
4/13/2021	2021 / 10	Apr	April	John Deere 772g Motor Grader	TM217308	4	Equipment	Equipment	TP2J1971	D2-Bemidji	494.65	395.72	2406	HR	Hours	48074976
4/13/2021	2021 / 10	Apr	April	Plow Truck	TM207509	25	Equipment	Equipment	TP2J1971	D2-Bemidji	183.4375	146.75	2406	M	Miles	48074976
4/13/2021	2021 / 10	Apr	April	Plow Truck	TM208556	0	Equipment	Equipment	TP2J0713	D2-Bemidji	0	0	2406	M	Miles	48076084
4/13/2021	2021 / 10	Apr	April	Plow Truck	TM208556	200	Equipment	Equipment	TP2J0713	D2-Bemidji	1375	1100	2406	M	Miles	48076083
4/13/2021	2021 / 10	Apr	April	Salt	17416	3	Material	Material	TP2J1971	D2-Bemidji	320.8	0	2406	26	Ton	48076585
4/13/2021	2021 / 10	Apr	April	Salt	17416	4	Material	Material	TP2J1971	D2-Bemidji	427.73	0	2406	26	Ton	48074976
4/13/2021	2021 / 10	Apr	April	Salt	17416	5	Material	Material	TP2J1972	D2-Bemidji	534.66	0	2406	26	Ton	48076563
4/13/2021	2021 / 10	Apr	April	Salt	17416	9	Material	Material	TP2J0713	D2-Bemidji	962.39	0	2406	26	Ton	48076083
4/13/2021	2021 / 10	Apr	April	Salt	17416	10.6	Material	Material	TP2J0024	D2-Bemidji	1133.49	0	2406	26	Ton	48059401
4/13/2021	2021 / 10	Apr	April	Salt	17416	10.6	Material	Material	TP2J0024	D2-Bemidji	1133.49	0	2406	26	Ton	48059426
4/13/2021	2021 / 10	Apr	April	Vleck, Alan	1168832	1	Labor	Overtime	TP2J0024	D2-Bemidji	51.24	44.36	2406	HR	Hours	48059426
4/13/2021	2021 / 10	Apr	April	Vleck, Alan	1168832	8	Labor	Regular	TP2J0024	D2-Bemidji	509.9825	336.655	2406	HR	Hours	48059401
4/14/2021	2021 / 10	Apr	April	Hannem, Brady	1200011	10	Labor	Regular	TP2J0713	D2-Bemidji	583.1180556	384.9319444	2415	HR	Hours	48085525

APPENDIX F:
WINTER 2 BARE LANE DATA

Bare Lane Indicator	Event Begin Date Time	Event End Date Time	Lane Lost Date Time	Lane Regain Date Time	Comments	Bare Lane Indicator2	Event Duration Hours	Lane Lost Duration Hours	Regain Time (Hours)	District Name	Truck Station Name	Project Maintenance Route	Maintenance Area Name	Project Id	Weather Condition Description	Service Level Name
390516	12/11/2020 9:00	12/11/2020 12:00			NO LOSS BITKER	390516	3	0	0	D2-Bemidji	Bemidji	W JCT TH 197 TO M.P. 110.827 - BYPASS	Maintenance Area 2	TP2J0024	Ice Condition	URBAN COMMUTER
390529	12/13/2020 10:00	12/13/2020 17:00	12/13/2020 13:00	12/13/2020 18:00	BITKER	390529	7	5	1	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
390850	12/18/2020 7:00	12/18/2020 12:00			REESE	390850	5	0	0	D2-Bemidji	Bemidji	W JCT TH 197 TO M.P. 110.827 - BYPASS	Maintenance Area 2	TP2J0024	Snow Condition	URBAN COMMUTER
390861	12/18/2020 7:00	12/18/2020 12:00	12/18/2020 8:00	12/18/2020 13:30	BITKER	390861	5	5.5	1.5	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
390964	12/20/2020 18:00	12/21/2020 7:00	12/21/2020 1:00	12/21/2020 8:30	BITKER	390964	13	7.5	1.5	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
391306	12/23/2020 7:00	12/23/2020 13:30	12/23/2020 8:00	12/23/2020 14:30	BITKER	391306	6.5	6.5	1	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
391808	12/27/2020 18:00	12/28/2020 7:00	12/28/2020 3:00	12/28/2020 10:00	BITKER	391808	13	7	3	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
392360	12/29/2020 15:00	12/30/2020 10:30	12/29/2020 17:00	12/30/2020 11:00	BITKER	392360	19.5	18	0.5	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
393430	1/8/2021 6:00	1/8/2021 12:00	1/8/2021 9:00	1/8/2021 11:30	MATHIOWETZ	393430	6	2.5	0	D2-Bemidji	Bemidji	N. JCT. TH 2 TO JCT. TH 72 AT BLACKDUC	Maintenance Area 2	TP2J0713	Ice Condition	RURAL COMMUTER
393430	1/8/2021 6:00	1/8/2021 12:00	1/8/2021 9:00	1/8/2021 11:30	MATHIOWETZ	393430	6	2.5	0	D2-Bemidji	Bemidji	N. JCT. TH 2 TO JCT. TH 72 AT BLACKDUC	Maintenance Area 2	TP2J0713	Ice Condition	RURAL COMMUTER
393756	1/14/2021 1:00	1/15/2021 9:00	1/14/2021 3:00	1/15/2021 9:00	BITKER	393756	32	30	0	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
394155	1/19/2021 6:00	1/19/2021 10:00			BITKER NO LOSS	394155	4	0	0	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
394939	1/21/2021 3:00	1/21/2021 10:00			BITKER NO LOSS	394939	7	0	0	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
395219	1/23/2021 14:00	1/24/2021 7:30	1/23/2021 16:00	1/24/2021 8:00	BITKER	395219	17.5	16	0.5	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
396199	1/23/2021 16:00	1/24/2021 4:00	1/23/2021 17:30	1/24/2021 8:00	O'BRIEN	396199	12	14.5	4	D2-Bemidji	Bemidji	W JCT TH 197 TO M.P. 110.827 - BYPASS	Maintenance Area 2	TP2J0024	Snow Condition	URBAN COMMUTER
396200	1/23/2021 16:00	1/24/2021 4:00	1/23/2021 17:30	1/24/2021 8:00	O'BRIEN	396200	12	14.5	4	D2-Bemidji	Bemidji	N. JCT. TH 2 TO JCT. TH 72 AT BLACKDUC	Maintenance Area 2	TP2J0713	Snow Condition	RURAL COMMUTER
396341	1/30/2021 13:00	1/31/2021 8:00	1/31/2021 2:00	1/31/2021 9:00	BITKER	396341	19	7	1	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Ice Condition	URBAN COMMUTER
397054	2/4/2021 1:00	2/4/2021 4:00	2/4/2021 2:00	2/4/2021 11:00	HANNEM	397054	3	9	7	D2-Bemidji	Bemidji	N. JCT. TH 2 TO JCT. TH 72 AT BLACKDUC	Maintenance Area 2	TP2J0713	Ice Condition	RURAL COMMUTER
397055	2/4/2021 1:00	2/4/2021 4:00	2/4/2021 2:00	2/4/2021 11:00	BURNHAM	397055	3	9	7	D2-Bemidji	Bemidji	JCT S197&71 TO JCT CSHA 9	Maintenance Area 2	TP2J0711	Ice Condition	RURAL COMMUTER
397072	2/4/2021 0:00	2/4/2021 9:00	2/4/2021 3:00	2/4/2021 11:00	BITKER	397072	9	8	2	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
399365	2/24/2021 18:00	2/25/2021 0:30	2/25/2021 3:00	2/25/2021 10:00	BITKER ICE	399365	6.5	7	9.5	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER
400695	3/10/2021 16:00	3/11/2021 1:00	3/10/2021 22:00	3/11/2021 10:00	BITKER	400695	9	12	9	D2-Bemidji	Bemidji	E JCT TH 2 TO W JCT. TH 2	Maintenance Area 2	TP2J1971	Snow Condition	URBAN COMMUTER

APPENDIX G:
WINTER 2 DETAILED SURVEY RESULTS

Interview Subject Information

The six District 2 staff interview subjects are listed below by title. Each is identified by a letter throughout this report. Five of these individuals (B, C, E, F and G) previously provided comments at the end of Winter 1 as documented in Appendix C. Respondent A is a different person from respondent A in the previous report, and is denoted A*.

Operators and Mechanics

A*. Transportation Generalist
B. Transportation Generalist Senior
C. Transportation Generalist

Supervisors

E. Transportation Operations Supervisor II
F. Fleet Manager/Shop Supervisor

Superintendent

G. Maintenance Superintendent

Responses are presented first by question and then by equipment type. In some cases, responses were grouped by type (for example, responses applied to both slurry spreaders, or all three types of plow equipment).

Note that some responses have been edited for clarity or grouped and combined as appropriate. All interview subjects received an opportunity to review and correct/revise these items prior to publication of this report.

Interview Results

Which pieces of equipment did you work with, and in what capacity?

- Operated Henke spreader (A*)
- Operated Swenson and Henke spreaders (B)
- Operated Swenson spreader (C)
- Supervised all pieces, but mostly heard feedback on spreaders (E)
- Supervised all pieces (F)
- Management on all pieces; worked through issues with operators or shops and mediated to make sure that we could correct any issues (G)

What worked well?

<u>Both Spreaders</u>

- Both could potentially work under the right circumstances, though the Henke might be easier to make work for MnDOT. (F)

Henke Spreader

- I operated this equipment along four lanes going each way for five miles (10 total) of metropolitan area outside Bemidji. It seemed to work very well for covering multiple lanes at one time with a wide spread of material. The slurry material worked well for the circumstances. (A*)
- It wasn't too complicated to fill with brine. (A*)
- Everything inside the cab was self-explanatory. (A*)
- No difficulty operating this equipment. (A*)
- It can carry lots of brine. (B)
- Operators said they liked the Henke more than the Swenson. It was easier to run and more convenient. (E), (F) It was also easier to see the material. (E)
- Henke uses a standard FORCE America controller, unlike the Swenson which uses its own system. (F)

Swenson Spreader

- When it worked right (infrequently), it could spread material on two-to-three lanes. (C)
- The slurry came out OK. (E)

All Plow Equipment

- I've heard fairly positive comments on the underbody scraper, true-float wing and the two-way reversible plow. They had to adjust the plow a little bit, but once it was adjusted, the operators seem to really like it. (E)

Underbody Scraper

- This equipment fared well once we adjusted the road pressure settings correctly. (F)

True-Float Wing Plow

- This equipment fared well. (F)

Two-Way Reversible Plow

- This equipment worked as advertised. (G)
- This equipment did well after it was remounted. This addressed the spray-back issue. We made a recommendation back to Henke about this. (H)

What were the challenges?

Both Spreaders

- Operators wished these could hold more dry materials. (E)
- Operators can't pinpoint where slurry is being thrown. (E), (G)

- Both spreaders sit high in the box. There is concern about going up on a ramp to load these. (E), (F), (G) Any time we have to deviate from the norm, it's difficult for staff. (F)
- It takes a long time to set up, though Swenson might have been a bit worse. (E)
- We are unable to haul trailers with these vehicles; traditional slurry spreader trucks can also haul. (E)
- Covid made it difficult to get vendor support. We had to fight for it. (F)

Henke Spreader

- Though it didn't happen often, it was tough to tell if the material had bridged, since it was in the middle of the box. A camera on that area would have been helpful. (A*)
- For application of how we used it, didn't work. For example, when we wanted to put salt in certain places, we could not (e.g., in multiple lanes) It was almost impossible to hit the centerline—the spreader threw the brine too far. (B)
- It can't carry much salt, which is not ideal. (B)
- It's an inconvenience to have in a truck when we want to do other activities. Getting the system into or out of truck is not ideal. It doesn't slide in or out easily like a traditional sander (in less than 5 minutes), and as a result we tended not to take it out because it was such a chore. (B)

Swenson Spreader

- Never ever worked consistently; there was always something wrong with it. (B) We had a lot of trouble with it. (C) Operators had more struggles with the Swenson spreader; it was down more than the Henke. (E)
- It was constantly giving off codes, and we were constantly troubleshooting. (B) We were unable to keep it working consistently. (G)
- Covid made getting manufacturer support very difficult. (B), (G)
- It was inconsistent: sometimes you'd get salt, sometimes brine. Seems we seldom got what we wanted. Often it worked in the shop but not on the road. (B)
- Loading is very difficult. We have to use a loading ramp and stand 20 feet in the air. This is not something we should buy. It took hours to load. (B) It is much slower to add or change material compared with a tailgate spinner. (C)
    - We have to use loader ramps to load these, and walk along the edge of the box to move/break chuck on the top grate.
    - It takes 15 minutes to unload.
- Has a stand, but the front end is too low, so it has to be lifted. (B)
- There were speed sensor issues. (C)
- It holds a lot of brine if it's warm enough to use it, but up here it's too cold to use. I would think it would work better for a warmer climate -- not subzero temperatures for weeks at a time. (C)
- A truck equipped with this spreader is limited to snow-and-ice all winter; can't be quickly repurposed if needed. (C)
- Salt bridging was a problem. (E)

- This system didn't interact well with MnDOT's; this included hydraulics and electronics. (G)

Did the equipment work as well as, better than, or worse than traditional equipment designed for the same purpose?

Henke Spreader

- **Better than** traditional; it can carry a much better amount of brine. (A*)
- **Worse than** traditional. (B)
- In our area, **worse than**. But if we had more multilane roads, I would expect better. (E)

Swenson Spreader

- **Worse than** traditional, and worse than Henke. (B)
- Way **worse than** traditional. (C)
- In our area, **worse than** traditional. But if we had more multilane roads, I would expect better. (E)
- **Worse than** traditional. (G)

If this equipment gets passed to another MnDOT district, what advice would you give someone with the same role as yours?

Henke Spreader

- Before they even go on the road, run a test path in the yard to see where you want the spinner set. I had it going too hard at first, and was sending it farther than I wanted. A test pass in the yard would serve to calibrate the system. (A*)
- Make sure you get everything dumped and cleaned out at the end of shift to avoid clumps. I didn't use a lot of sand, but when I did, I had some freezing issues if left overnight. (A*)

Swenson Spreader

- Keep the codebook handy; the equipment throws different codes when it quits working. It would be the computer, or it could be mechanical. Sensors were the most common issue. (C)
- We had a mechanic add a reverse function on the system to empty the load—you can't just dump it out. (C)
- The equipment needs to be shimmed a few inches and ratchet-strapped so it doesn't move around on the box. A few inches. Also, you can't lift the box very high, because the spinner arm hangs down low. (C)
- Use straight salt; sand will cause bridging and material won't shift down into the auger. You can't get it out. (C)
- Don't release the box latches (two big pins) on the tailgate, or the whole machine comes out. (C)
- Address the hydraulics before using this equipment. There will be problems without proper flow. (F)

Both Spreaders

- Hopefully we have figured out all the programming issues. Be patient to get them up and running. (E)
- Be patient. Allow time to work out the kinks. (B)
- Be careful loading this equipment, because it can be tricky. (B)
- Select open-minded operators, because there are sure to be some obstacles. (G)
- Communicate with District 2 staff on what they learned. (G)

Based on your experience in winter 2019-2020 and winter 2020-2021, would you recommend MnDOT continue to use this equipment?

Henke Spreader

- **Yes**, but on a location-by-location basis. On a long rural route there won't be enough capacity, but a shorter metro route would work great. Brine seems to make things work so much faster. (A*)
- **Yes**, but not for District 2. (B)
- Likely **yes** for multilane roads; but **no** for two-lane roads in District 2. (E)
- **Yes**. There are some positives, and we haven't tested enough to give up. Better for shorter routes. (F)
- **Yes**. (G)

Swenson Spreader

- **No**. (B)
- **No**. (C)
- **Possibly**, if they could get the bugs worked out. (E)
- **Yes**. There are some positives, and we haven't tested enough to give up. Better for shorter routes. (F)
- **No**. (G)

Underbody Scraper

- **Yes**. (F)

True-Float Wing Plow

- **Yes**. (F)

Two-Way Reversible Plow

- **Yes**. We had some growing pains with it, but once it was set up correctly, we were very happy with it and plan to keep using it. (F)

Based on your experience in winter 2019-2020 and winter 2020-2021, would you recommend MnDOT purchase more of this equipment?

Henke Spreader

- **Yes**, but situationally. It's highly dependent, based on route and need. (A*)
- **No** for District 2. (B)
- I expect MnDOT is going to. They're so new and operators are so familiar with the old system, it will take some getting used to. (E)
- Need to learn more before saying yes or no, but leaning more toward Henke. (F)
- **Yes**. (G)

Swenson Spreader

- **No**. (B)
- **No**. (C)
- **No**. (E)
- Need to learn more before saying yes or no, but leaning more toward Henke. (F)
- **No**. (G)

Underbody Scraper

- **Yes**. (F)

True-Float Wing Plow

- **Yes**. (F)

Two-Way Reversible Plow

- **Maybe**. I would like to see more before making a recommendation. (F)