A d d e n d u m

Iowa Department of Transportation
Office of Contracts

Date of Letting: April, 19, 2016
Date of Addendum: April 5, 2016

B.O.	Proposal ID	Proposal Work Type	County	Project Number	Addendum
110	78-0801-459	PCC PAVEMENT - GRADE & NEW	POTTAWATTAMIE	IM-NHS-080-1(371)3--03-78 IM-NHS-080-1(384)4--03-78 IM-NHS-080-1(459)3--03-78 IM-NHS-080-1(460)3--03-78 IM-NHS-080-1(461)3--03-78 NHSN-192-1(24)--2R-78 NHSN-192-1(25)--2R-78	19APR110.A01

Make the following changes to the PROPOSAL SCHEDULE OF PRICES:

Change Proposal Line No. 0890 2102-0425071 SPECIAL BACKFILL;
From: 16,173.100 CY
To: 15,204.200 CY

Change Proposal Line No. 0950 2111-8174100 GRANULAR SUBBASE;
From: 39,334.900 SY
To: 36,428.500 SY

Change Proposal Line No. 1030 2301-1034115 STANDARD OR SLIP FORM PORTLAND CEMENT CONCRETE PAVEMENT, CLASS C, CLASS 3I DURABILITY, 11.5 IN.;
From: 23,254.300 SY
To: 20,349.900 SY

Change Proposal Line No. 1780:
From: 2102-0425070 SPECIAL BACKFILL
To: 2102-0425071 SPECIAL BACKFILL
From: 389.700 TON
To: 206.200 CY

Change Proposal Line No. 1800:
From: 2102-0425070 SPECIAL BACKFILL
To: 2102-0425071 SPECIAL BACKFILL
From: 337.900 TON
To: 178.800 CY

If the above changes are not made, they will be made as shown here.

Make the following change to the Proposal:

Replace SP-150089 with attached SP-150089a, SPECIAL PROVISIONS FOR GROUND IMPROVEMENT WITH RIGID INCLUSIONS , from the Proposal Special Provisions Text and the Proposal Special Provisions List.

Delete DS-15038, DEVELOPMENTAL SPECIFICATIONS FOR QUALITY MANAGEMENT CONCRETE (QM-C), from the Proposal Special Provisions Text and the Proposal Special Provisions List.

Replace plan sheets C.7, Q.19, Q22, & W.55-W.62 for project IM-NHS-080-1(459)3--03-78 with the attached:

SPECIAL PROVISIONS
FOR
GROUND IMPROVEMENT WITH RIGID INCLUSIONS

Pottawattamie County
IM-NHS-080-1(459)3--03-78

Effective Date
April 19, 2016

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150089a.01 DESCRIPTION.

A. Scope of the Work.
The work shall consist of detailing, furnishing, installing, monitoring, and testing of rigid inclusions up to the lines and grades designated on the project drawings and as specified herein. The installation of the rigid inclusions shall also include the hauling, stockpiling, removal, and disposal of excavation spoils resulting from the installation process of the rigid inclusions. The excavated material is all assumed to be unsuitable and shall either be wasted or used in accordance with the Standard Specifications. The cost of installation of the rigid inclusions shall include the cost of hauling, stockpiling and disposal, of the excavated material.

B. List of Approved Rigid Inclusion Types and Vendor Information.

1. Controlled Modulus Column (CMC) by Menard (Phone: 1 800 326 6015) or their affiliate Nicholson Construction (Phone 1-800-388-2340).
2. Auger Pressure Grouted Displacement Piling (APGD) by Berkel & Company Contractors, Inc. (Phone: 1-913-422-3588).
3. Omega Rotary Torque Displacement Pile (ORTD) by Malcolm Drilling Company (Phone: 1-206-571-9945).
4. Rigid Inclusions (RI) by Hayward Baker (Phone: 1-800-456-6548).
5. Geo-Concrete Columns (GCC) by Tensar- GEOPIER FOUNDATIONS (Phone 1-800-371-7470).

C. References.
The publications listed below form a part of this specification to the extent referenced. The publications are referred to by the basic designation only.

1. American Society of Testing and Materials (ASTM).

- ASTM D1143 / D1143M - 07e1 Standard Test Methods for Deep Foundations Under Static Axial Compressive Load.

- ASTM C39/C39M-12a Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- ASTM D4595-11 Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- ASTM D4751-04 Standard Method for Determining Apparent Opening Size of a Geotextile.
- ASTM D5261-10 Standard Method for Measuring Mass per Unit Area of Geotextiles
- ASTM D3080 Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.
- ASTM D4318-05 Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- ASTM C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
- ASTM D5882 - 07 Standard Test Method for Low Strain Impact Integrity Testing of Deep Foundations

2. Geosynthetic Research Institute (GRI).
GRI GT7-92 Standard Practice for Determination of Long-Term Design Strength of Geotextiles.

D. Definitions.

Rigid Inclusions: Rigid inclusions may consist of CMC, APGD, RI, GCC, or ORTD. The purpose of the rigid inclusions is to provide ground improvement and support for highway embankment fill.

Test (Demonstration) Rigid Inclusion: Test (Demonstration) rigid inclusion is a rigid inclusion that is installed at non-production rigid inclusion locations. These test rigid inclusion will be installed as demonstration to verify the installation technique, to assist in selecting location of load tests, develop installation criteria, and identify installation sequence. The rigid inclusions that will be selected for static load tests shall either be installed prior to production of rigid inclusion as verification load test, or during production installation to proof load test the rigid inclusions. Rigid inclusions installed prior to production rigid inclusions are to allow for selection, performance and evaluation of static load tests as well as developing of the installation criteria by the Engineer. For each additional different rig brought to the site, additional demonstration rigid inclusions shall be installed to assess the rig's capabilities.

Working Pad: The working pad shall consist of a 24 inch layer of macadam crushed stone that is placed above the existing ground surface after the top soil is removed. The purpose of the working pad is to provide a stable bearing material for the rigid inclusion installation.

E. Subsurface Conditions.

1. Borings completed within the limits of the project encountered varying thicknesses of soft to medium stiff alluvial silt and clay overlaying medium stiff to stiff clay as shown in the plans.

2. Groundwater at the time of boring drilling was recorded between 2 feet to 20 feet below ground surface, which was performed in 2010 and 2015. It is anticipated that the groundwater level will rise during prolonged periods of precipitation or flooding, and perched groundwater may be present. For the purpose of installation, assume that the ground water is 5 feet below ground and make all necessary preparation to complete the installation under this condition at no additional cost to Iowa DOT

3. Installation of the rigid inclusions to the minimum tip elevation will typically require penetration of the stone working pad. The contractor shall be aware that based on the historical aerial photos of the site, significant portion of the Rigid Inclusion Area was part of Western Engineering Company facility. The area were used to manufacture and/or store paving and landscaping materials which may include, rocks, boulders, pavement, wood, debris, gravel,

etc. The screening machines and the warehouse used to be at the site may also have concrete foundations below grade. The current plan is to excavate the top 4 feet to remove these obstructions. However, some obstruction may still exists below the proposed working pad elevation.

F. Submittals.

1. A certification that states that no techniques that cause vibration to install the elemement are used in the installation.

2. Shop drawings that include spacing, diameter, installation procedure, sequence of construction with sufficient details including transitions areas, planned cut-off and tip elevations, material, proposed equipment, and mix design.

3. A load testing program to verify the design in accordance with the requirements of this special provision. The load testing program should comply with the following:
- **a.** It shall be performed prior and during production of rigid inclusions.
- **b.** The rigid inclusion production shall only start upon completion of two successful load tests and after the Engineer issues the final tip elevation, and installation criteria of the rigid inclusions.
- **c.** The load test shall be performed on rigid inclusion in accordance with ASTM D1143. Verification rigid inclusion shall be tested to a maximum load equal to 300% of the design load or until failure. The location of the test rigid inclusion will be selected by the Engineer with input from the Contractor and depending on the work and traffic control sequence. The Contractor shall accommodate in his schedule the time required to perform and evaluate the load test, and issue the installation criteria by the Engineer.

4. Design calculations for the load test reaction piles including diameter, type, reinforcement, depth as well as the reaction frame and beams. All details and supporting calculations shall be submitted for review by the Engineer. Design the reaction piles and frame for minimum two times the maximum test load. All shop drawings and supporting calculations shall be signed and sealed by a Professional Engineer registered in the State of Iowa.

5. Calibration records load cells, hydraulic jacks, pumps and pressure gauges should be submitted at least 7 days prior to performing the load testing.

6. A complete load test report should be submitted within 3 days of completion of each test. The Engineer shall evaluate the results of the load tests and issue the final tip elevations and planned spacing for the production rigid inclusions within 14 days from the receipt of the last load test report. Shop drawings and any supporting calculations should be sent to the Engineer at least 15 days prior to start the installation of the production rigid inclusions. Each rigid inclusion shall receive a reference number, which will be indicated on the shop drawings. The shop drawing submittal shall also show cut-off elevations, typical sections, and detail drawings, as required.

7. As-built plans for the installed rigid inclusions based on actual locations and tip elevations. The surveyed locations shall be sealed and signed by a licensed surveyor and tip elevations shall be certified by the Contractor's Professional Engineer registered in the State of Iowa.

8. Rigid inclusion installation records as specified. Installation records shall include all recordable information versus penetration depth, including applied torque, applied static down pressure (crowd pressure), advance rate (penetration speed), grout pressure, and grout volume.

9. A work plan including details of the equipment, sequence of construction, and method of installation should be submitted to the Engineer for review. The submittal should include a

detailed quality control plan and explain how the work plan will comply with all the requirements of the project safety plan.

10. Documentation for all imported materials including pertinent laboratory test results prior to arrival on site.

11. Documentation of the Contractor's qualifications shall show that it has been engaged in successful design and installation of deep ground improvements for at least five years, and designed and constructed a minimum of five similar projects with similar scope utilizing the deep ground improvement method proposed for the subject project. A list of previous projects including name, description, amount of rigid inclusions, and contact person with phone number shall be provided. Resumes of the Contractor's site superintendent and/or foreman shall also be provided. Qualifications of the firm that will be performing the pile integrity tests shall also be provided.

G. Design and Performance Criteria.

1. The Contractor shall be responsible for the shop drawings of the deep ground improvement system, with the following constraints:
- **a.** The rigid inclusions may consist of CMC, APGD, RI, GCC, or ORTD. No other substitute shall be accepted. The design shall conform to the requirements summarized in the contract documents.
- **b.** The working pad shall be as shown on the plan documents and as specified herein.

2. The Contractor shall be responsible for the design of the load tests reaction frames and piles.

150089a.02 MATERIALS.

A. Working Pad.
The working pad shall be macadam crushed stone with a nominal maximum size of 3 inches. Screen over a 3/4 inch screen. This is identified as Gradation No. 13 of the Aggregate Gradation Table, Article 4109.02 of the Standard Specifications
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B. Grout.
For CMC, APGD, RI, or ORTD, meet the following grout requirements.

1. Portland Cement**:** Shall conform to requirements of Article 4101.01, A of the Standard Specifications
- **a.** Type I or Type II.
- **b.** Cement shall be from an approved source per Materials I.M. 401. If the brand or type of cement is changed during the course of the project, additional grout mix tests shall be conducted to ensure consistency of quality and performance.

2. Fly ash shall meet the requirements of Section 4108 of the Standard Specifications.

3. Sand shall meet the requirements of Section 4110 of the Standard Specifications.

4. Water reducer shall meet the requirements Materials I.M. 403.

5. Fluidifier.

a. Water Reducing Agent.
- Specrete-IP Incorporated; Intrusion-Aid SCX.
- Specrete-IP Incorporated; Intrusion-Aid FG.
- Grace Concrete Products; WRDA 35.
- Grace Concrete Products; ZYLA 640.

b. Retardant.
- Specrete-IP Incorporated; Flo-Aid XR.
- Grace Concrete Products; Recover.

6. Water shall conform to requirements of Section 4102 of the Standard Specifications.

7. Grout Mix.
a. Proportion by weight to produce a grout capable of being satisfactorily pumped and of penetrating and filling all voids.
b. Minimum Compressive Strength:
- 2000 psi at 7 days as required prior to pile integrity testing.
- 4000 psi at 28 days.

c. Minimum Flow Cone Rate: 10 seconds to 25 seconds with modified 3/4 inch opening flow cone, ASTM C939.
d. Slump: 6 inches to 8 inches.
e. The grout mix shall be designed utilizing fluidifiers as needed to maintain the range of acceptable fluid consistency (flow cone rate) for a period of at least 2 hours.

8. A ready mix truck shall be supplied from an approved ready mix plant with certified plant inspection according to Articles 2001.20 and 2001.21 of the Standard Specifications and Materials I.M. 528. An Iowa DOT ticket per Materials I.M. 528 shall be prepared and provided to the Iowa DOT Inspector.

C. Concrete for GCC Construction.

1. All materials, proportioning, air entraining, mixing, slump, and transporting of PCC shall be according to Section 2403 of the Standard Specifications, except as modified herein.

2. Water/cement ratio: not to exceed 0.45.

3. Use Class D PCC mixture with a slump of 6 inches ±1.5 inches.

4. Portland cement: meet the requirements of ASTM C 150 Type I / II and Section 4101 of the Standard Specifications.

5. Fly Ash shall meet requirements of Section 4108 of the Standard Specifications.

6. Sand shall meet the requirements of Section 4110 of the Standard Specifications.

7. Water Reducer shall meet the requirements of Materials I.M. 403.

8. Air entrainment: apply Section 2403 of the Standard Specifications.

9. Retarder is required according to Materials I.M. 403 to maintain workable concrete.

10. Do not use GGBFS.

11. Minimum Compressive Strength:.
- 4000 psi at 28 days.
- 2000 psi at 7 days as required prior to pile integrity testing.

12. A ready mix truck shall be supplied from an approved ready mix plant with certified plant inspection according to Articles 2001.20 and 2001.21 of the Standard Specifications and Materials I.M. 528. An Iowa DOT ticket per Materials I.M. 528 shall be prepared and provided to the Iowa DOT Inspector.

150089a.03 CONSTRUCTION.

A. Safety Requirements.
Complete all work in accordance with the Project Safety Plan. The Contractor shall be responsible for ensuring that all conditions of these requirements are met to the satisfaction of the Engineer.

B. Equipment.

1. Utilize machines or combinations of machines and equipment that are in good working condition, safe to operate, cause no vibration, and will produce the results specified herein.

2. Utilize equipment that is capable of advancing the rigid inclusion through the subsurface materials efficiently to meet the project schedule.

3. The equipment shall be of sufficient size and capacity, and capable of installing rigid inclusions to the minimum depths shown in the plans or that required by the design, whichever is deeper.

4. The equipment shall be capable of installing rigid inclusions in the presence of very dense granular soils and/or obstructions, where encountered.

5. The rigid inclusion equipment must be equipped with installation monitoring capabilities including, as minimum, the following: (a) applied torque (b) applied static down pressure (crowd), (c) advance rate (penetration speed), (d) grout pressure, and (e) grout volume.

C. Site Preparation.

1. Inspect the site prior to the start of operations to verify the deep ground improvements can be constructed using the proposed equipment.

2. Excavation for the working pad shall not begin until the results of the load testing program on rigid inclusions has been submitted and approved by the Engineer.

3. The final excavation for the working pad shall be made using an excavator equipped with a smooth-edged bucket to minimize disturbance of the in-situ soils. The prepared subgrade shall consist of in-situ soils compacted to moisture content within ±2% of optimum moisture content. If compaction is not practical due to natural water contents far above optimum and/or wet weather conditions, the in-situ soils shall be over excavated to a depth of 12 inches and replaced with compacted granular fill. Any organic or otherwise unsuitable soils shall be removed and replaced with compacted granular fill.

D. Working Pad Construction.

1. Prior to construction of the working pad, topsoil and other unsuitable materials shall be removed as specified in Article 150089a.03, C, 3.

2. Construct the working pad which consists of at least 2 feet of Macadam Crushed Stone and proof roll it.

3. Any rutting of the working pad that occurs during installation of the rigid inclusions should be measured and the Engineer notified. If practical, when rutting occurs, reroute construction traffic to avoid further damage to the underlying in-situ soils, or remove and replace the rutted material with compacted granular fill.

E. Rigid Inclusion Construction.

1. Provide adequate number of drilling rigs to meet the project schedule considering all facets of the project.

2. Evaluate the site and subsurface conditions and assess any need for working platforms. Such platforms, preparatory work, and material needed is considered part of the means and methods and no additional payment or time will be granted toward such work.

3. Install ten demonstration rigid inclusions at non-production locations throughout the site to assess any variation in soil conditions and select the locations of the rigid inclusions that will be load tested and to be used in the development of the production installation criteria. These demonstration rigid inclusions shall be included before the load tests and before installation of production rigid inclusions. The demonstration rigid inclusion shall be paid at the same unit rate as the production rigid inclusion and no separate mobilization or additional cost shall be borne by Iowa DOT.

4. Perform two verification load tests prior to the start of rigid inclusion production. The load test results will be signed and sealed by the Contractor's Professional Engineer and submitted to the Engineer. One load test should be done after the rigid inclusion grout has gained the design strength and the other one should be done ~~14~~ 10 days after construction of the inclusion. No payment shall be made for load tests which were unsatisfactorily performed as determined by the Contractor and/or the Engineer.

5. Layout and Tolerances.

- **a.** Surveying: Prior to installation of the rigid inclusions, each rigid inclusion location shall be surveyed by a licensed surveyor. Provide all survey layouts, maintain utility clearances and provide any required coordination with the Engineer and any other local, state, and federal agencies having jurisdiction, prior to the start of construction. The location of each rigid inclusion shall be marked using a numbered utility flag.
- **b.** Plan position: The center of the completed rigid inclusion shall be within 3 inches of the plan location.
- **c.** Verticality: The axis of the completed rigid inclusion shall not deviate more than 2% from vertical. The verticality of the mast of the rig shall be checked by the operator before start of the installation for each rigid inclusion. The operator shall indicate on the daily drilling log for each rigid inclusion that verticality was within tolerance by checking the appropriate box on the installation log.
- **d.** Diameter: The completed rigid inclusion diameter shall not deviate more than 10% from the plan diameter.

6. Rejection: Rigid inclusions improperly located or installed beyond the maximum allowable tolerances or reported to be defective as a result of pile integrity testing, shall be abandoned and replaced with new rigid inclusions unless the Contractor and the Contractor's designer propose a remedial measure which is acceptable to the Engineer, either of which will be done at no additional cost to the Iowa DOT.

7. Schedule: Mobilize and maintain sufficient equipment, materials, and personnel to complete the work in accordance with project milestones and shall coordinate operations with all other aspects of the project.

8. Installation Sequence: Install the rigid inclusions in accordance with the sequence detailed in the approved work plan. If adjacent rigid inclusions are observed to be influenced by the installation of a neighboring rigid inclusion, the installation sequence shall be modified to prevent disturbance of already constructed rigid inclusions. Any required modifications to the sequence, or mitigation of rigid inclusions deemed unusable due to disturbance, shall be completed at no additional cost to the Iowa DOT or extension in the project schedule.

Rigid inclusion spacing and length as noted in the contract plans will be optimized based on the static load tests. Any required modification to the sequence based on the optimization shall be completed at no additional cost to the Iowa DOT or extension in the project schedule.

9. Depth: Install the rigid inclusions to the minimum tip elevation, or deeper as required to found the rigid inclusions on a suitable bearing stratum, as determined by the Engineer.

10. Obstructions: Subsurface obstructions may include but are not limited to boulders, timbers, concrete, bricks, utility lines, foundations, slabs, etc. that prevent rigid inclusions to be installed to the required depth. In the event that obstructions are encountered during installation of a rigid inclusion that cannot be penetrated with reasonable effort, one or more of the following procedures will be used:

- Position the element a short distance not more 1.5 feet away from the original position.
- Pre-drill the obstruction.
- Install additional elements to bridge over the obstruction.

Any change made to the design or rigid inclusion layout because of obstructions shall be approved by the Engineer. An as-built submittal should be provided to the Engineer no later than 7 calendar days after the modification has been performed on site. This submittal shall be signed and sealed by the Registered Professional Engineer responsible to the Contractor. All elements that are abandoned due to obstructions or equipment malfunction shall be completely backfilled with grout.

The Contractor shall be paid for the abandoned rigid inclusion elements per the contracted price per foot of rigid inclusions. No additional compensation or time for any items related to obstructions that can be remedied by the above procedures shall be awarded for delays, or mobilization to the relocated position of the rigid inclusion. For obstructions that cannot be remedied by the above procedures, the Contractor shall be compensated in accordance with Article 1109.14 of the Standard Specification.

11. Cut-off Elevation: Cutoff the rigid inclusions 6 to 12 inches below the top elevation of the working pad, or slightly higher to allow any required trimming or removal of low strength material at the top of the rigid inclusion.

12. Ground Heave: Up to 2.0 feet of heave of the working pad is expected due to rigid inclusion installation. The rigid inclusions may need to be cut down prior to construction of the MSE wall leveling pad. Any cut to the rigid inclusion shall be performed using methods that do not crack or damage the rigid inclusion. Such work is considered incidental and shall be performed at no additional cost to the Iowa DOT.

13. Axial load test on selected rigid inclusions should be performed after the design strength has been achieved. The working pad should be excavated to the original ground surface at the test location. Perform the excavation, load test setup, load testing, and backfill the excavation, in a single shift.

14. Disposal of Excavation Spoils: Stockpile all spoil material, including any topsoil and spoils generated by rigid inclusion installation, at the locations designated on the soil erosion plan. Handling and disposal of spoils shall be performed at no additional cost to the Iowa DOT.

F. MSE wall Construction.

MSE wall construction shall not begin in any area until the rigid inclusion design strength has been reached. If any rigid inclusion is broken or otherwise damaged during embankment construction, a remediation should be proposed within 2 days and construction shall be resumed only after all parties have approved the remediation solution and it has been completed.

G. Contractor Quality Control.

The following describes the minimum inspection and testing required in the Contractor's Quality Control (CQC) Plan and Program for the work of this section and is for CQC only. The implementation of the Contractor Quality Control Program does not relieve the Contractor from the responsibility to provide the work in accordance with the contract documents, applicable codes, regulations, and governing authorities.

1. Supervision, inspection, and records.

a. The Contractor shall have an on-site field engineer to manage all of the QC activities on the project including pile integrity testing, grout sampling (if applicable), and other testing. These tests should be performed as defined in the Design Submittal and approved by the Engineer. Load tests, production rigid inclusions, subgrade preparation, and working pad shall be done under the direct supervision of a professional geotechnical engineer registered in the State of Iowa from the Contractor's side. The geotechnical engineer shall have supervised a minimum of five similar deep ground improvement projects.

b. An accurate installation record shall be kept for all rigid inclusions. The record shall indicate the location, length, cut-off elevation, date and time of construction, applied torque, applied static down pressure (crowd pressure), advance rate (penetration speed), grout pressure, and any other pertinent installation details as indicated in the Design Submittal and approved by the Engineer. Any unusual conditions encountered during installation should be immediately reported to the Engineer and any corrective measures recorded. Daily records shall be signed by the Contractor' superintendent and by the inspector. A complete tabulation of all records pertaining the approved rigid inclusions installation shall be certified by the Contractor's engineer and shall be delivered to the Engineer no later than ~~14~~ 10 days after the completion of the rigid inclusion work. All testing and inspection documents certifying that the rigid inclusions and working pad were installed based on the construction and installation criteria shall be reviewed and approved by the Contractor's engineer.

c. Pertinent installation data as defined in the Design Submittal and approved by the Engineer should be provided on a daily basis. These documents shall be prepared continuously as the production progresses and shall be submitted to the Engineer no later than one working day after the installation of a rigid inclusion. The Contractor has to ensure that the Engineer has complete access at all times to the data for the rigid inclusion installation, as required.

2. Working Pad.

a. Perform proof-rolling of the top of the working pad prior to and following completion of the rigid inclusion installation. The proof-rolling shall cover the entire work area, and the wheel pass spacing shall be equal to the axle length of the dump truck. All required testing will be completed to the satisfaction of the Engineer at no additional cost to the Iowa DOT.

b. Following installation and curing of the rigid inclusions, proof-roll the working pad using a fully loaded dump truck. Where deflections more than 1/4 inch are observed, remove the working pad, over excavate 12 inches per Article 150089a.03, C, 3, and reconstruct the working pad. The excavation shall not damage the rigid inclusions.

3. Concrete and Grout.

Conduct strength testing of the concrete in accordance with ASTM C 39 and Articles 2001.20 & 2001.21 of the Standard Specifications and Materials I.M. 528. For concrete testing, cured cylinders measuring 3 inches in diameter by 6 inches high are required. For testing grout, 2-inch cubes are used. For the cylinders and molds, molds and a curing environment conforming to the requirements of ASTM C 39 should be provided. At a minimum, prepare a set of four test cylinders or cubes for each 50 cubic yards of concrete or grout placed or a minimum of two sets of four cylinders or cubes per day (whichever is greater). One cylinder or cube from each set shall be tested for strength at 1, 2, 7, and 28 days. Certified strength test results should be provided to the Engineer for acceptance.

4. Rigid Inclusions.

Pile Integrity Testing: Pile Integrity Testing (PIT) shall be performed on all the inclusions used for load test and approximately ~~2~~ 5% of the rigid inclusions. The PIT shall be performed in accordance with ASTM D5882. The production elements selected for the PIT shall be at the discretion of the Engineer based on daily records indicate likelihood of anomalies in the inclusions. The PIT shall be performed by a firm qualified to do such testing. Documentation of the firm's qualifications shall show that it has successfully performed PIT testing for at least 5 years, and for a minimum of five similar projects. A list of previous projects including name, description, number of tests performed, and contact person with phone number shall be provided. A report of the test results shall be provided to the Engineer within 48 hours of test completion.

5. Strain Gauges.

a. The test rigid inclusion shall be instrumented with five levels of strain gauges. The strain gauges shall be Geokon model 4911, 4911A or approved equivalent. The strain gauges shall be compatible with a real time monitoring system. The test rigid inclusions shall include a rebar to facilitate installation of the strain gauges. The test rigid inclusion may include, to the contractor's choice, a lightly reinforcement cage for the top five feet of the rigid inclusion to avoid any risk while transmitting the load effectively into the rigid inclusion. Preliminary strain gauges elevations are provided in Table 150089a-1. Strain Gauges final elevations shall be adjusted by the Engineer on site based on the confirmation borings and length of the rigid inclusion.

Table 150089a-1: Strain Gauges Preliminary Elevations

Elevation (feet)	Sub-surface Layer
2 feet below top of RI	Silt and clay
965	Silt and clay
960	Silt and clay
950	Silt and clay
2 feet above RI tip elevation	Silt and clay

b. Take initial readings 24 hours after completing installation and testing of each strain gauge. During the load test, the strain gauges shall be monitored prior to construction of production rigid inclusions. After monitoring the strain gauges during load tests, the strain gauges cables or wires shall be routed through a buried schedule 80 PVC pipe and shall be connected to the real time monitoring system to be monitored during placement of embankment as defined in the Special Provisions for Instrumentation. Strain gauges shall be compatible with the real time monitoring system. Readings shall be taken daily and made available online to the engineer. Any strain gauge that malfunctions or becomes inoperable during the load test shall be replaced and the load test shall be redone by the contractor at no additional cost to the Iowa DOT.

c. After the load tests, the strain gauges will continue to be monitored as defined in the Special Provision for Instrumentation and Monitoring. A minimum of two readings every 24 hours shall be taken using real time automated monitoring system for each strain gauge.

d. Additional special provisions for instrumentation related to the grading works are included in the contract documents.

150089a.04 METHOD OF MEASUREMENT.

A. The length of a rigid inclusion should be measured from the cut-off elevation to tip elevation and rounded to the nearest foot for payment. This includes the test (demonstration) rigid inclusions.

B. The amount of Macadam Crushed Stone used on the working pad will be rounded to the nearest cubic yard.

C. For the purpose of subcontracting, the rigid inclusions and load tests will be considered specialty items.

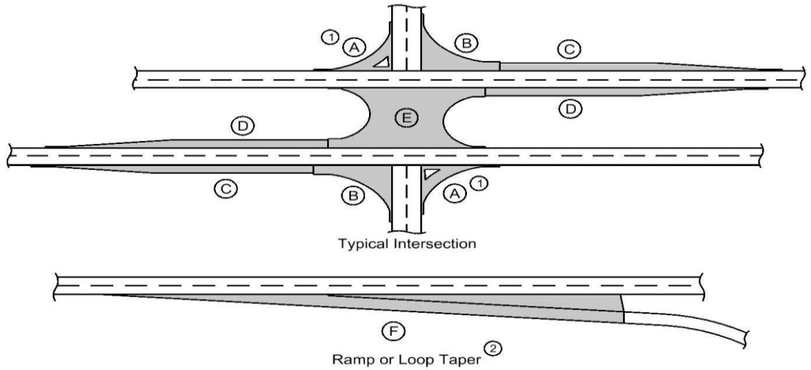
150089a.05 BASIS OF PAYMENT.

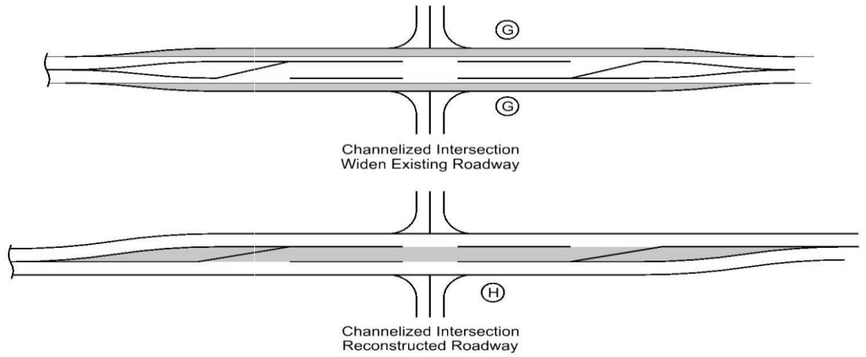
A. The rigid inclusions will be paid by linear foot of installed inclusion at the bid unit price and will constitute full compensation for providing all labor, material, equipment, design, site preparation, test pile installation, production installation, handling and disposal of cuttings, and any associated inspection, PIT, or laboratory testing services.

B. The load test will be paid as a lump sum and will constitute full compensation for providing all labor, material, equipment, and any associated installation inspection, testing, and monitoring, including PIT, and strain gauges.

C. The construction of the working pad and any associated inspection or laboratory testing, will be paid at the bid unit price per cubic yard for granular backfill, working pad stone.

PCC PAVEMENT





(1) Does not include raised island area or curb. Refer to tabulation 112-4 for quantities.

(2) Refer to PV-410, PV-411, PV-412, and PV-414.

(3) Quantity includes Pavement Header.

Location				Mainline			Area (3)								Total Area By Pavement Thickness		Special Backfill	Modified Subbase	Granular Subbase	Remarks
Road Identification	Direction of Travel	Station to Station		Width	Length	Area	A (1)	B	C	D	E	F (2)	G	H	SY					
				FT	FT	SY	SY	SY	SY	SY	SY	SY	SY	SY	10 IN	11½ IN	CY	CY	SY	
I-29 (MLE029N)	NB	8536+50.00	8538+30.00	36.0	180.0	720.0										720.0	240.0		720.0	
I-29 (MLE029N)	NB	8538+30.00	8544+00.00	0-12	570.0	380.0										380.0	126.7		380.0	
I-29 (MLE029N)	NB	8538+30.00	8544+00.00	36.0	570.0	2280.0										2280.0	760.0		2280.0	
I-29 (MLE029N)	NB	8544+00.00	8551+46.00	48.0	746.0	3978.7										3978.7	1326.2		3978.7	
I-29 (MLE029N)	NB	8555+78.60	8557+40.00	0-10.8	161.4	96.5										96.5	32.2		96.5	
I-29 (MLE029N)	NB	8555+78.60	8559+50.00	48.0	371.4	1980.8										1980.8	660.3		1980.8	
I-80 (ML080)	WB	7535+00.00	7539+00.00	4-12	400.0	340.0										340.0	113.3		340.0	
I-80 (ML080)	WB	7535+00.00	7539+00.00	36.0	400.0	1600.0										1600.0	533.3		1600.0	
I-80 (ML080)	WB	7539+00.00	7551+47.00	48.0	1247.0	6650.7										6650.7	2216.9		6650.7	
I-80 (ML080)	WB	7555+78.55	7559+53.83	36.0	375.3	1501.1						820.1				2321.2	773.7		2321.2	
IA192 LOOP A (IA192A)		51546+00.00	51551+40.00	18.0	540.0	1109.2									1109.2			369.7		
													TOTAL:		1109.2	20347.9	6782.6	369.7	20347.9	

FILE NO.	ENGLISH	DESIGN TEAM Strum\Brinkman\Janus	POTTAWATTAMIE COUNTY	PROJECT NUMBER IM-NHS-080-1(459)3--03-78	SHEET NUMBER C.7

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GROUND IMPROVEMENT USING RIGID INCLUSIONS

1. Ground improvement consisting of rigid inclusions shall be installed in the areas shown on the plans. The work shall be performed in accordance with the Special Provision for "Ground Improvement using Rigid Inclusions."

2. Before starting the ground improvement work, the grading contractor shall excavate the entire RI area to elevation 973 feet. The contractor shall be aware that based on the historical aerial photos of the site, significant portion of the Rigid Inclusion Area was part of Western Engineering Company facility. The area were used to manufacture and/or store paving and landscaping materials which may include, rocks, boulders, pavement, wood, debris, gravel, etc. The screening machines and the warehouse used to be at the site may also have concrete foundations below grade. The site was stripped part of 370 grading project. ~~Removal and disposal of such material that may be encountered below elecation 973 shall be considered incidental at no additional cost to Iowa DOT.~~ The cost of removing and disposing such material that encountered above elevation 973 feet will be paid part of the roadway excavation bid item.

3. Once excavated, the Contractor shall construct 2 feet thick stone layer using MACADAM crushed stones or equivalent to elevation 975 feet to serve as a working pad for the RI area. Approximately 5,000 CY of stone backfill is required for the working pad and no shrinkage was assumed in the quantity.

4. The Rigid Inclusions installation shall commence only after the load testing and other requirements of the Special Provisions are met and after obtaining approval from the Engineer. The contractor is advised to review the available boring logs.

5. The rigid inclusions shall be installed in accordance with the spacing and depth criteria shown in the typical drawings. These rigid inclusions will require penetration into the 2 ft thick working pad.

6. Approximately 1,050 RI element are required for this project with estimated length of approximately 32,500 linear feet.

7. All rail lines in the vicinity of the Rigid Inclusion area will be abandoned and removed from the site; however, the RI may be obstructed with some old rail road omponents that were left in place. The contractor should assume that he may have to relocate the RIs if obstructions occur, while keeping the average tributary area of the RI less than 65 square feet unless otherwise directed by the engineer.

8. The site within the Rigid Inclusion Area has existing sign structures, and posts for overhead lines which either abandoned or will be abandoned and removed from the site. However, these structures may have a foundation below grade that will be left in place. Therefore, the contractor shall obtain the as-built plan of these structures and relocate the RI around them to avoid any potential interference with the proposed rigid inclusions. If the plans are not available, the contractor may perform test pits to identify the exact location. Any relocation due to the utility conflict should be selected to keep average tributary area of the RI less than 65 square footing unless otherwise directed by the engineer.

9. All utility lines in the vicinity of the Rigid Inclusion area will be abandoned and left in Place or removed. The contractor may perform test pits or potholes to identify the exact location to avoid the conflict with the proposed rigid inclusion. Any relocation due to the utility conflict should be selected so that the RI's will have the same or less triburary area.

10. The Rigid Inclusion installation shall be coordinated with the proposed MSE wall, driven piles for the proposed abutments, proposed foundations for the light pole, and the drilled shafts for the proposed structure. Refer to Q.21 and Q.22 for more details.

Table 1 : Required Holding Period for the Different Grading Areas

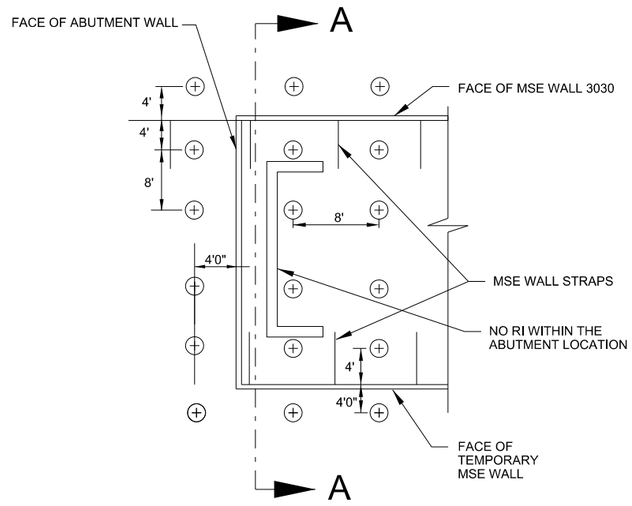
Road	Station		Overbuild to Finished Grade	Required Holding Period (days)[1]
	From	To		
I-80 WB	7547+00	7549+00	Yes	30
	7555+25	7559+00	No	30
I-29 NB	8547+00	8548+00	No	30
	8548+00	8549+25	No	30
	8554+75	8559+50	No	30
Detour 300800	300833+50	300838+50	No	150

STAGE CONSTRUCTION NOTES:

1. All the embankment within the areas summarized in Table 1 shall have a holding period after the end of grading. The required holding period are shown in Table 1.

2. The remainder of the fill embankment shall be constructed with no holding period.

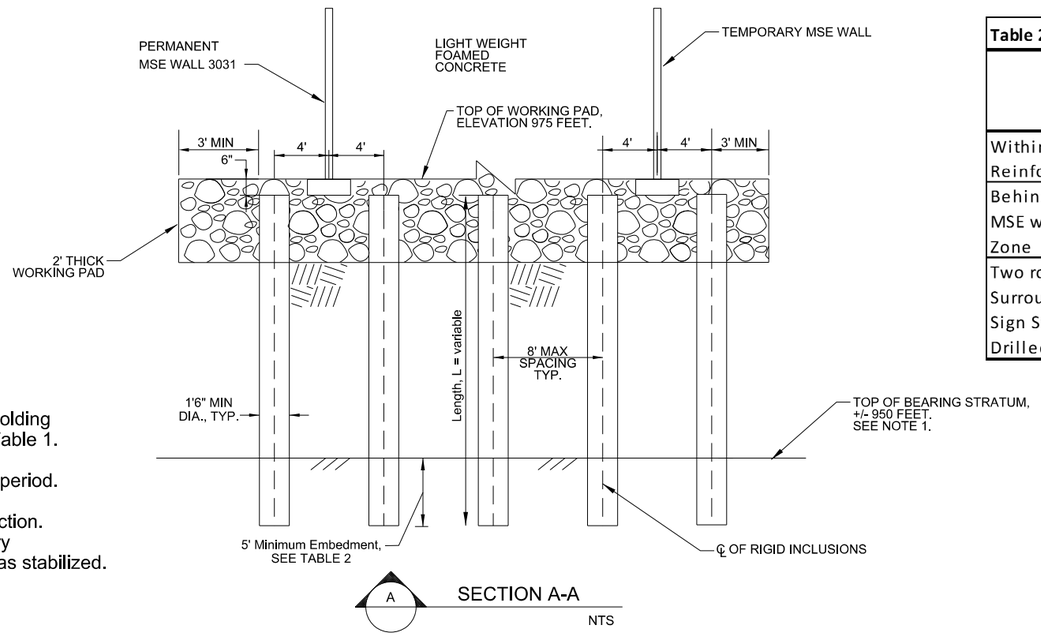
3. The holding period in Table 1 is estimated and may change during construction. The Engineer will evaluate the settlement rate and confirms that the primary consolidation or elastic settlement is complete and the rate of settlement has stabilized.



PLAN

1 GRID SPACING DETAIL

NTS



A SECTION A-A

NTS

NOTES:

1. THE TOP OF BEARING STRATUM IS APPROXIMATE AND WILL BE CONFIRMED IN THE FIELD DURING THE INSTALLATION OF PRE-PRODUCTION RI
2. INSTALLATION CRITERIA AND FINAL EMBEDMENT FOR RIGID INCLUSIONS SHALL BE ESTABLISHED BY IOWA DOT BASED ON INSTALLATION AND RESULTS OF LOAD TESTS ON TEST ELEMENTS
3. THE DESIGN SERVICE LOAD ARE PROVIDED IN TABLE 2.

Table 2: Design Load and Embedment for Rigid Inclusions

Location	Design Axial Load (Kips)	Design Embedment (ft)	Estimated Tip Elevation (feet)
Within MSE wall Reinforced Zone	135	7	943
Behind and Front of MSE wall Reinforced Zone	120	5	945
Two rows Surrounding the Sign Structure Drilled Shafts	150	10	940

DETAILS FOR RIGID INCLUSIONS

MSE WALL GENERAL NOTES

1. The MSE wall shall be installed in accordance with the special provision for MSE wall with lightweight foamed concrete fill (LFCF).
2. The MSE wall shall be designed according to AASHTO LRFD bridge design specification (2014).
3. The selected wall supplier shall submit a detailed design and shop drawings for approval.
4. The permanent wall shall be designed for a minimum service life of 100 years.
5. The temporary wall shall be designed for a minimum service life of 5 years.
6. Light weight foamed concrete shall have a maximum unit weight of 48 pcf.
7. The anticipated MSE wall total settlement is less than 4 inches. The anticipated total settlement of the wall over the life time after completion of the wall construction is less than 2 inches.
8. The ground improvement with rigid inclusion under the MSE wall is designed to support maximum service applied bearing pressure of 2350 psf for the MSE walls in front of the sign truss foundations and 2100 psf for the reminder of the MSE wall.
9. ~~The MSE wall vendor shall design the straps around the drilled shafts for sign structure to account for the additional pressure from the sign structure. Each of the north side drilled shafts are supporting service loading of 10 kips lateral load and 150 kips-feet bending moment at the top of shaft. The drilled shaft for the south wall supports service loading of 16 kips lateral load and 560 kips-feet bending moment at the top of shaft~~
10. The length of the MSE reinforcement for all the walls shall be the greater of 10 feet and 0.7H. where H is the wall height from the finished grade as shown in the Q.2 to top of leveling pad
11. MSE wall straps shall be deflected as needed around proposed abutment piles and the proposed sign structure foundations.
12. MSE wall strap location are shown for schematic purposes only.
13. The top lift of the LFCF shall have minimum of 6 inches cover above the reinforcing straps
14. Rebar stakes and horizontal rebars may be needed to keep the straps horizontal within the LFCF.
15. New fill material used to widen the considered roadways or placed in front of the MSE wall, to attain the final design elevations should be structural fill material with minimum effective friction angle of 30 degrees and total unit weight of 120 ±5 pcf. Pre-approved, compacted, granular soil from the borrow # 32 would be acceptable as structural fill as long it has effective friction angle of 30 degrees and total unit weight of 120 ±5 pcf. Embankment fill material should be placed in accordance with section 2107 of the standard specifications, and compacted with a compactor appropriate for the soil type.
16. Bench cuts are required for fills placed on existing grades that have a slope of 3H:1V or steeper and are more than 10 feet in height.Refer to the IOWA standard specifications Section 2107.03 for the benching details when constructing against existing embankment.

PROPOSED CONSTRUCTION SEQUENCE:

1. Excavate to elevation 973 feet, remove unsuitable soil and prepare the subgrade.
2. Drive the piles and install the Corrugated Metal pipe around them.
3. Install the rigid inclusions as shown in the plans, after installing the working pad to elecation 975 feet.
4. Install the drilled shafts for the sign structures and wrap the drilled shaft portion within the MSE wall with Yellow Jacket. The drilled shaft can be installed before the rigid inclusions or simultaneously.
5. The contractor shall coordinate the placement of the LFCF with the construction of the storm sewer pipe. The contractor can slope the top of the LFCF at the pipe invert elevation to match the pipe inclination and install the pipe after that. Alternatively, the contractor can place the LFCF in steps, install shims, bricks, concrete blocks, or MACADAM crushed stones to allow the installation of the pipe at the proposed inclination. After the installation of the pipe, the contractor shall placed LFCF around and above the pipe carefully such that the pipe is not misaligned horizontally or vertically. Any cost of forming, shims, stone, should be at no additional cost to the department.
6. Begin the construction of the MSE walls with light weight foam concrete fill (LFCF). MSE wall panels and LFCF are placed simultaneously up to the bottom of the abutments.
7. After the completion the MSE wall, wait for a minimum of 30 days before paving.

9. The MSE wall vendor shall design the straps around the drilled shafts supporting the sign structure to account for the additional pressure from the sign structure. Reinforcement Straps for the MSE wall panels between wall stations 5312+75 and 5313+25 and between stations 5313+75 and 5314+25 shall be designed for an additional lateral service pressure of 500 psf applied between elevation 997 and 977 feet.

MSE GENERAL NOTES AND CONSTRUCTION SEQUENCE

FILE NO.	ENGLISH	DESIGN TEAM IOWA DOT\CH2M	POTTAWATTAMIE COUNTY	PROJECT NUMBER IM-NHS-080-1(459)3--03-78	SHEET NUMBER Q.22

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ML 029N

Proposed Lightweight Foamed Concrete Fill

140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

1010 1000 990 980 970

979.14
110.82
977.56
106.07
33.3%
977.56
96.07
980.98
98.27
98.16
82.76
100.43
70.10
1.50
1.58
1.60

8555+25.00

1000 990 980

8555+00.00

980

8554+75.00

980

8554+50.00

8554+25.00

8554+00.00

8553+75.00

140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

FILE NO.	ENGLISH	DESIGN TEAM Strum \ Brinkman \ Janus	POTTAWATTAMIE COUNTY	PROJECT NUMBER IM-NHS-080-1(459)3--03-78	SHEET NUMBER W.55

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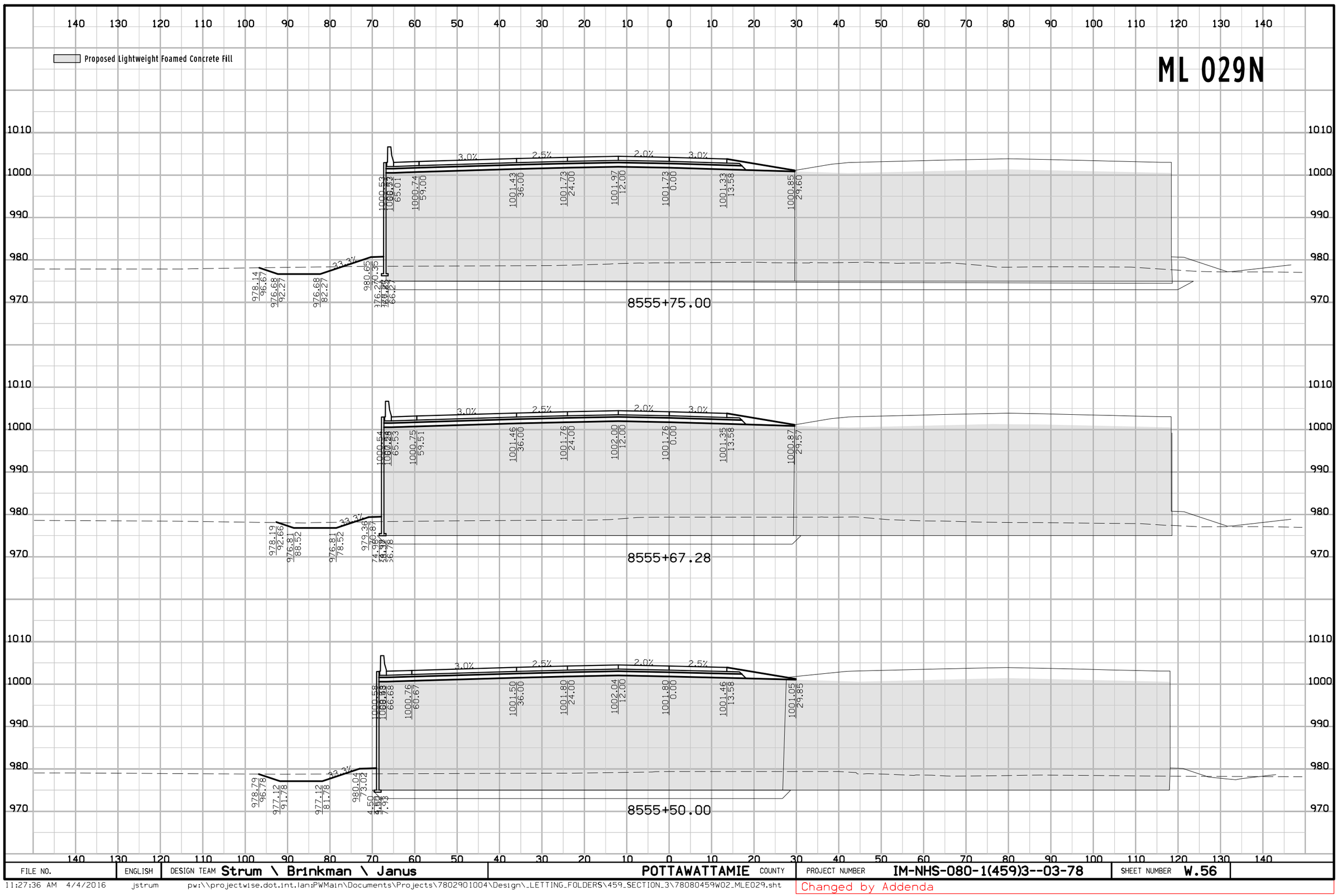
Proposed Lightweight Foamed Concrete Fill

ML 029N



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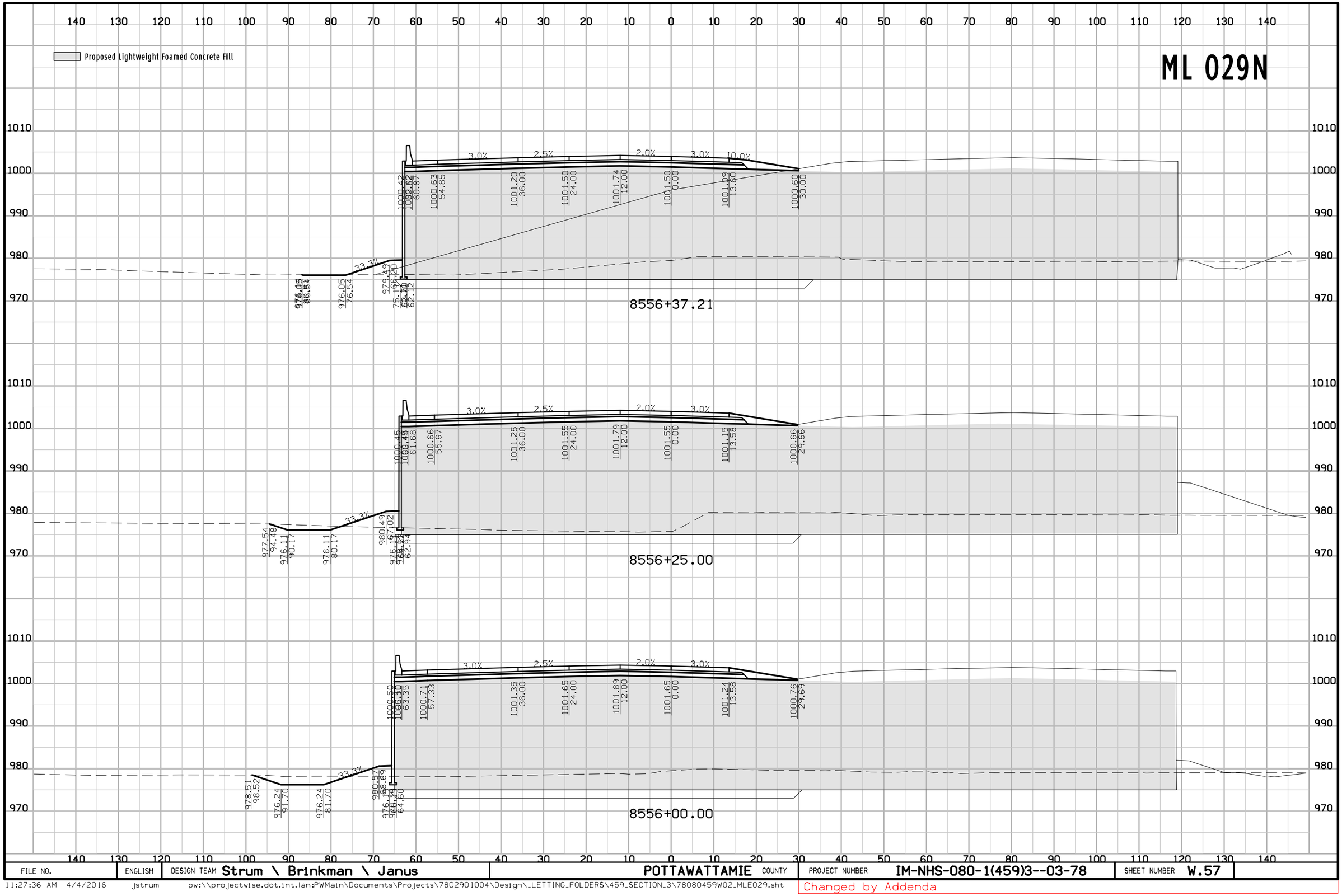
ML 029N

Proposed Lightweight Foamed Concrete Fill



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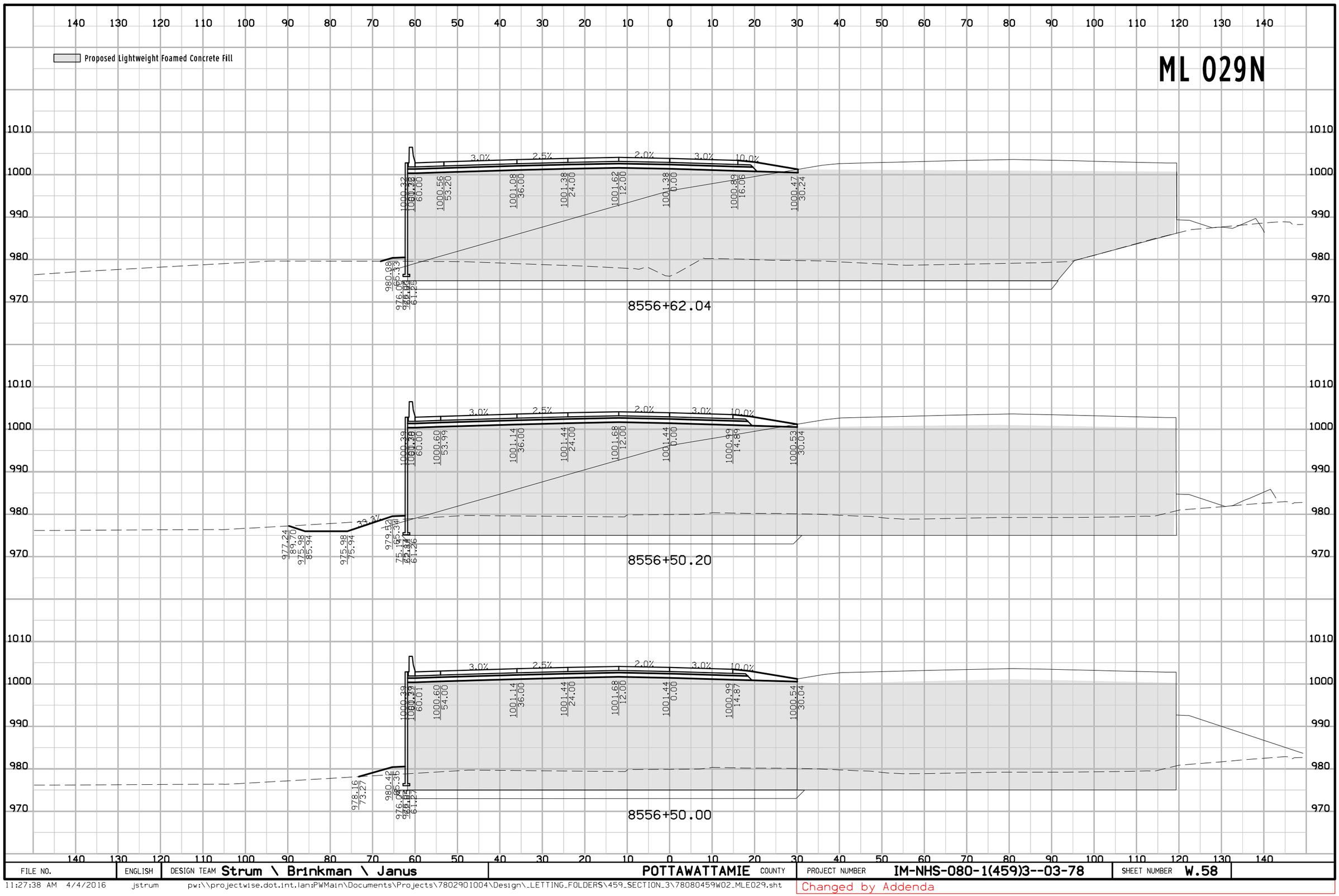
Proposed Lightweight Foamed Concrete Fill

ML 029N



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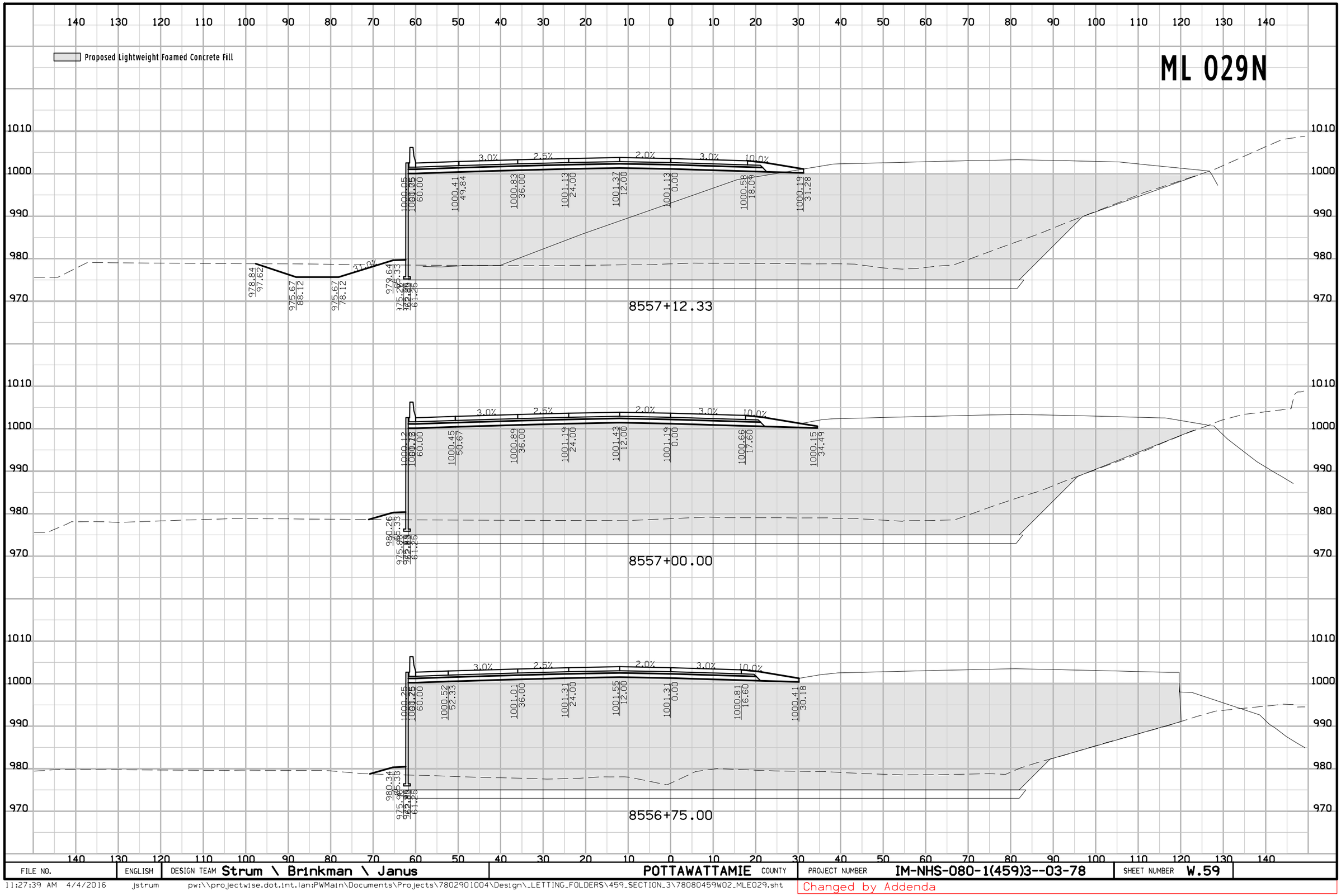
ML 029N

Proposed Lightweight Foamed Concrete Fill



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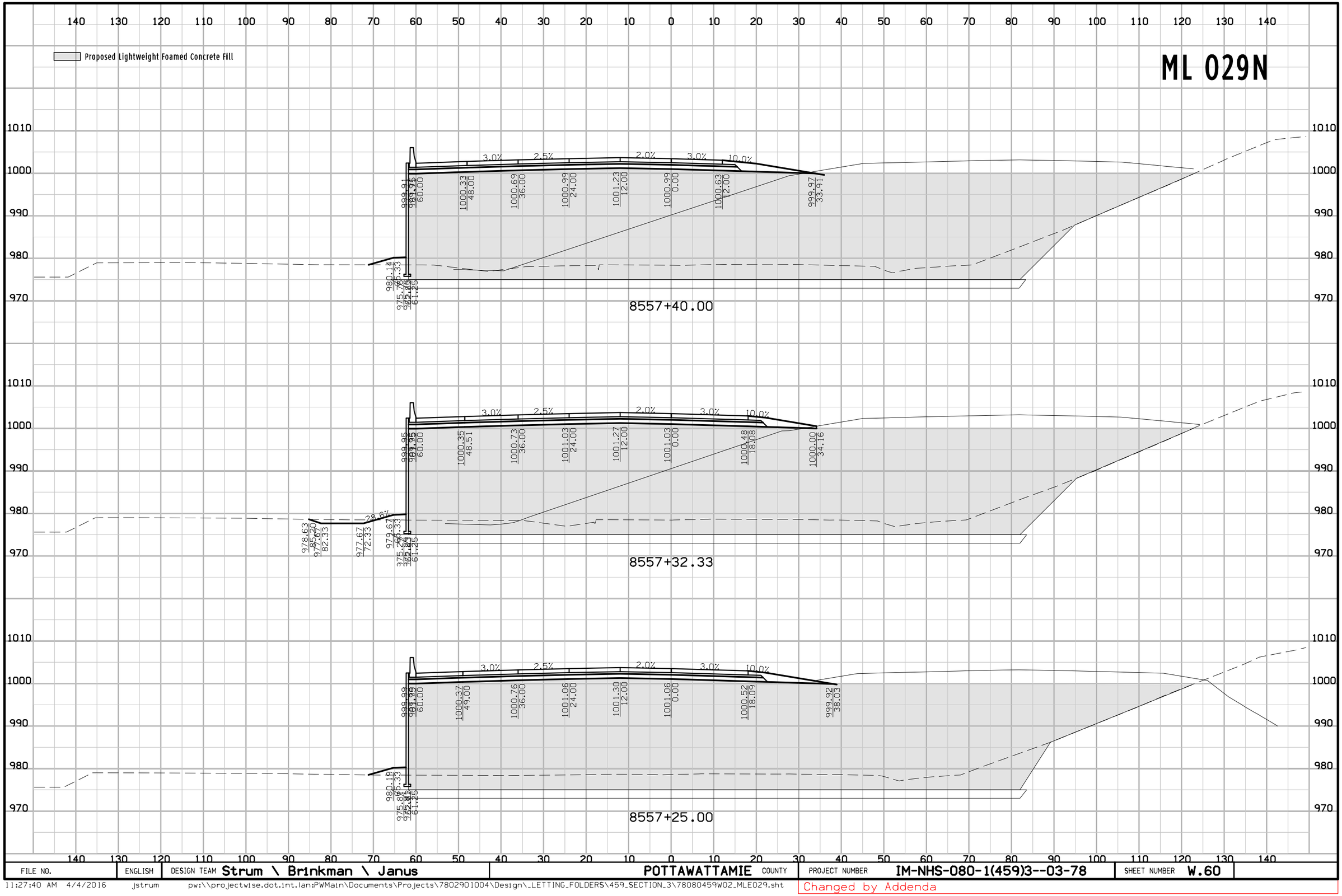
Proposed Lightweight Foamed Concrete Fill

ML 029N



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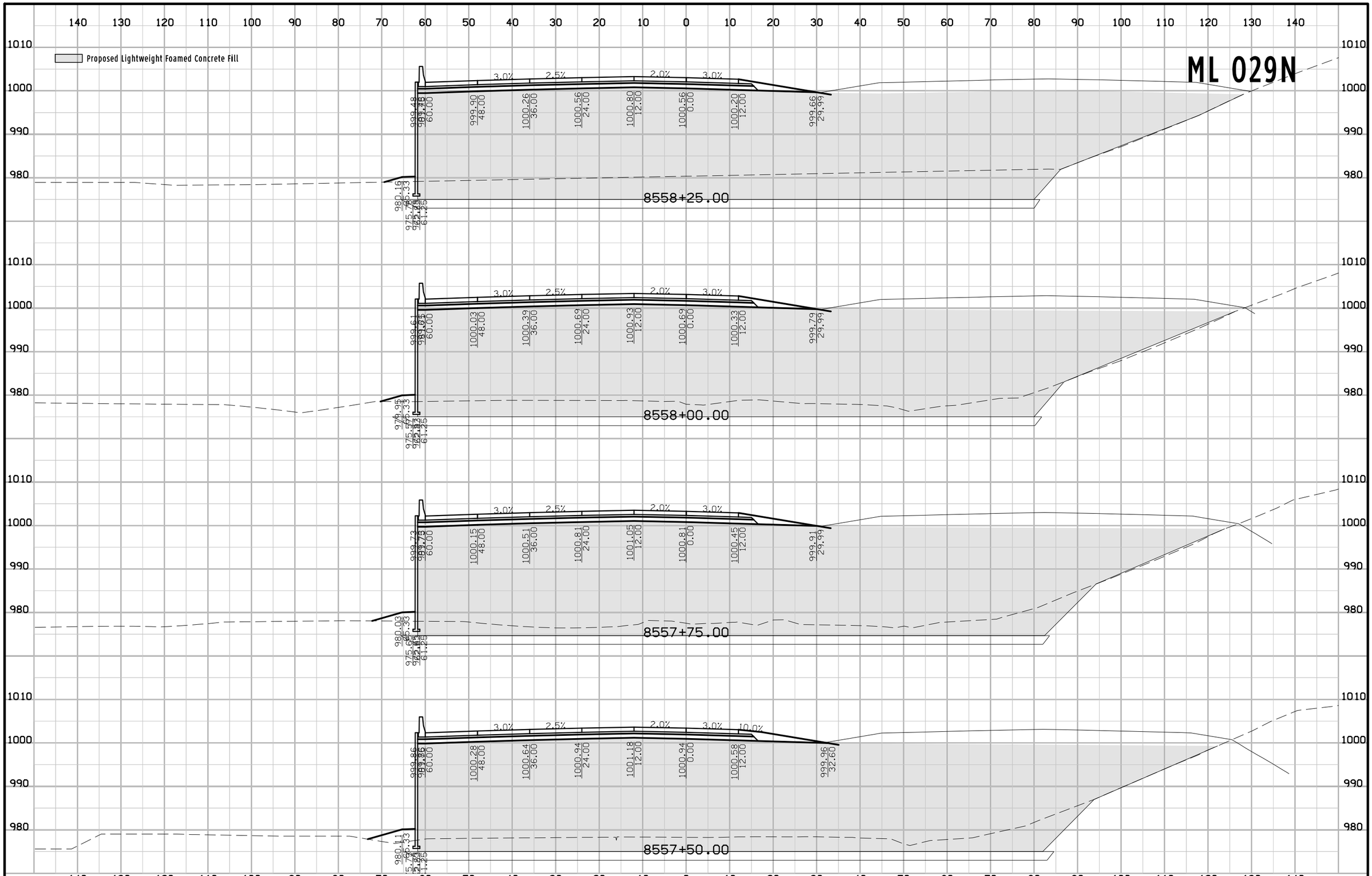
ML 029N

Proposed Lightweight Foamed Concrete Fill



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Proposed Lightweight Foamed Concrete Fill

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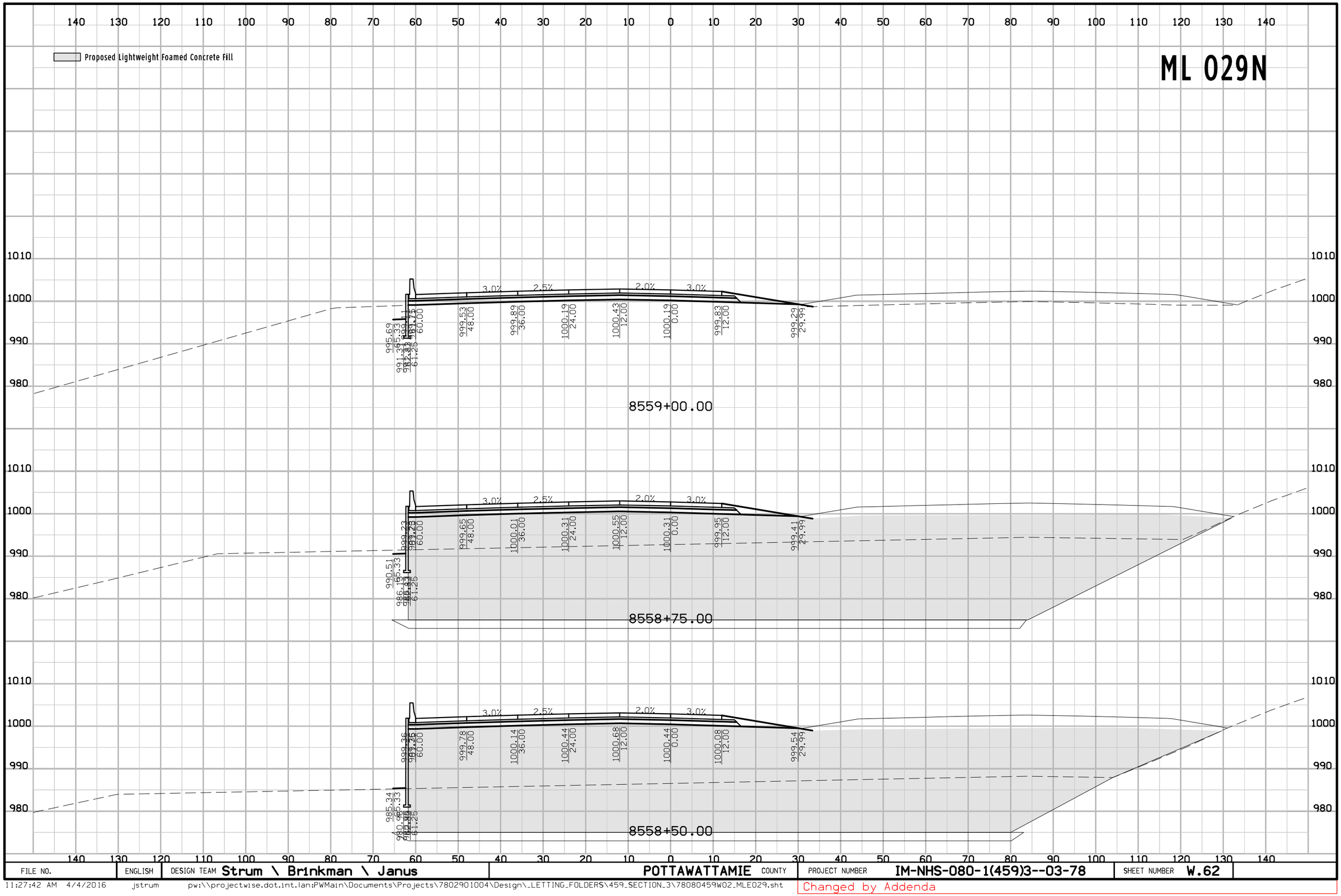

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