GEI Consultants

Consulting
Engineers and
Scientists

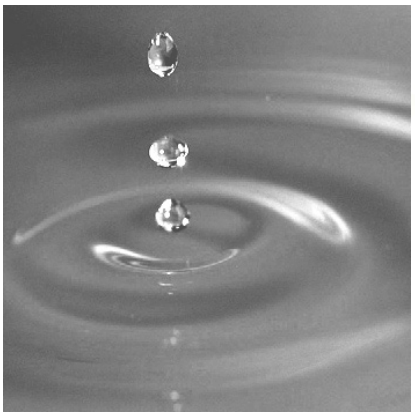
Keetac Tailings Basin – Permit to Mine Amendment

Keewatin, Minnesota

Submitted to:
United States Steel Corporation - Keetac
1 Mine Road
Keewatin, Minnesota 55753

Submitted by:
GEI Consultants, Inc.
515 NE Second Avenue
Grand Rapids, Minnesota 55744
920.455.8200

Originally Submitted November 24, 2021
Updated February 11, 2022 per DNR Comments
Project 2100305



James P. Bonner, PE
Senior Engineer

Michael J. Wheeler, PE
Senior Vice President

Consulting Engineers and Scientists

February 11, 2022
Project 2100305

Mr. Evan Shefik, PE
United States Steel Corporation – Keetac
1 Mine Road
P.O. Box 217
Keewatin, Minnesota 55753

Re: Keetac Tailings Basin – Permit to Mine Amendment for Tailings Deposition to Stage 2 Exterior Tailings Basin (Updated January 21, 2022 and February 7, 2022 and February 11, 2022 per DNR Comments)
United States Steel Corporation – Keetac
Keewatin, Minnesota

Dear Mr. Shefik:

GEI Consultants, Inc. has prepared information to support application for an amendment to the existing Permit to Mine for the USS Keetac facility, as summarized in the following report.

We have been pleased to provide our engineering services for this application. If you have any questions, or if we may be of further service, please contact us.

Sincerely,

GEI CONSULTANTS, INC.

James P. Bonner, P.E.
Senior Engineer

Michael J. Wheeler, P.E.
Senior Vice President

Cc: Chrissy Bartovich, United States Steel Corporation
Darren Gietzen, United States Steel Corporation
Lukas Klemke, United States Steel Corporation

JPB:cah
K:\KEETAC (US Steel)\2100305_Keetac_2021 Quarterly Tailings Basin PM\05_In_Progress\Reports\Permit to Mine Amendment\R2100305_Keetac_PTMA_FINAL_20220121.docx

GEI Consultants, Inc.
515 NE Second Avenue, Grand Rapids, MN 55744
920.455.8200

Proposed Project

The proposed Project is a near-term interim solution (Phase 1) for United States Steel Corporation (USS) Keetac Mine (Keetac) to transition to a longer-term tailings basin storage alternative (Phase 2) that utilizes tailings storage within the full area of the Stage 2 Exterior dike. The long-term solution (Phase 2) will address the tailings storage for 40-plus years to align with mine life and will be completed as a separate project. The proposed Project (Phase 1) consists of the construction of external dike raises (as currently permitted by the existing dam safety permit) to maintain freeboard, and internal diversion dikes to allow for controlled deposition of tailings within the majority of the Stage 2 Exterior Tailings Basin to provide stability improvement to the Stage 2 Interior Tailings Basin embankment. The proposed Project (Phase 1) is intended to allow for safe operation of the existing active Stage 2 Interior Tailings Basin to maintain production of taconite pellets at the Keetac processing facility. This near-term solution (Phase 1) is needed to provide stability improvement for the Stage 2 Interior dike and suitable tailings storage while tailings basin engineers complete additional analyses, design, and permitting for the long-term tailings storage solution (Phase 2).

Tailings deposited as part of Phase 1 will provide stability improvement to the Stage 2 Interior embankment. The intent of Phase 1 is not to expand the capacity of the basin. However, referring to the isometric view on **Figure 5** approximately 7,500 ac-ft would likely be deposited during Phase 1.

The northernmost dike of the external east dike includes new construction. The referenced internal dike segment lies over the previous alignment of St Louis County CSAH 16, which was the southern boundary of the Stage 1 tailings basin. This area was previously disturbed and portions of the proposed alignment are currently used as part of the internal road system. Construction acreage is shown in **Table 1**.

Background

Tailings material generated by Keetac is currently stored within the Stage 2 Interior Tailings Basin. The original Stage 1 Keetac Tailings Basin had an area of approximately 1,560 acres and was operated as the primary tailings storage facility from the mid-1960s to the early 1980s. The Stage 2 Exterior Tailings Basin dike system was generally constructed in the 1970s and functioned as the tailings storage from the early 1980s to the mid-1990s. The Stage 2 Interior Tailings Basin was established in the mid-1990s with an area of approximately 2,500 acres and has been operated as the primary tailings storage facility from the mid-1990s to present.

Figure 1 provides a plan view of the basins. A 2019 aerial photograph of the Stage 1 and Stage 2 basins is shown on **Figure 2**.

Vertical expansion of the Keetac Stage 2 Interior Tailings Basin is currently planned to an ultimate perimeter dike crest elevation of +1,585 feet. 2021 interior south dike crest elevations varied between approximately +1,555 feet and +1,565 feet. Average rate of pond rise has been approximately 2.7 feet per year. Keetac requires approximately 5,570 acre-feet of tailings storage volume per year based on current production rates and comparison of survey data.

Project Basis

Based on GEI Consultants, Inc. (GEI) studies using peak undrained shear strength parameters, portions of the Stage 2 Interior Tailings Basin perimeter dike will require stability improvement prior to vertical expansion above elevation +1,570 feet. Stability improvement would consist of mechanical and/or hydraulic deposition of tailings to improve downstream stability of the Stage 2 Interior Tailings Basin.

Continued raising of the Stage 2 Interior Tailings Basin south dike will further decrease the factor of safety of the Stage 2 Interior perimeter dike embankment. As continued vertical expansion of the Stage 2 Interior Tailings Basin occurs, additional sections of the perimeter dike will drop below the recommended minimum factor of safety criteria and require stability improvement measures be constructed before continuing to vertically expand the basin.

Deposition of tailings into the Stage 2 Exterior Tailings Basin to improve dike embankment stability is required to begin during 2022 to allow for vertical expansion of the Stage 2 Interior Tailings Basin to elevation +1,570 feet. Construction of the dike raises and diversion dikes is planned to begin in March 2022 with completion expected in Fall 2022.

Near-Term Phase 1 Solution

A near-term shift to tailings disposal within the Stage 2 Exterior Tailings Basin footprint would allow for hydraulic deposition of tailings for stability improvement and eliminate or slow additional vertical expansion of the Stage 2 Interior Tailings Basin.

Keetac proposes to construct internal diversion dikes within Stage 2 Exterior Tailings Basin footprint to allow for controlled deposition of tailings, allowing for stability improvement of the Stage 2 Interior Tailings Basin south dike. To maintain adequate freeboard it is proposed to raise the external dikes as well. Locations of the proposed dike raises and diversion dikes and a near-term tailings discharge schematic are graphically depicted on **Figure 3**. A summary of the proposed external dike raises and internal diversion dikes is provided in **Table 1**.

Table 1 - Phase 1 Dike Construction Summary

Designation (see **Figures 3 and 5**)	Purpose	Approximate Height of Phase 1 Construction	Approximate Surface Area of Proposed Dike	Comment
Internal Northwest	Diversion within Stage 2 Exterior Basin footprint for controlled deposition of tailings	10 feet	5 acres	Internal dike over previously deposited tailings
Internal West	Diversion within Stage 2 Exterior Basin for controlled deposition of tailings	10 feet	9 acres	Raise of existing internal dike
External South	Additional freeboard	5 to 10 feet	18 acres	Raise up to permitted crest elevation of +1,470 feet
External East	Additional freeboard	5 to 10 feet	24 acres	Raise up to +1,500 feet

Wetlands are present within the Stage 2 Exterior Tailings Basin footprint to the south of the Stage 2 Interior Tailings Basin. Deposition of tailings into the Stage 2 Exterior Tailings Basin footprint will likely impact wetlands as shown on **Figure 4**. A wetland permit application was submitted by USS on October 12, 2021.

With stability improvement to meet minimum factor of safety criteria at ultimate south dike crest elevation +1,585 feet, the Stage 2 Interior Tailings Basin allows for approximately 8 to 10 years of tailings storage. However, there is a 40-plus year Life of Mine; therefore, additional tailings storage will be required outside of the active Stage 2 Interior Tailings Basin. The Phase 1 solution will provide necessary stability improvement for the Stage 2 Interior Tailings Basin to allow for vertical expansion of the Stage 2 Interior Tailings Basin to elevation +1,570 feet.

Typical sections of the proposed external dike raises and internal diversion dikes are shown on **Figure 5**.

Construction of the Stage 2 Exterior Tailings Basin was authorized by Dam Safety Permit 1965-0351. Construction and operation of the Stage 2 Interior Tailings Basin have also been completed under Permit 1965-0351 since the 1990s.

The current crest elevation of the Stage 2 Exterior dike varies from approximately +1,460 feet along the south portion up to approximately +1,490 along the east portion. The Stage 2 Exterior dike was designed to crest elevations of +1,470 feet along the south portion and +1,510 along the east portion. A summary of current, designed/dam safety permitted, and proposed crest elevations along the Stage 2 Exterior dike is provided in **Table 2**.

Table 2 - Stage 2 Exterior Dike Crest Elevation Summary

General Area	Approximate Current Crest Elevation	Designed/Dam Safety Permitted Crest Elevation	Proposed Phase 1 Crest Elevation
West	+1,462 feet	+1,470 feet	+1,470 feet
South	+1,462 feet	+1,470 feet	+1,470 feet
East	+1,490 feet	+1,510 feet	+1,500 feet

Proposed Phase 1 construction crest elevations are consistent with crest elevations authorized by Dam Safety Permit 1965-0351.

Pumping and Water Management

Operations requirements related to tailings pumping energy are not expected to be significantly different from what is currently required. The same pipeline could be used to discharge tailings downstream from the Stage 2 Interior Tailings Basin south dike embankment. Tailings deposition would shift into the Stage 2 Exterior footprint instead of the Stage 2 Interior footprint, bypassing the decant system within the Stage 2 Interior basin. The return water circuit will remain the same, with tailings discharge water reporting to the Stage 2 Exterior Pond, flowing through the Stage 2 Exterior decant structure into Reservoir 6, and then being pumped from Reservoir 6 to the processing facility. **Figure 3** shows a summary of the current discharge pumping and flow regime for the Stage 2 Interior Tailings Basin as well as potential near-term pumping concepts.

Additional Information

The Project does not increase the size of the tailings basin and does not impact any areas that have not previously been used for tailings storage. Many of the statute requirements have been satisfied by the current permit and previous amendments, as summarized in the following table.

Minnesota Rules Part 6130.4300 Summary

Subpart Description	Comment
Subp. 2. Documents (certificates of insurance, financial statements).	Financial Assurance estimate is provided in cost estimate section. There are no other changes from previous amendments or the permits.

Subp. 3. Organizational data.	No changes from previous amendments and annual plans
Subp. 4. Environmental setting maps.	No changes to environmental setting. See previous sections for Project information.
Subp. 5. Environmental setting analysis.	No changes to environmental setting. See previous sections for Project information.
Subp. 6. Mining and reclamation maps.	No changes to mining or reclamation plans. Areas disturbed by construction on the Stage 2 Exterior embankment will be stabilized in accordance with Minnesota Rules 6130.3600.
Subp. 7. Mining and reclamation plan.	No changes to mining or reclamation plans. See previous sections for Project information related to tailings deposition. Areas disturbed by construction on the Stage 2 Exterior embankment will be stabilized in accordance with Minnesota Rules 6130.3600.

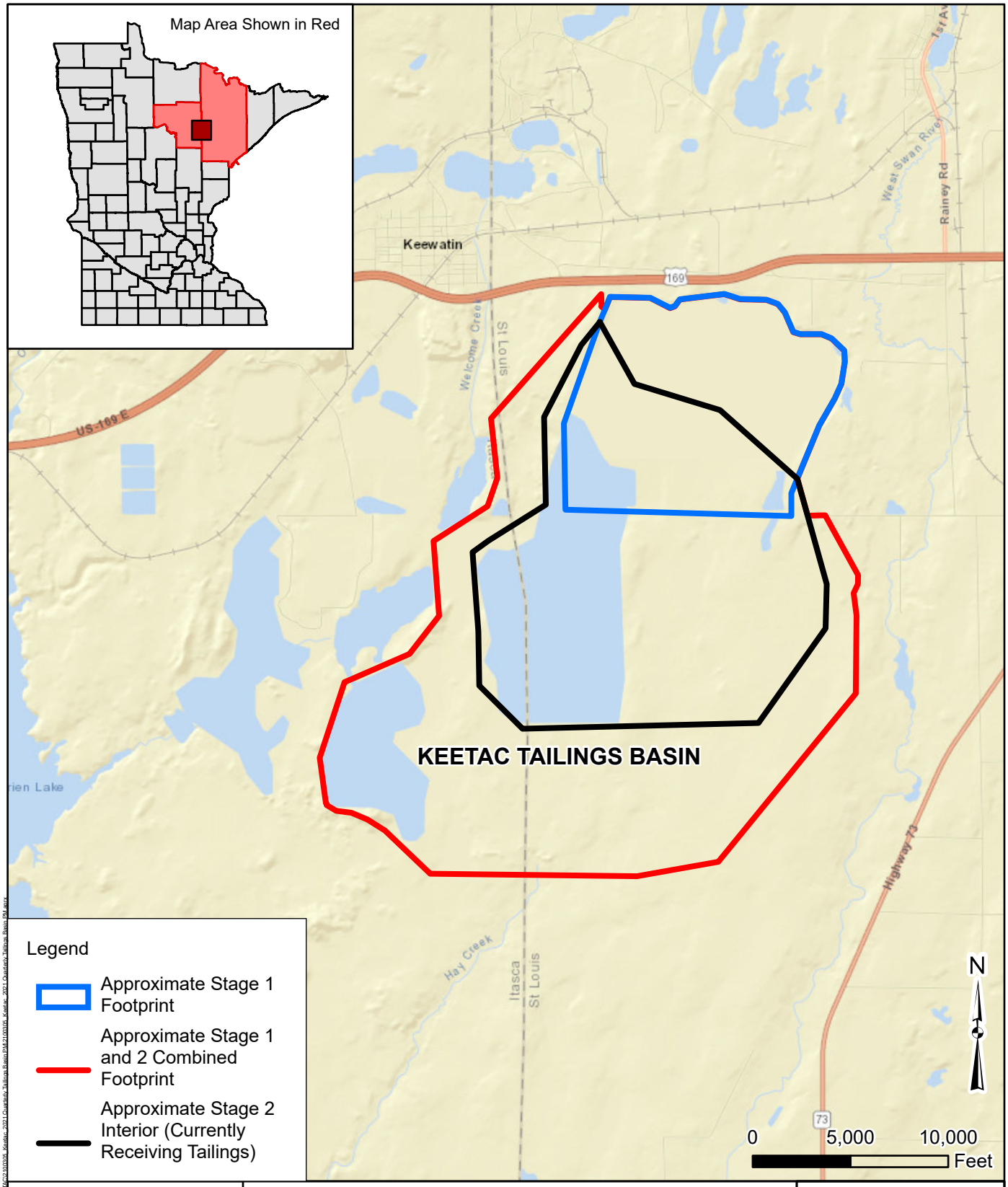
Cost Estimate for Stabilization

Areas disturbed by construction on the Stage 2 Exterior embankment will be stabilized in accordance with Minnesota Rules 6130.3600. The total surface area of the proposed dikes is 56 acres as shown on Figure 5 and summarized in Table 1. Assuming a unit rate of $1,400 per acre, the approximate cost for stabilization would be $78,400. This unit rate includes cost of seed and mulch, as well as the application cost. An additional $3,000 per year is accounted for to cover any maintenance activities and $5,000 per year to cover administration costs related to reclamation activities over the 10-year monitoring period. Permit to mine fees are included in this price estimate over the 10-year period. Financial assurance for these fees will be covered by the first finalized estimate and may be covered under previous applications. A contingency percentage of 10% is included to cover any price changes. Financial assurance will be provided in the form of a Letter of Credit. In addition, sloping will not be required as part of this project as the dikes will be built at a 2.5:1 slope and will meet 6130 reclamation rules without further sloping.

Estimated Costs for Reclamation of the Keetac Tailings Basin Phase 1 Project

Item	Task	Unit cost	Unit	Total cost
1	Seed, mulch, etc.	$1,400/acre	56	$ 78,400
2	Reclamation maintenance costs.	$3,000/year	10	$ 30,000
3	Reclamation administration costs	$5,000/year	10	$ 50,000
4	Permit to Mine Fees	$30,000/year	10	$ 300,000
5	Contingency (Items 1-3)	10%		$ 15,840
	Total			$ 474,240

Figures

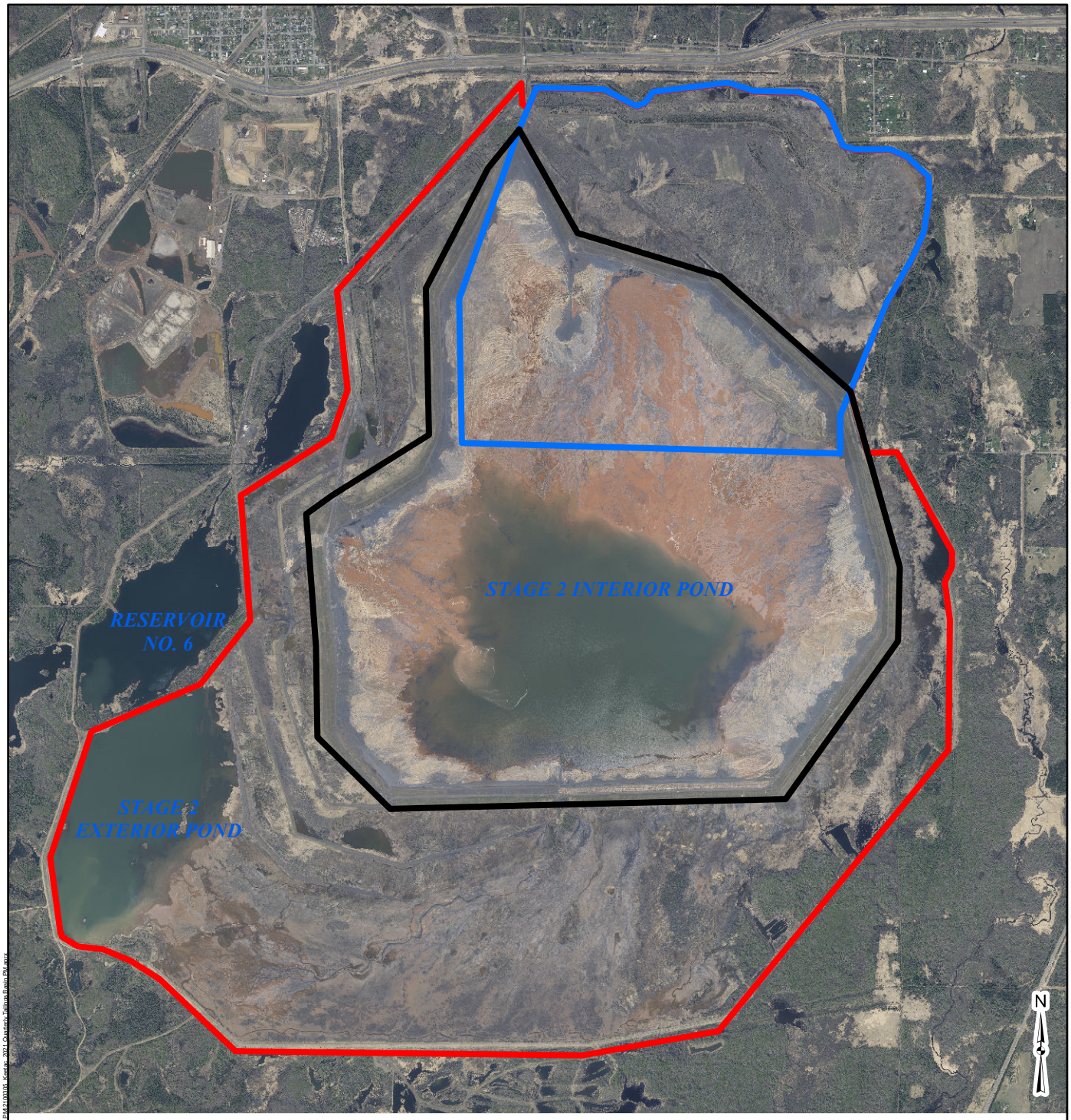


GEI Consultants
3159 Voyager Drive
Green Bay, WI 54311
www.geiconsultants.com

KEETAC TAILINGS BASIN LOCATION DIAGRAM

UNITED STATES STEEL CORP.
KEEWATIN TACONITE TAILINGS BASIN
ITASCA & ST. LOUIS COUNTY, MN
KEEWATIN, MINNESOTA

Drawn: JLH	11/22/2021
Approved: MJW	11/22/2021
Scale: AS SHOWN	
Project Number: 2100305	
Figure Number: 1	



Legend

- Approximate Stage 2 Interior (Currently Receiving Tailings)
- Approximate Stage 1 Footprint
- Approximate Stage 1 and 2 Combined Footprint

0 2,500 5,000 Feet

GEI Consultants
3159 Voyager Drive
Green Bay, WI 54311
www.geiconsultants.com

KEETAC TAILINGS BASIN
2019 AERIAL PHOTOGRAPH

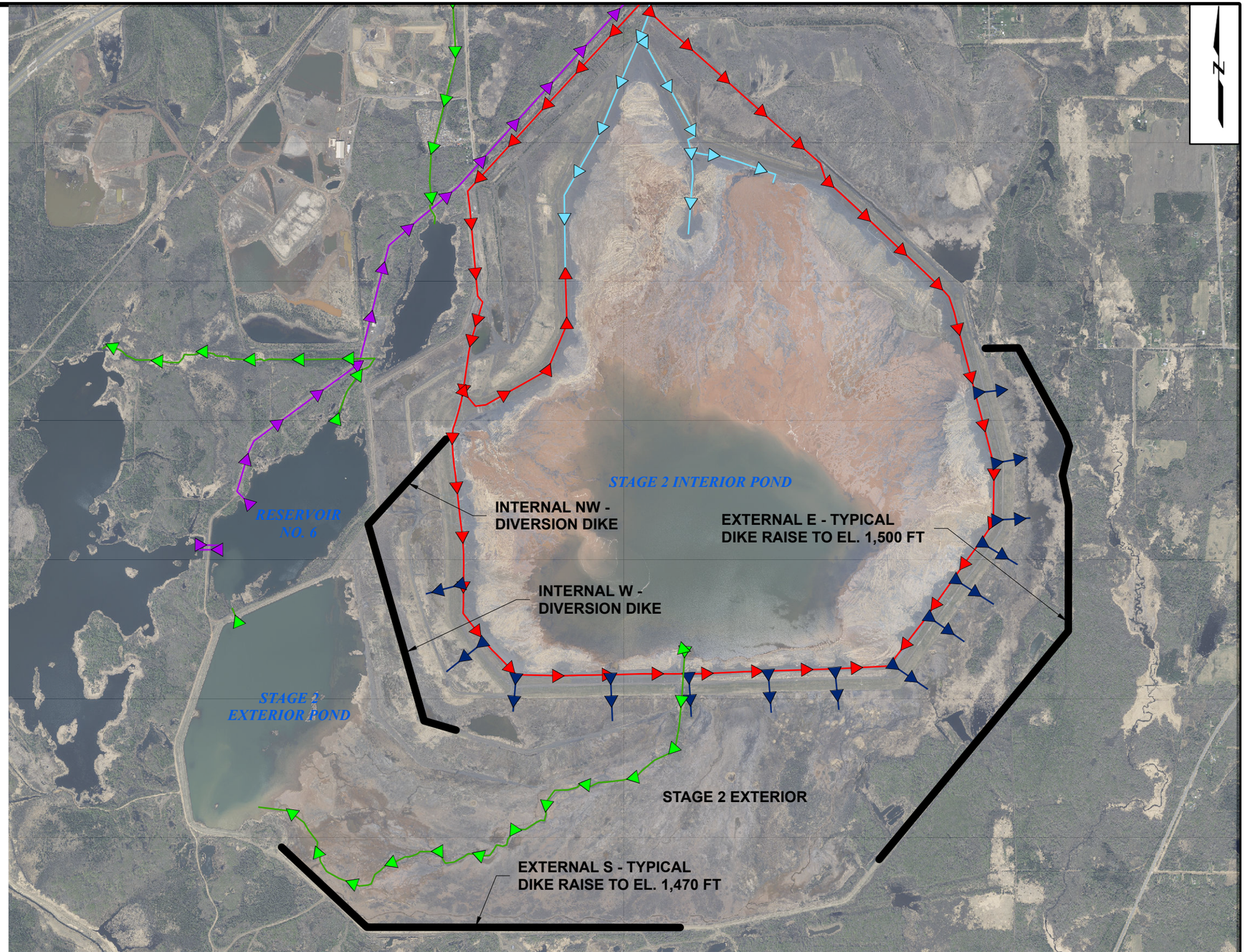
UNITED STATES STEEL CORP.
KEEWATIN TACONITE TAILINGS BASIN
ITASCA & ST. LOUIS COUNTY, MN
KEEWATIN, MINNESOTA

Drawn: JLH	11/22/2021
Approved: MJW	11/22/2021
Scale: AS SHOWN	
Project Number: 2100305	
Figure Number:	2

LEGEND:

Discharge Schematic

- Gravity / Natural Drainage
- Normal Tailings Line
- Pumping Flow
- Potential Short Term Tailings Discharge Line
- Standby Tailings Line
- 2022 Construction Area



0 1,000 2,000 4,000 6,000 8,000 Feet

Spatial Reference
Name: NAD 1983 2011 StatePlane Minnesota North FIPS 2201 Ft US

Permit to Mine Non-Substantial Amendment
Keetac Tailings Basin
Keewatin, Minnesota

United States Steel Corp.
Keewatin, Minnesota

GEI Consultants

Project 2100305

NEAR TERM DISCHARGE SCHEMATIC

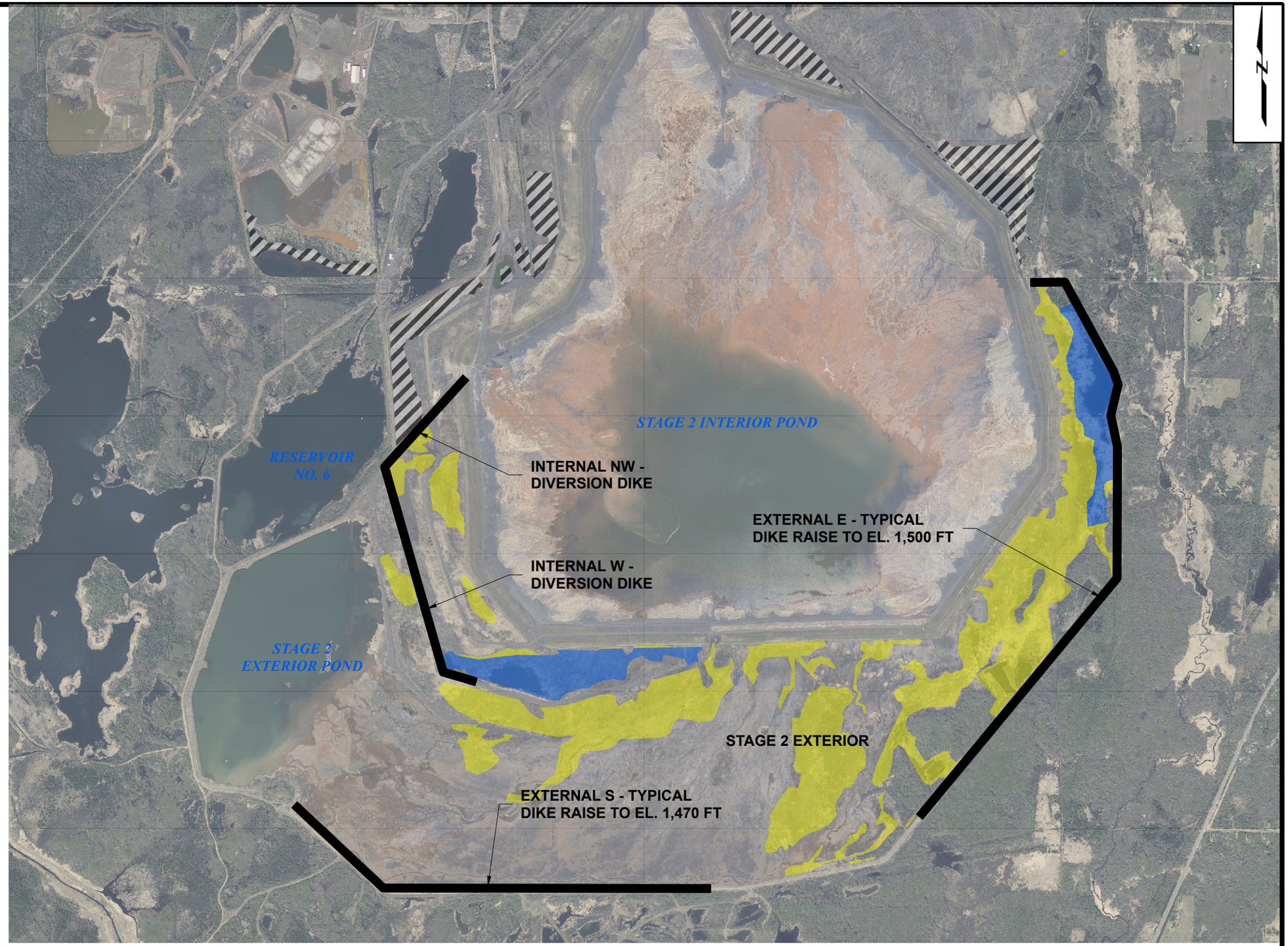
January 2022 Fig. 3

Path: C:\Users\jhansen\OneDrive - GEI Consultants, Inc\Documents\GIS_Work\KEETAC\2100305_Keetac_2021 Quarterly Tailings Basin PM\2100305_Keetac_2021 Quarterly Tailings Basin PM.aprx

Type	Approximate Acres
Mitigation Wetlands Impacted	116
Non-Jurisdictional Wetlands Impacted	522
Wetlands Outside of Current Project Boundary	145
Total	783

LEGEND:

- 2022 Construction Area
- Wetlands Outside of Current Project Boundary
- Mitigation Wetlands Impacted
- Non-Jurisdictional Wetlands Impacted



0 1,000 2,000 4,000 6,000 8,000 Feet

Spatial Reference
Name: NAD 1983 2011 StatePlane Minnesota North FIPS 2201 Ft US

Permit to Mine Non-Substantial Amendment
Keetac Tailings Basin
Keewatin, Minnesota

United States Steel Corp.
Keewatin, Minnesota

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TAILINGS BASIN WETLANDS

Project 2100305 | 1/19/2022 | Fig. 4

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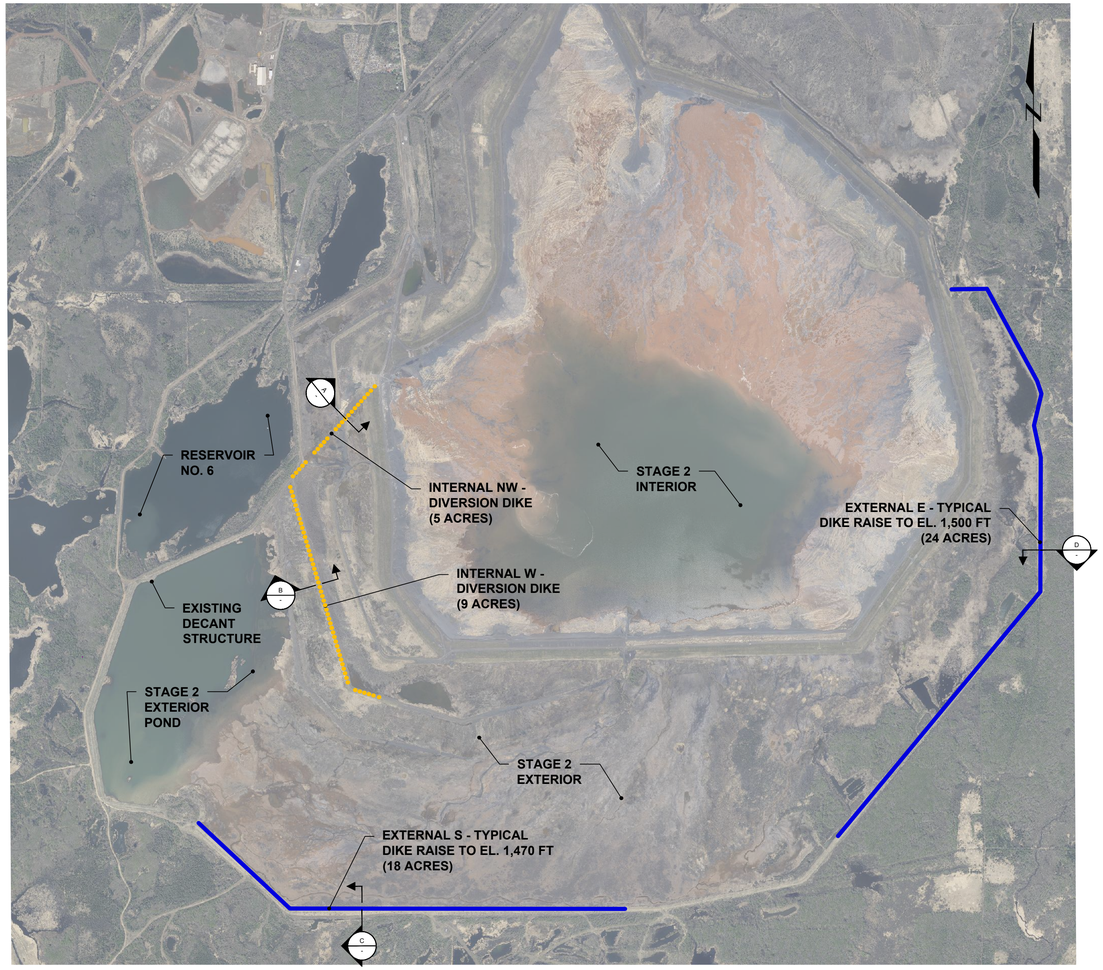
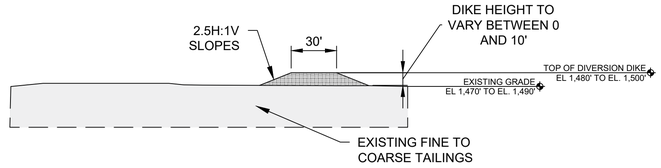


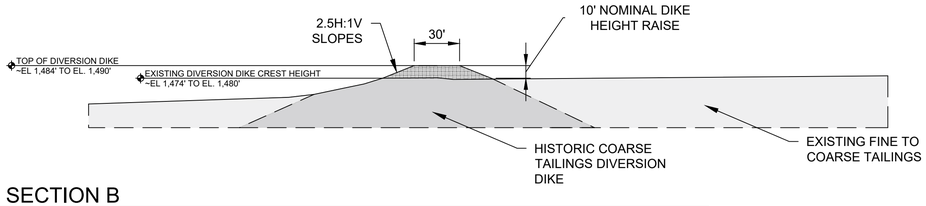
PLAN VIEW
DIVERSION DIKES

0 750' 1500' 3000'
SCALE: 1" = 1500'

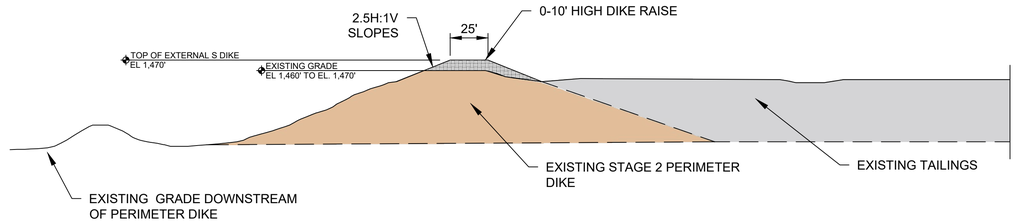
ISOMETRIC VIEW
2X VERTICAL EXAGERATION



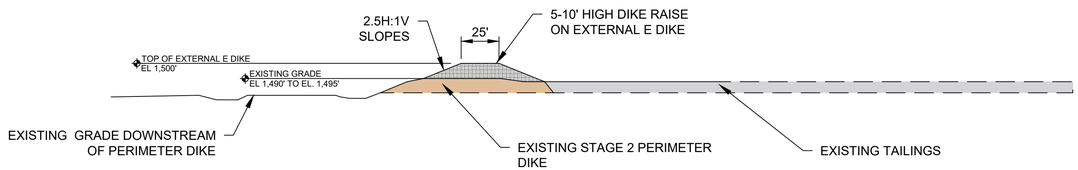
A - SECTION A
INTERNAL NW - DIVERSION DIKE
NOT TO SCALE



B - SECTION B
INTERNAL W - DIVERSION DIKE
NOT TO SCALE



C - SECTION C
EXTERNAL S - TYPICAL DIKE RAISE TO EL. 1,470 FT
NOT TO SCALE



D - SECTION D
EXTERNAL E - TYPICAL DIKE RAISE TO EL. 1,500 FT
NOT TO SCALE

Permit to Mine Non-Substantial Amendment Keetac Tailings Basin Keewatin, Minnesota	GEI Consultants	PHASE 1 STAGE 2 EXTERIOR DIKE RAISE AND TAILINGS DIVERSION DIKES
United States Steel Corporation - Keetac Keewatin, Minnesota	Project 2100305	JANUARY 2022 Fig. 5