FAIRVIEW COMMUNITY RECREATION CENTER WINTER STORM WATER INFILTRATION SYSTEM 4-6-14

NEW SECTION 55.24 WINTER STORM WATER INFILTRATION SYSTEM

Article 23.1 Description

Where indicated on the Drawings install winter storm water infiltration system in accordance with latest revision of MASS and these specifications. The Contractor shall furnish all labor, materials, and equipment for completing the Work including but not limited to natural gas line installation, boiler and glycol heat exchanger installation, concrete grouting, pipe connection, pipe installation, pipe fittings, and appurtenances.

Article 23.2 Definitions

A. **Winter Storm Water Infiltration System:** A two part system to dispose of snow by melting the snow and then conveying the melt water to an infiltration gallery where the water will percolate into the surrounding native soil.

B. **Natural Gas Tie-In**: Location were pipe and fittings are used to make a connection between a newly installed Natural Gas line and an existing Natural Gas line.

C. **Machinery Space**: Concrete vault structure housing the boiler and electrical components for the Melting structure

D. **Melting Structure**: Concrete vault structure that snow is placed in to be melted.

E. **Sprayer**: An orifice used to disperse water over snow in the Melting structure.

F. **Sprayer Manifold**: Pipe line that delivers water to sprayers

G. **Sprayer pump**: Submersible pump used to convey water through the sprayer manifold to the sprayers

H. **Drain field**: Bed of engineer approved gap graded soils that have high hydraulic conductivity and thus allow water to infiltrate at a higher rate.

I. **Infiltration Gallery**: Perforated pipe network that allows water to infiltrate to the drain field.

J. **Discharge Piping**: Piping that conveys melt water from the structure to the infiltration gallery

K. **EMT:** Electrical Metallic Tubing (conduit material).

L. **Instrumentation Leg:** Circuit branch that operates the instruments which control the

M. **NAND Gate:** Logical gate that will only produce a voltage if one of the inputs is considered open.

N. **Normally-Closed:** Contact that will remain closed until excited by a voltage, at which point they open.

O. **OCPD:** Over-current Protection Device (also known as a circuit breaker).

P. **Reference Ground:** Ground used to provide a reference to the potential on the secondary side of the transformer.

Q. **Secondary Phase:** Unused tap to establish a reference ground.

R. **THHN:** Thermoplastic High Heat-resistant Nylon insulation for the conductor.

Article 23.3 Submittals

Submit the following for review and approval by the Engineer:

1. Product information for Natural Gas Boiler
2. Product information and MSDS for ethylene glycol
3. Calculations and stamped structural drawings
4. Work experience and credentials for professional licensed plumber
5. Concrete strength test results verifying greater than 4000 psi concrete mix design is used in vault structures
6. Product information for the 2-inch submersible sprayer pumps verifying they meet the outlined specifications
7. Product information for RTD with Thermocouple
8. Product information for Float Level Switch
9. Product information for Temperature Activated Switch
10. Product information for Time Delay Switch
11. Product information for AC/DC converter
12. Product information for Transformers used
13. Product information of OCPD units used
14. Wire sizing calculations to electrical professional
15. A workplan including the following:

a. For each pit describe the excavation boundary and dimensions at the base of the pit and at the ground surface.

b. Schedule of excavation and piping installation

Article 23.4 Materials

All materials shall be in accordance with MASS unless otherwise specified in the contract documents.

A. Corrugated Polyethylene Pipe

Piping materials used shall be Type SP and shall meet requirements of MASS section 55.02 Furnish & Install Pipe.

B. Ductile Iron Pipe

Piping materials used shall be Class 50 and shall meet requirements of MASS section 50.02 Furnish & Install Pipe.

C. PVC Pipe

Piping materials used shall be C-900 DR18 PVC and shall meet requirements of MASS section 60.02 Furnish & Install Pipe.

D. Concrete Vaults

Melting and Machinery vaults shall be constructed of precast reinforced portland cement concrete and shall meet ASTM C-478.

Article 23.5 Construction

A. Safety

The Contractor shall carry out this operation in strict accordance with all OSHA and manufacturer's safety requirements and shall meet the requirements of MASS Section 10.06, Article 6.8 Safety. Particular attention is drawn to those safety requirements involving working with scaffolding entering confined spaces and operations with hot media.

B. Remove asphalt

Remove asphalt in accordance with Section 20.09

C. Melting and Machinery Vault Pits

Locate and construct pit required to install the Melting and Machinery vaults based on the information represented on the Drawings, the conditions of the project site, and any design and/or manufacturing limits precast structure. Design level survey was not conducted for this project. It is the contractor's responsibility to coordinate with the appropriate Muni representative to determine the location. Excavation and backfill for the construction of the pit will be in accordance with Section 20.13 Trench Excavation and Backfill.

D. Installing Precast Melting and Machinery Vaults

Prior to placing vault, contractor shall excavate 3-feet deeper than needed to place the top of the structure level with the existing ground surface. Contractor shall furnish foundation backfill in accordance with Section 20.19 with the exception that all material under the vaults shall be placed in 6-inch lifts and be compacted to at least 95% of maximum density.

Furnish and install vault as per the drawings. All portions of the vault must be approved by the engineer. The Contractor shall provide timely notice (at least two Working days in advance of casting) to allow time for the Engineer to arrange for necessary inspections. Installation of vault sections without the Engineer's written approval shall not be allowed. This approval does not relieve the Contractor of the responsibility for protection of vault against damage during handling and installation.

The vault frames and covers shall be cast in to the precast vault top and brought to grades shown on the Drawings unless otherwise approved by the Engineer. Vault joints shall be doweled and set in a full bed of non-shrink grout to ensure a water tight and secure connection. No lateral offset is permitted between vault sections.

The Melting Vault and Machinery Vault should be square with one another as per the drawings. Once aligned, they should be connected by core drilling an aligned penetration between the two structures and placing a steel bar inside the penetration. The annular space shall then be filled with non-shrink grout. The number and spacing of the connections and the size of the steel bars will be as per the structural engineer's recommendations.

E. Connecting Discharge Piping

Connect the discharge piping to the Melting vault as per the drawings. The pipe connection shall be made using a NPC Kor-N-Seal or approved equal to provide a water tight connection. Furnish and install the discharge pipe network as per drawings and in accordance with Section 60.02.

F. Infiltration Gallery

A layer of non-woven geotextile fabric shall be placed over top of a 95% maximum density prepared surface of type IIA or engineer approved equal. Install all geotextile fabric in accordance with Section 20.25.

An 18-inch bed of ¾–inch drain rock shall be placed as per the drawings on top of the non-woven geotextile fabric. Furnish and install infiltration piping in accordance with drawings. Connect the 8-inch PVC discharge piping to the 24-inch CPEP infiltration piping by placing a 24-inch CPEP cap on the 24-inch pipe and cutting an 8-inch diameter pipe penetration in the cap. Ensure that the gap between the 8-inch pipe and the cut surface of the cap is less than ¼-inch. The penetration should be cut to align the flow lines of both pipes. Stab the 8-inch pipe approximately 2-feet inside the penetration and then seal the pipe penetration using ramneck or engineer approved equal. The 24-inch CPEP shall then be bedded in ¾–inch drain rock as per the drawings. A non-woven geotextile fabric shall be placed over top of the drain field. All seams of the top layer of fabric shall overlap the bottom layer by one foot as per the drawings. Contractor shall ensure that non-woven geotextile fabric covers all sides of the drain field.

G. Backfill

All backfill shall be conducted in accordance with Sec 20.13.

H. Installation of Machinery and Melting equipment

Boiler and heat exchanger shall be installed by a licensed professional plumber or other engineer approved heating professional. The boiler is to be installed in the Machinery vault on the side closest to the Melting vault. The heat exchanger shall be installed on the wall of the Melting structure closest to the Machinery vault. The heat exchanger shall be installed so that the top of the exchanger is not higher than 4-feet from the bottom of the vault to ensure that the heat exchanger remains submerged during operation. A ¼-inch thick expanded metal steel plate with openings no larger than 2-inches shall be installed to cover the entire vertical surface and top portion of the heat exchanger. Connect the heat exchanger to the boiler by performing a water tight pipe penetration between the two vaults.

Two 12-inch perforated pipes shall be installed and secured to the wall of the vault as per the drawings. Place ¾-inch drain rock inside each pipe until approximately 3-feet of ¾ -inch drain rock has been added to each pipe. Contractor is responsible for securely permanently fastening the perforated pipes to the vault.
Install approximately 8-feet of 2-inch HDPE piping to each submersible sprayer pump using camlock connections. Lower each pump inside a 12-inch perforated CPEP sump until the pump rest on the bed of ¾-inch drain rock. See electrical section of this specification for pump electrical connection instructions. Furnish and install sprayer manifold piping to both longitudinal sides of the Melting vault as per drawings. Ensure that sprayers are offset from each other 4-feet and 2-feet from the sprayer across the vault as per drawings. All sprayer manifold piping except for the two stand pieces

coming up from the sprayer pumps to the camlock 90s shall be securely fastened to the vault. This will allow maintenance personnel to disconnect the camlock 90 and lift the sprayer pump by the HDPE pipe for maintenance and inspection

I. Electrical construction

A licensed professional electrician shall perform all electrical work. Contractor shall install a conduit from the nearest pedestal to the Machinery Vault. A mast shall be used to bring the conduit to the meter. A 1/0 THHN copper conductor shall be ran through a 1" EMT Conduit to a panel. Contractor shall install OCPD circuit breaker rated at 90 Amps inside the panel. A bus bar shall be installed inside the panel to distribute the electrical current to three different branches. The first branch will control the instrumentation for the system. It will include a 120/208V single-phase transformer to reduce the voltage to 120VAC before entering am AC/DC converter. The transformer must have a secondary phase pulled to a reference ground to ensure the DC voltage is correct for the instrumentation leg. The instrumentation leg will consist of a normally-closed temperature activated switch, normally-closed float level switch, and a normally closed time delay switch. These three components will pass through a logical NAND gate which will determine whether the toggle switches controlling the system are opened.

The other two legs of the system will be providing power to the pumps. These legs will be connected to an earth ground. The leg controlling the sump pumps will have another 120/208V transformer to bring the voltage to 120VAC. This will not be required to have a secondary phase attached to a reference ground because the earth ground mentioned previously will suffice. From this transformer a #10 THHN copper conductor will be pulled to a 20A motor protection circuit breaker. From this OCPD two more #6 THHN conductors will pass through a manually controlled push button switch, and through the automatically controlled toggle switch to power the pumps. Contractor shall furnish and install round rubber shielding on the conductors providing power to the submerged pumps. The third leg will not require a transformer, as the centrifugal pump and boiler can operate with 208VAC. Contractor shall install two #6 THHN conduits through a ½-inch EMT conduit to the centrifugal pump and boiler. Similarly, this leg will pass through a 40A motor protection circuit breaker, a manually operated push button switch, and an automatically controlled toggle switch.

Contractor shall furnish and install a centrifugal pump to circulate glycol through the heat exchanger. This pump shall be specified by a licensed professional plumber to meet the demands of the winter storm water infiltration system.

J. Clean Up

After the installation Work has been completed and all testing accepted the Contractor shall clean up the entire project area. The Contractor shall dispose of all excess material and debris not incorporated into the permanent installation.

V. Final Acceptance

The final acceptance for the work will be based on satisfactory testing, as well as visual observation of the engineer.

W. Record Drawing Information

Record the location, dimension, and size of all pipe and fittings and valves in relation to where they are located on the system. The information shall be recorded on the Contractor redline drawings for incorporation into the project record drawings.

As-built survey measurements shall be taken to document the vertical and horizontal location of the piping while it is exposed during the work. The as-built survey information shall be recorded on the Contractor redline drawings for incorporation into the project record drawings.

Article 23.6 Measurement

Measurement will be per each for Winter Storm Water Infiltration System.

Article 23.7 Payment

Payment for this Work shall be in accordance with Division 10, Section 10.07 Measurement and Payment.

Payment for the Winter Storm Water Infiltration System work shall include full payment for all Work described in this Section and shall include Winter Storm Water Infiltration System, traffic maintenance, trench excavation and backfill, furnish bedding material, classified fill and backfill, dewatering, disposal of unsuitable or surplus material, furnish and install pipe, furnish and install natural gas line, furnish and install precast vaults, construction survey, natural gas tie-ins natural gas boiler installation, furnish and install sprayer equipment, furnish and install geotextile fabric, furnish and install heat exchanger, and furnish and install necessary electrical components.

Unit cost payment shall be made on the following basis:

ITEM	UNIT
F & I Winter Storm Water Infiltration System	Lump Sum

ANCHORAGE- FAIRVIEW SNOW DISPOSAL PROJECT

Presented by
Rich Bailey

Task

- Design Snow Melting System
  1. Push Snow In
  2. System Melts Snow
  3. System Infiltrates Snowmelt to Surrounding Soils
  4. Entire Process Needs to be Cheaper than Current Snow Disposal Operations

Location

- Location
  - Does Not Affect Traffic Flow
  - Limits Parking Space Impact
  - Does Not Conflict with Current Snow Storage Operations

Soil Absorption

- Need to be Sure Soils Can Absorb Water
- Water Table
- No Data in Proposed Location
- Existing Data in Vicinity
  - Water Table Below 15
- Worth Pursuit
  - Need Funds to Pursue

54"

Additional Funding

- Dr. Alex Hills Civic Engagement Award
  - $2500
    - Soil Exploration

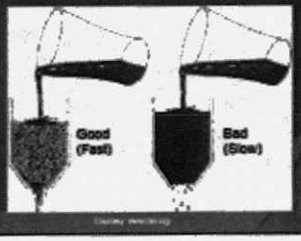
UAA Center for Community Engagement and Learning
University of Alaska Anchorage

Exploration

- DOWL HKM
  - On-Site Drilling
    - Soils Analysis & Infiltration Rate

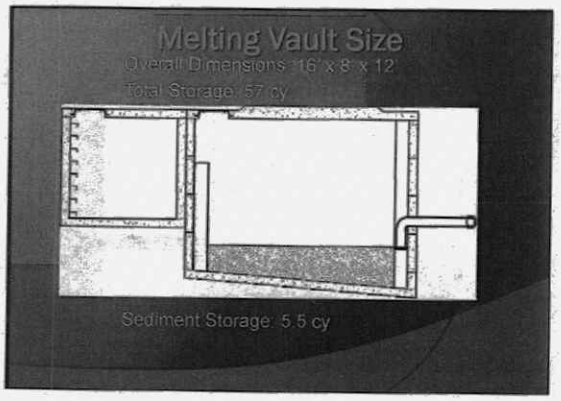
Data Results

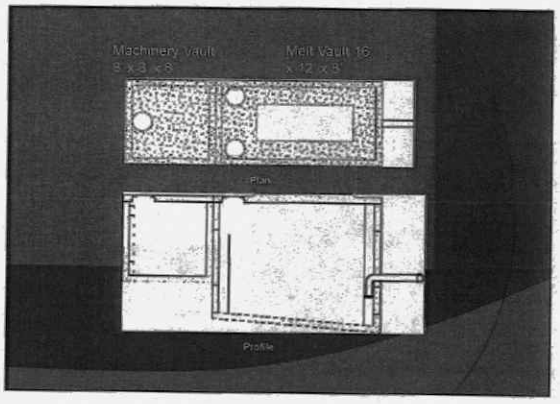
- Water Table Not Encountered
  - Drilled to depth of 15'
- Infiltration Rate – 54 in/hr
  - Very Good!

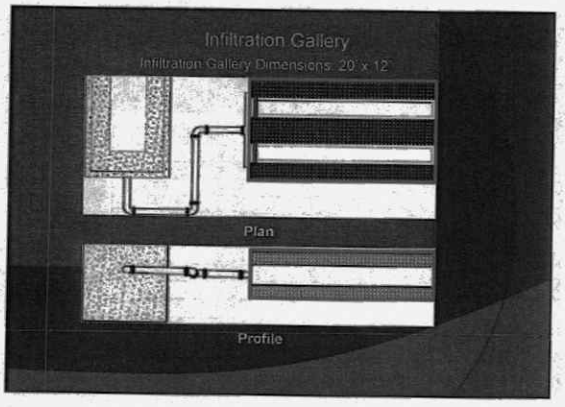


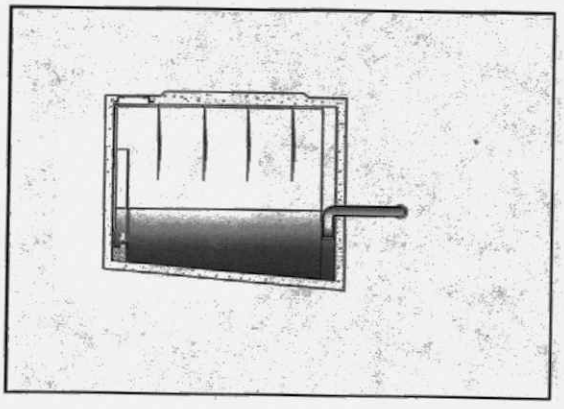
How Much Snow

- Parking Lot Size – 45,000 Sqft
- Annual Snow Load – 75-inches
- Sediment Load – 1% Of Snow Mass


Melting Vault Size
Overall Dimensions: 16' x 8' x 12'
Total Storage: 57 cy
Sediment Storage: 5.5 cy

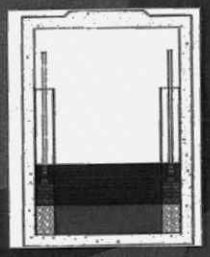

Machinery Vault
Melt Vault 16'
x 12' x 8'
Plan
Profile


Infiltration Gallery
Infiltration Gallery Dimensions: 20' x 12'
Plan
Profile

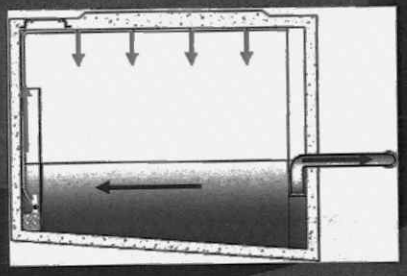


Heating Alternatives

- Natural Gas
  - With Glycol loop
- Electric –Not Feasible



Water Circulation Recap

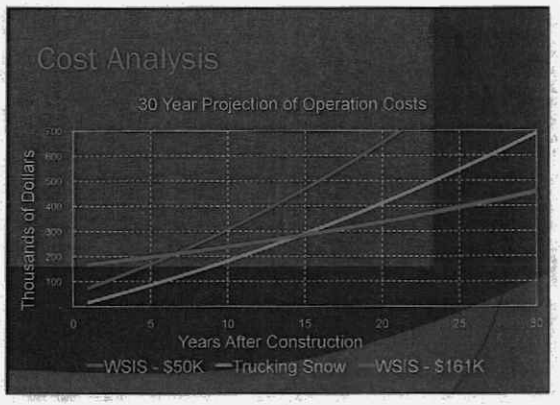


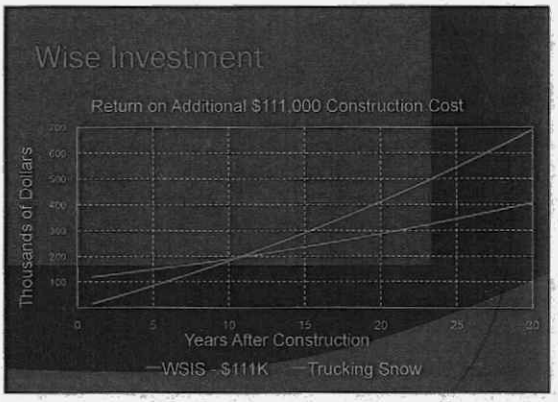
Melting Operation

- Maintain setting
  - Boiler
    - Minimal output
- Melting Setting
  - Boiler
    - Optimum output
  - Sprayer Pumps

Engineer's Construction Cost Estimate

Activity	ID	TOTAL
Demo	1	$ 3,000
Excavation for Vaults	2	$ 6,500
Install Vaults	3	$ 65,000
Excavate Gas Line	4	$ 5,600
Install Gas line	5	$ 4,500
Backfill Gas Line	6	$ 4,800
Pave AC	7	$ 6,000
Electrical and heating	8	$ 44,500
15% Contingency	9	$ 21,000
		$ 160,900



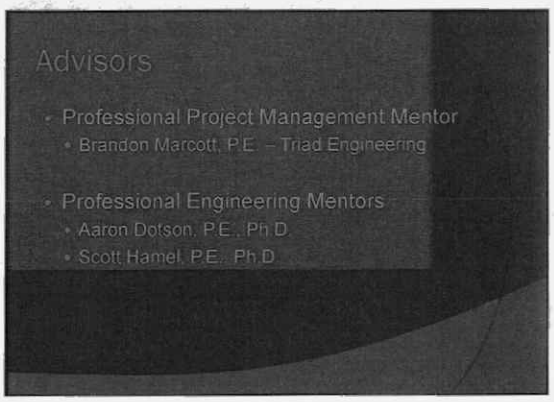


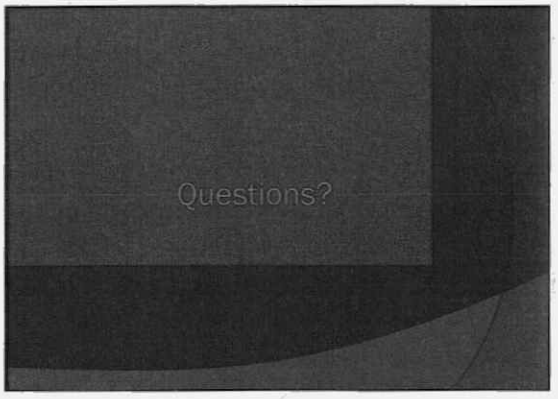
Special Thank You

- Dr. Alex Hills
- DOWL HKM
  - Keri Nutter
  - Maria Kampsen
  - Test lab staff
- Triad Engineering
- Quantum Spatial
  - Stephen Sparks

Additional Thanks

- Northern Geotechnical/Terra Firma Testing
  - Keith Mobley
- Diamond Fab
- HD Supply
- Stephl Engineering
- Alaska X
- Bristol Construction Inc.


Advisors
Professional Project Management Mentor
Brandon Marcott, P.E. – Triad Engineering
Professional Engineering Mentors
Aaron Dotson, P.E., Ph.D
Scott Hamel, P.E., Ph.D


Questions?