Neal Run Restoration Project -Phase III
Operation, Maintenance & Replacement Plan

Project Information and Overview

Project Name (coordinates)	**Neal Run Restoration Project – Phase III** (40.566511, -79.295047)
Site Access	Hill Road, Homer City, PA 15748
Hydrologic Order	Neal Run → Aultmans Run→ Conemaugh River → Allegheny River
Landowner	Central Blair Electric Company
Treatment Type	Passive Treatment
Design/Build Contractor	BioMost, Inc. **(BMI)**; bmi@biomost.com, www.biomost.com
Project Sponsor/Administration	Stream Restoration Incorporated **(SRI)**

The Neal Run Restoration Project – Phase-III is located in the village of McIntyre, PA at the corner of Hill and McIntyre Roads. The project is a continuation of the Neal Run Restoration Plan which intends to treat one of the worst mine drainages in western Pennsylvania.

In March of 2008, a $14,000 grant from the PA Department of Environmental Protection **(PADEP)** Growing Greener program was received to evaluate options and to develop a conceptual restoration plan for the site. A consensus by members of the Aultman Watershed Association for Restoring the Environment **(AWARE)**, the PADEP Watershed Manager, Robindale Energy Services, US Environmental Research Service, and the design team was developed. As the cost of actively or passively treating the drainage to the desired water quality was determined to be prohibitive, only partial treatment could be realized at that time. With the support of the landowner, Central Blair Electric, and of Robindale Energy Services, a restoration plan was developed that included the recovery of acid-producing coal refuse for power generation and the construction of oxidation and precipitation channels **(OPCs)** to remove iron from the mine drainage by encouraging the formation and storage of iron solids at low pH.

A $200,000 Growing Greener 2 remining grant was awarded to AWARE to implement the design plan. Construction occurred over the course of 2011 and 2012 during which 37,608 tons of refuse were removed. As non-fuel grade material was to remain onsite, over 7,753 tons of Mineral CSA, a PADEP-approved co-product, were blended with potentially acid-producing material to provide alkaline addition. (Please note that the Mineral CSA was donated by project partner Harsco Minerals.) In addition, Synagro donated, permitted, placed, and incorporated 487 tons of biosolids onto the re-graded site, which provided an excellent growth medium for revegetation with a seed mixture that included warm and cool season grasses and flowers.

Additional treatment was necessary due to the highly degraded mine drainage. In 2015 SRI, in cooperation with AWARE, received grants totaling $125,000 from the PADEP's Growing Greener Program and the Foundation for Pennsylvania Watersheds. These grants enabled the construction of a 715-ton AFVFP (AFVFP1) and settling pond. A third phase was funded in 2021 totaling $210,956 to construct an additional AFVFP (AFVFP2). AFVFP2 treats the drainage using approximately 1,850 tons of high calcium carbonate (~90% $CaCO_3$) AASHTO #1 limestone. The Pond was initially set to flush into the OPC approximately every other day utilizing a solar-powered Agri Drain Automatic Water Level Control Structure. A check dam was constructed within the OPC to encourage the settling of precipitated metals before flowing into Neal Run.

Oxidation Precipitation Channel (OPC)

System Components: Diversion Dam, Conveyance Channel, 8" SCH40 PVC pipe

The Oxidation Precipitation Channel (OPC), also known as Terraced Iron Formation (TIF), is a channel constructed to treat highly acidic AMD with high iron content. Iron precipitates at a low pH in the presence of certain microorganisms, which greatly reduces the cost of treatment. During Phase I of the project, a total of three OPCs were constructed to help improve the discharges located on site. The longest, OPC1, carries the seeps emanating from the toe of the large, reclaimed coal refuse pile located upgradient of the site through an existing culvert and into Neal Run. OPC2 was constructed to address any lingering discharges and lower the water table within the remaining non-fuel grade (NFG) refuse located to the south of an existing diversion ditch. Some refuse was fuel grade; however, the majority of the refuse within this area of the site had been mixed with soil material and, therefore, unusable for power generation. OPC3 is west of McIntyre Road (SR-3031) and was constructed to intercept and to convey AMD seepage, which is located behind a residence, to OPC1. OPCs generally require little maintenance. The iron precipitates tend to be self-leveling and the capacity within the channels allow for decades of iron accumulation. Occasionally, the precipitates near the weir at the beginning of the channel (RAW) will need cleaned out to allow the weir to be functional. Phase III included installing an 10" SCH40 PVC pipe over OPC1 to convey water from the Settling Pond to AVFP1 and installation of a check dam in OPC1 downgradient of McIntyre Road.

Inlet

System Components: Diversion Dam, Conveyance Channel, 8" SCH40 PVC pipe

The conveyance channel diverts water out of OPC1 and towards the AFVFP1 inlet pipe. During Phase II, a diversion dam was constructed within OPC1 utilizing on-site soil material armored with AASHTO #1 aggregate. The top of the diversion dam is approximately 1' lower than the top of OPC1 to allow water to stay within the OPC during high-flow precipitation events. During Phase III, a 10" SCH40 pipe was installed that extends from the settling pond to AFVFP2.

The conveyance channel should be inspected during each site visit to ensure the diversion dam is intact and that the water can flow freely into the conveyance channel, through the 8" SCH40 PVC pipe, and into AFVFP1. The 10" pipe should also be inspected to ensure that water can flow from the settling pond and into AFVFP2. Remove leaves, debris, and vegetation from the diversion dam area, conveyance channel, and pipes as needed. Occasionally, the pipes may need to be cleaned using a power snake or jet-type pipe cleaner.

Auto Flushing Vertical Flow Pond (AFVFP)

AFVFP1

System Components: Limestone Pond, Automatic Water Control structure, 8" DR17 HDPE underdrain, 8" SCH40 PVC pipe

AFVFP1 contains 5' of high $CaCO_3$ AASHTO #1 limestone aggregate totaling approximately 700 tons. An 8" SCH40 PVC pipe connects the AFVFP to the inlet channel. The water is controlled by an Agri Drain Automatic Water Control Structure with solar powered valve. The water control structure will fully drain the pond on a once-a-day schedule over the course on an hour between 08:00 to 09:00 (EST). This schedule can be modified if needed using the controller (see Attachment 1). An 8" HDPE underdrain allows for efficient and even draining of the pond. A solar powered actuator will raise and lower an 8" Valterra valve within the water control structure. Water then drains from AFVFP1 to the settling pond via an approximately 100' long 8" SCH40 PVC pipeline.

AFVFP2

System Components: Limestone Pond, Automatic Water Control structure, 8" DR17 HDPE & 12" DR26 HDPE underdrain, 12" PVC outlet pipe.

AFVFP2 contains 5' of high $CaCO_3$ AASHTO #1 limestone aggregate totaling approximately 1,850 tons. A 10" SCH40 PVC inlet pipe connects the settling pond to the AFVFP2. The outlet flow is controlled by an Agri Drain Automatic Water Control Structure with solar powered valve. The water control structure will fully drain the pond on Tuesday, Thursday, and Saturday over the course on an hour between 06:00 to 07:00 (EST). This schedule can be modified if needed using the controller (see Attachment 1). This controller uses Coordinated Universal Time, which is five hours ahead of EST. Currently, the controller is set to 11:00 to 12:00 UTC. An 8" DR17 HDPE underdrain allows for efficient and even draining of the pond. A solar powered actuator will raise and lower an 8" Valterra valve within the water control structure. Water then drains from the AFVFP to the OPC via a 12" PVC pipeline that extends to and from the Agri Drain structure.

Pond Maintenance

Due to the very high acidity and high metals content of water being treated by the AFVFPs, stirring of the limestone should be a regularly scheduled task. During the first two to three years of operation, one stirring event per year should be expected. Beyond the third year of operation the stirring events may need to be increased. Stirring of the limestone should be to a depth as low as possible within the pond without damaging the pond liner material. Increases or decreases in stirring frequency can be loosely based on pond drainage times. The drain pipe can be expected to flow full for between 10 and 20 minutes for AFVFP1 and up to an hour for AFVFP2 depending on flow rates from the previous 24 hours. If the effluent pipe does not flow full, quickly stops flowing full after opening, or if pond stops fully draining and builds up water over a period of days, then stirring frequencies may need to be increased.

Maintenance of both inlet and outlet pipes will be similar and on an as-needed basis. Visually inspect exposed pipe over the OPC for any cracks or breaks and repair as needed. The inlet and outlets of the pipes should be kept clear debris or other material that could potentially restrict flow in to or out of any pipe. If water is observed flowing from the AFVFP outlet outside of the designated schedule or if water is not flowing from the AFVFP outlet pipe during designated flush time, maintenance may be needed on the water control structures.

Agri Drain Automatic Water Control Structure

The water control structures serve two functions; they serve as the primary control system to flush the entire volume of water from the pond and it also serve as an overflow in cases of exceptionally high flows. The flush valves are knife gate-type and the sizes correspond to the outlet piping. The valves are opened and closed by an electronic actuator operated by a controller mounted adjacent to the control structure. The controllers and actuators are battery powered, the batteries are recharged by a solar panel mounted directly to the control structure along with the weather proof boxes containing the controllers and batteries. The controllers are programmable and can display system status (See Attachment 1). During periods of high flow or if the drain stops working, the pond will fill and overflow the stop logs within the control structure and will continually flow into the downstream component. The stop logs must be lubricated every year so that they can be easily removed if needed. Remove stoplogs and grease seal with Lubriplate No. 105 Motor Assembly Grease or equivalent. Ensure there is no debris in the tracks or along the bottom of the structure. Replace stoplogs after greasing, ensuring the bottom stoplog is installed first.

Settling Pond (SP)

System Components: Pond, 8" SCH40 PVC influent pipe, 10" SCH40 PVC effluent pipe

The SP is approximately 72,000 cubic feet and holds approximately 500,000 gallons of water. Routine inspections should take place to check for erosion of embankments, berms, and slopes. Any erosion shall immediately be graded as needed and stabilized utilizing seed and mulch or, in cases of bad erosion due to flooding or vandalism, erosion control fabric may be needed. The SP effluent pipe is a 10" SCH40 PVC pipe that discharges into the AFVFP2. The 10" SCH40 PVC pipe is supported by 10" SCH40 PVC vertical pipes driven into the ground and hose clamped. The 10" SCH40 PVC effluent pipe should be kept clear of any heavy vegetation or accumulated iron that could restrict flows. Any restriction should be removed.

Monitoring

Due to the highly degraded quality of the discharge, field analysis of the water is limited. Conductivity and pH can be measured in the field with meters at all sample points. Field alkalinity and iron tests can also be collected on sample points OPC1-MID, DD, D6, NL0-MP2, NL0-MP3, and NEAL01. Lab samples will be collected by the Kiski-Conemaugh Stream Team on a quarterly basis. Flows should be measured with a bucket and stopwatch at the culvert below D3, D7A (influent pipe to the AFVFP1), and DD. Weirs at RAW and OPC1-MID should be measured to calculate flow. Flow of Neal Run and NL0-D3 (within the culvert) can also be measured using the cross-section method. The As-Built Plan (see Attachment 2) contains the locations of the sample points.

Attachment 1
Agri Drain Smart Drainage System
Operator's Manual

Agri Drain

Smart Drainage System®

www.agridrain.com

Operator's Manual

Multiple Valve, 2-Level, Day of Week, Locally Programmable Controller

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Version August 25, 2021
RSG1744

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1. Hardware Installation

Bagged hardware included: *8 pcs. – 3/8" x 2.5" long bolts with nuts.*
8 pcs. – ¼"-20 x ¾" long countersunk Phillips machine screws

Located inside controller: *5 pcs. – 5 Amp 250 Volt, slow blow/time delayed, 5x20mm cartridge fuses.*

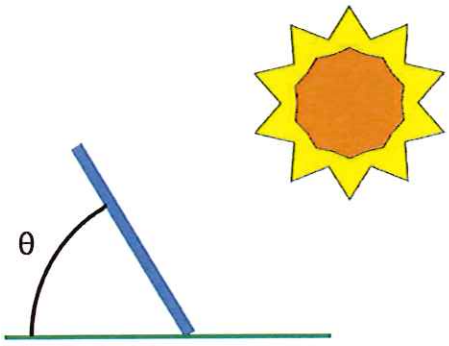
1.1. Secure the two posts in place
1.1.1. Ensure that the tops of the posts are level to each other and at approximately the level you intend to install the top of the controller enclosure.

1.2. Bolt the controller mounting plate onto the posts, resting the top bend of the plate on the top of the posts.

1.3. Attach the solar panel mounting rod to the back of the controller mounting plate using the included U-clamps.

1.4. Attach the solar panel (pre-installed in its bracket) to the top of the solar panel mounting rod using the included U-clamps.

1.5. Adjust the solar panel to receive the maximum amount of sunlight by orienting it to the south and adjusting the angle according to the table below, then tighten the 4 – ¼" bolts at the bracket pivot point to secure panel in position.



Latitude	Solar Panel Angle (Θ)
25	48.43
30	53.43
35	58.43
40	63.43
45	68.43
50	73.43
55	78.43

1.6. Attach the controller enclosure to the controller mounting plate using the 4 machine screws provided.

1.7. Ensure all five (5) of the fuse holders inside the enclosure are open.

1.8. Connect the included extension cable between the actuator cable and the enclosure bulkhead connector labeled "VALVE[1..3]".

1.9. Install the included 12V battery into the enclosure connecting the positive (+/red) cable first and the negative (-/black) cable second. Always connect the battery before connecting the solar panel to avoid high voltage being present at the battery cables.*

*If the battery must be removed/disconnected for replacement or maintenance, always be sure to open all fuse holders and disconnect the solar panel BEFORE disconnecting the battery.

1.10. Attach the solar panel cables from the enclosure to the connectors on the solar panel.

1.11. Once all electrical connections are made, install the included fuses into the fuse holders and close the fuse holders to start the controller.

1.12. When the controller starts, follow the instructions in the Operator's Manual for programming the desired schedule.

2. Overview

The Banner DXM Series Industrial Controller makes it possible to control external equipment and create a simple schedule that is configurable from the front panel of this device.

This configuration allows for manual and automatic modes of operation. Manual mode consists of setting the valves open or closed from the controller interface. Automatic mode allows the user to configure a time to open each valve, the duration the valve will remain opne and the day(s) of the week this schedule will be run. A manual override switch is also included for each valve to allow the valve commands from the Banner DXM Controller to be overridden (see section 9 for details).

By default, when power is applied or the controller restarted, the system returns to the mode it was previously in. From the factory, the system is in automatic mode and will attempt to run the schedule programmed into the controller. If the battery voltage drops below 11.5 V, the unit will go into low power mode. In low power mode, the unit will close the valve. If the battery voltage

goes back above 12 V in low power mode, it will return to normal power mode and run the configured schedule.

The controller allows for the open day, time and duration for each valve to be set individually. Multiple valves can be open at the same time if the times overlap.

3. Controls

3.1. Buttons

The device has 4 buttons on the front panel.
Up/Down Arrows - Used for choosing menu items or changing values of registers
Enter - Used for Navigator to current chosen menu item / adding or setting value in register
Back - Used for Navigating back to previous screen or menu / Deleting character from register

3.2. Indicators

LED1 (GREEN) - On when main script loop is executing
LED2 (RED) - On when set to manual mode
LED3 (ORANGE) - On when any valve is open
LED4 (RED) - Unused

4. Automatic Mode Operation

Automatic mode allows the user to schedule the valve to be opened for a specified duration at a specified time for each day of the week.

The examples below will cover the following:

- Setting the unit into automatic mode
- Setting the start time for the daily schedule
- Setting the duration for the daily schedule
- Setting which days of the week to run the schedule.

For the purpose of this example, we will schedule Valve1 to open on Monday at 22:30 UTC (4:30 pm CST) for 3 hours (180 minutes). Valve2 will open on Tuesday at 22:30 UTC (4:30 pm CST) for 3 hours (180 minutes). Valve3 will open on Wednesday at 22:30 UTC (4:30 pm CST) for 3 hours (180 minutes). This is the factory default program.

NOTE: Hours and Display time are in UTC. Maximum value for duration should not exceed 1440 minutes (24 hours). See Section 7 for a conversion chart.

4.1. Set Automatic Mode

The factory default mode is automatic so this should not have to be changed unless it was explicitly set to manual mode.

4.1.1. Press "ENTER" to access the Registers menu
4.1.2. Press "Down arrow" to ManualMode register
4.1.3. Press "ENTER" to access the ManualMode setting

4.1.4. Set the ManualMode to 0 (OFF):

4.1.4.1. Press "Down arrow" to change from 1 (ON) to 0 (OFF)
4.1.4.2. Press "ENTER" to "accept" the value
4.1.4.3. Press "ENTER" to navigate to "SEND" value
4.1.4.4. Press "ENTER" to "send" the value to the register

4.2. Set the Start Time

4.2.1. Set StartHour (Example: 22 UTC)
4.2.1.1. Press "ENTER" to access the Registers menu
4.2.1.2. Press "Down Arrow" until you are on the StartHour register
4.2.1.3. Press "ENTER" to access StartHour register

4.2.1.4. Set the desired hour to open the valve (Example: 22 UTC)
4.2.1.4.1. Press "Up arrow" to 2, Press "ENTER" to move to the next digit
4.2.1.4.2. Press "Up arrow" to 2, Press "ENTER" to move to the next digit
4.2.1.5. Press "ENTER" to "accept" the value
4.2.1.6. Press "ENTER" to navigate to "SEND" value
4.2.1.7. Press "ENTER" to "send" the value to the register

4.2.2. Set StartMinutes (Example: 30)
4.2.2.1. Press "ENTER" to access the Registers menu
4.2.2.2. Press "Down Arrow" until you are on the StartMinutes register
4.2.2.3. Press "ENTER" to access StartMinutes register
4.2.2.4. Set the desired minutes to open the valve (Example: 30)
4.2.2.4.1. Press "Up arrow" to 3, Press "ENTER" to move to the next digit
4.2.2.4.2. Press "Up arrow" to 0, Press "ENTER" to move to the next digit
4.2.2.5. Press "ENTER" to "accept" the value
4.2.2.6. Press "ENTER" to navigate to "SEND" value
4.2.2.7. Press "ENTER" to "send" the value to the register

4.3. Set the Duration

4.3.1. Press "ENTER" to access the Registers menu
4.3.2. Press "Down Arrow" until you are on the Duration register
4.3.3. Press "ENTER" to access Duration register

4.3.4. Press "Up/Down Arrow" to set to the duration in minutes to keep valve open

4.3.5. Press "ENTER" to "accept" the value
4.3.6. Press "ENTER" to navigate to "SEND" value
4.3.7. Press "ENTER" to "send" the value to the register

4.4. Enable schedule per day

For each day of the week, you can enable or disable the schedule set above for the time and duration. So, if you only wanted to run this schedule on Mondays, you would turn this on for Monday and leave it off for the other days of the week. (The same steps below can be followed for any other day by changing the choice of register based on the day's schedule you would like to set.)

4.4.1. Press "ENTER" to access the Registers menu
4.4.2. Press "Down Arrow" until you are on the Monday register
4.4.3. Press "ENTER" to access the Monday Register

4.4.4. Change the value from 0 (OFF) to 1 (ON)

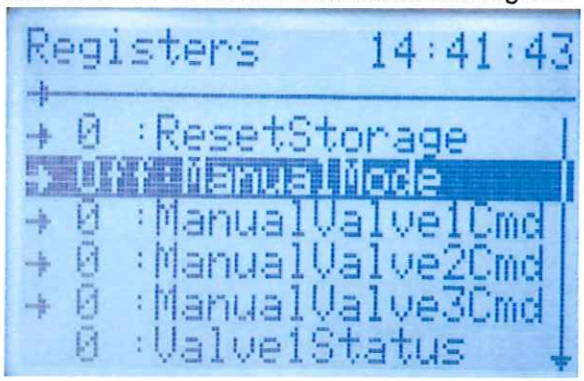
4.4.5. Press "ENTER" to "accept" the value
4.4.6. Press "ENTER" to navigate to "SEND" value
4.4.7. Press "ENTER" to "send" the value to the register

5. Manual Mode Operation

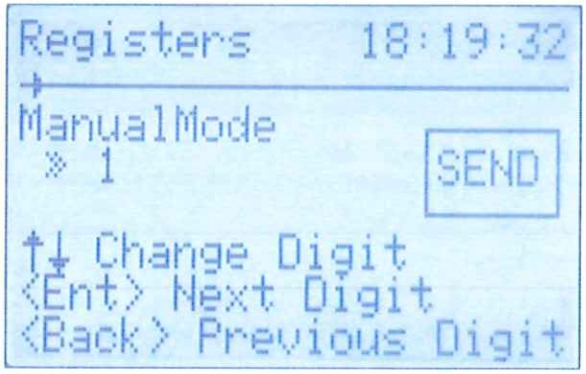
Manual mode operation allows the user to disable the schedule and set the valve to the desired position. The following example below shows setting the device into manual mode and opening the valve.

5.1. Set Manual Mode

5.1.1. Press "ENTER" to access the Registers menu
5.1.2. Press "Down Arrow" until you are on the ManualMode register
5.1.3. Press "ENTER" to access ManualMode Register



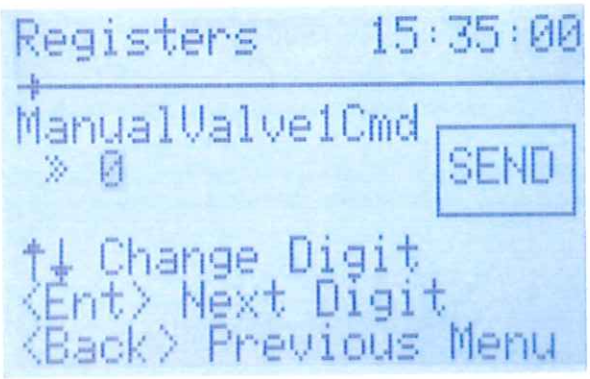
5.1.4. Set the ManualMode to 1 (ON):
5.1.4.1. Press "Up arrow" to change from 0 (OFF) to 1 (ON)
5.1.4.2. Press "ENTER" to "accept" the value
5.1.4.3. Press "ENTER" to navigate to "SEND" value
5.1.4.4. Press "ENTER" to "send" the value to the register



5.2. Open or Close the Valve

In ManualMode the ManualValve[1,2,3]Cmd register is used to manually control the state of the valve.

5.2.1. Press "ENTER" to access the Registers menu
5.2.2. Press "Down Arrow" until you are on the ManualValve[1,2,3]Cmd register
5.2.3. Press "ENTER" to access ManualValve[1,2,3]Cmd Register
5.2.4. Press "Up arrow" to change from 0 (CLOSED) to 1 (OPEN)
5.2.5. Press "ENTER" to "accept" the value
5.2.6. Press "ENTER" to navigate to "SEND" value
5.2.7. Press "ENTER" to "send" the value to the register



6. Checking Unit Voltages

6.1. Check Battery Voltage

6.1.1. Press "ENTER" to access the Registers menu

6.1.2. Press "Down Arrow" until you are on the Battery register

6. Register Reference

6.1. ResetStorage (1=RESET/0=NORMAL)

- Set to 1 to reset to "no" schedule

6.2. ManualMode (1=ON/0=OFF)

- While ON, the user can open/close the valve by setting the ManualValveCmd.
- While ON, the controller will ignore any scheduled open/close times.
- While ON, LED2 (RED) will be ON.
- While OFF, LED2 (RED) will be OFF.

6.3. ManualValve[1,2,3]Cmd (1=OPEN, 0=CLOSED)

- Controls Valve state when ManualMode is ON.
- While any valve is OPEN, LED3 (ORANGE) will be ON.
- While any valve is CLOSED, LED3 (ORANGE) will be OFF.

6.4. Valve[1,2,3]Status (1=OPEN, 0=CLOSED)

- Displays the current status of the valve.
- While any valve is OPEN, LED3 (ORANGE) will be ON.
- While any valve is CLOSED, LED3 (ORANGE) will be OFF.

6.5. Days of the Week [V1_Sunday…V3_Saturday] (1=ON/0=OFF)

- Set which days of the week the valve should open.
- When set to ON, the valve will open at the specified StartHour and StartMinute and remain open for the specified Duration.

6.6. [V1..V3]Duration (minutes)

- The amount of time in minutes that the valve will remain open.
- At the end of the Duration, the valve will close.
- Valves will close in 1,2,3 sequence if multiple valves are scheduled to close at the same time.

6.7. [V1..V3]StartHour

- The hour portion of the time you wish the valve to open.
- The same StartHour applies to all valves
- Valves will open in 1,2,3 sequence if multiple valves are scheduled to open at the same time.
- NOTE: This is based on the time displayed in the upper right-hand corner of the LCD display.

6.8. StartMinutes

- The minute portion of the time you wish the valve to open.
- Valves will open in 1,2,3 sequence if multiple valves are scheduled to open at the same time.
- NOTE: This is based on the time displayed in the upper right-hand corner of the LCD display.

6.9. Battery

- The current battery voltage.

8. Local time to UTC Conversion

To use this chart:

1. Find your local time in the row on the left.
2. The time converted to UTC will be in the column of your timezone.

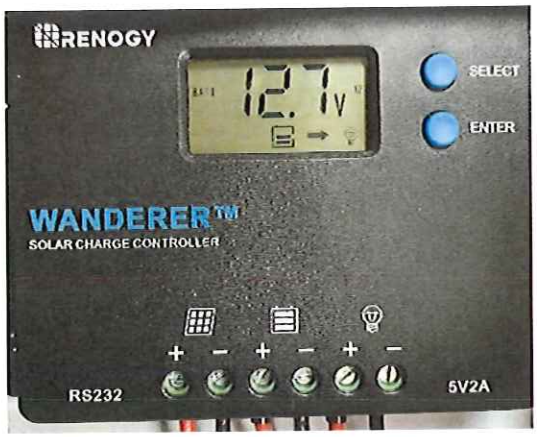
LOCAL	EDST	EST	CDST	CST	MDST	MST	PDST	PST
Midnight	0400	0500	0500	0600	0600	0700	0700	0800
1:00 AM	0500	0600	0600	0700	0700	0800	0800	0900
2:00 AM	0600	0700	0700	0800	0800	0900	0900	1000
3:00 AM	0700	0800	0800	0900	0900	1000	1000	1100
4:00 AM	0800	0900	0900	1000	1000	1100	1100	1200
5:00 AM	0900	1000	1000	1100	1100	1200	1200	1300
6:00 AM	1000	1100	1100	1200	1200	1300	1300	1400
7:00 AM	1100	1200	1200	1300	1300	1400	1400	1500
8:00 AM	1200	1300	1300	1400	1400	1500	1500	1600
9:00 AM	1300	1400	1400	1500	1500	1600	1600	1700
10:00 AM	1400	1500	1500	1600	1600	1700	1700	1800
11:00 AM	1500	1600	1600	1700	1700	1800	1800	1900
NOON	1600	1700	1700	1800	1800	1900	1900	2000
1:00 PM	1700	1800	1800	1900	1900	2000	2000	2100
2:00 PM	1800	1900	1900	2000	2000	2100	2100	2200
3:00 PM	1900	2000	2000	2100	2100	2200	2200	2300
4:00 PM	2000	2100	2100	2200	2200	2300	2300	2400
5:00 PM	2100	2200	2200	2300	2300	2400	2400	0100
6:00 PM	2200	2300	2300	2400	2400	0100	0100	0200
7:00 PM	2300	2400	2400	0100	0100	0200	0200	0300
8:00 PM	2400	0100	0100	0200	0200	0300	0300	0400
9:00 PM	0100	0200	0200	0300	0300	0400	0400	0500
10:00 PM	0200	0300	0300	0400	0400	0500	0500	0600
11:00 PM	0300	0400	0400	0500	0500	0600	0600	0700
LOCAL	EDST	EST	CDST	CST	MDST	MST	PDST	PST

Key Notes:

EDST= Eastern Daylight Standard Time.
EST= Eastern Standard Time.
CDST= Central Daylight Savings Time.
CST= Central Standard Time.
MDST= Mountain Daylight Savings Time.
MST= Mountain Standard Time.
PDST= Pacific Daylight Savings Time.
PST= Pacific Standard Time.

9. Renogy Wanderer Solar Charge Controller

The Renogy Wanderer solar charge controller ensures the health of the solar charging system and displays different information about the health of the battery and solar panel.



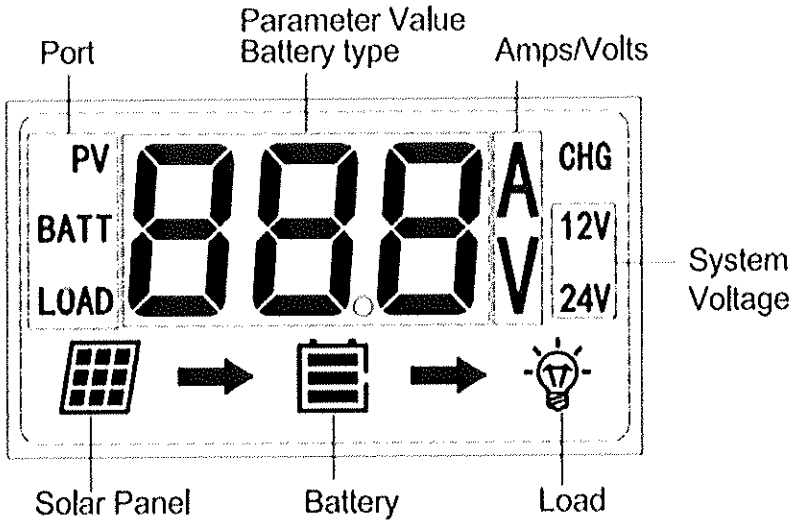
The LCD display of the controller automatically cycles through the various parameters:

- Solar Voltage
- Solar Charging Current
- Battery Voltage
- Load Current
- Load Setting

You can also cycle through the display parameters by pressing the "SELECT" button repeatedly. Do not press the "ENTER" button, as there are no parameters that should be changed for proper operation of the system.

The display also indicates the following parameters:

- Solar Charge Active
- Battery charge meter
- Load Active
- Errors



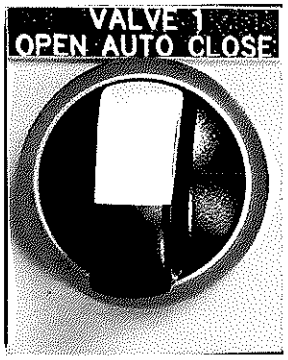
Icon or Value	State	Description
	Steady on	Solar Panels Charging Battery
	3 Bars Flashing	Battery Voltage (16.1V+)
	3 Bars	Battery Voltage (12.9V- 16.0V)
	2 Bars	Battery Voltage (12.5-12.8V)
	1 Bar	Battery Voltage (11.6-12.4V)
	No Bars	Battery Voltage (11.5V and below)
	No Bars Flashing	Battery Voltage (10.9V and below)
	Steady on	Load is On

Error Number	Description
E0	No error detected
E01	Battery over-discharged
E02	Battery over-voltage
E04	Load short circuit
E05	Load overloaded
E06	Controller over-temperature
E08	PV input over-current
E10	PV over-voltage
E13	PV reverse polarity
E14	Battery reverse polarity

10. Manual Valve Override

To completely bypass the output from the Banner DXM Industrial Controller a manual override switch has been provided. By turning and locking the switch to the desired Open or Closed position the valve will be commanded to move regardless of the output of the DXM controller.

Because this bypasses the controller, the controller will continue to run the scheduled program but will be unable to actuate the valve. To disable the override, return the switch to the middle "Auto" position. Upon returning to automatic mode the controller will check the position of the valve and actuate it as necessary according to the schedule.



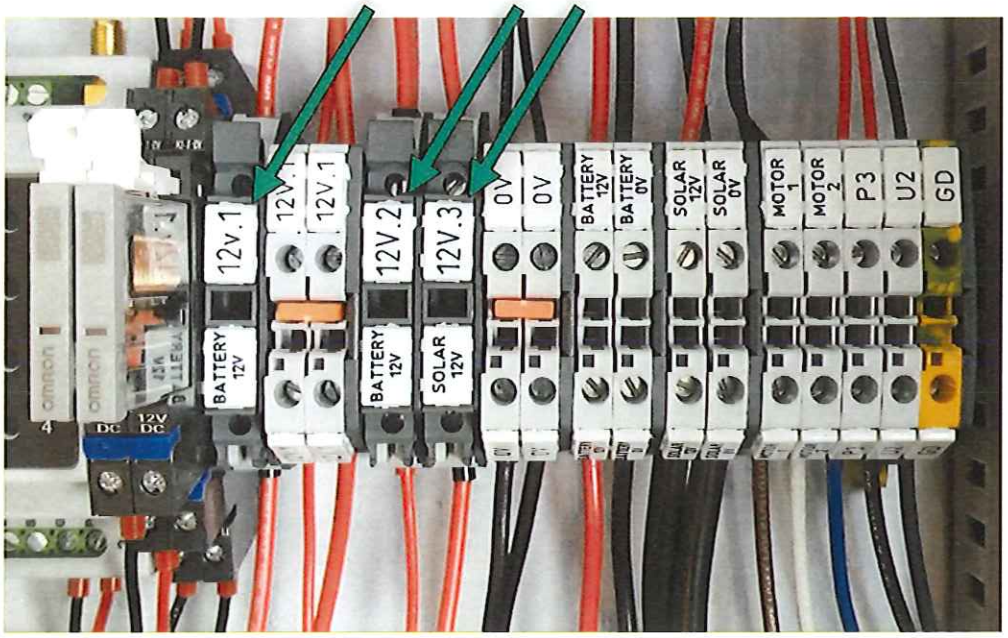
WARNING!

TO AVOID DAMAGE TO HARDWARE

Install fuses AFTER connecting antenna, solar panel, pressure transducer, and battery. If replacing hardware, disconnect fuses prior.

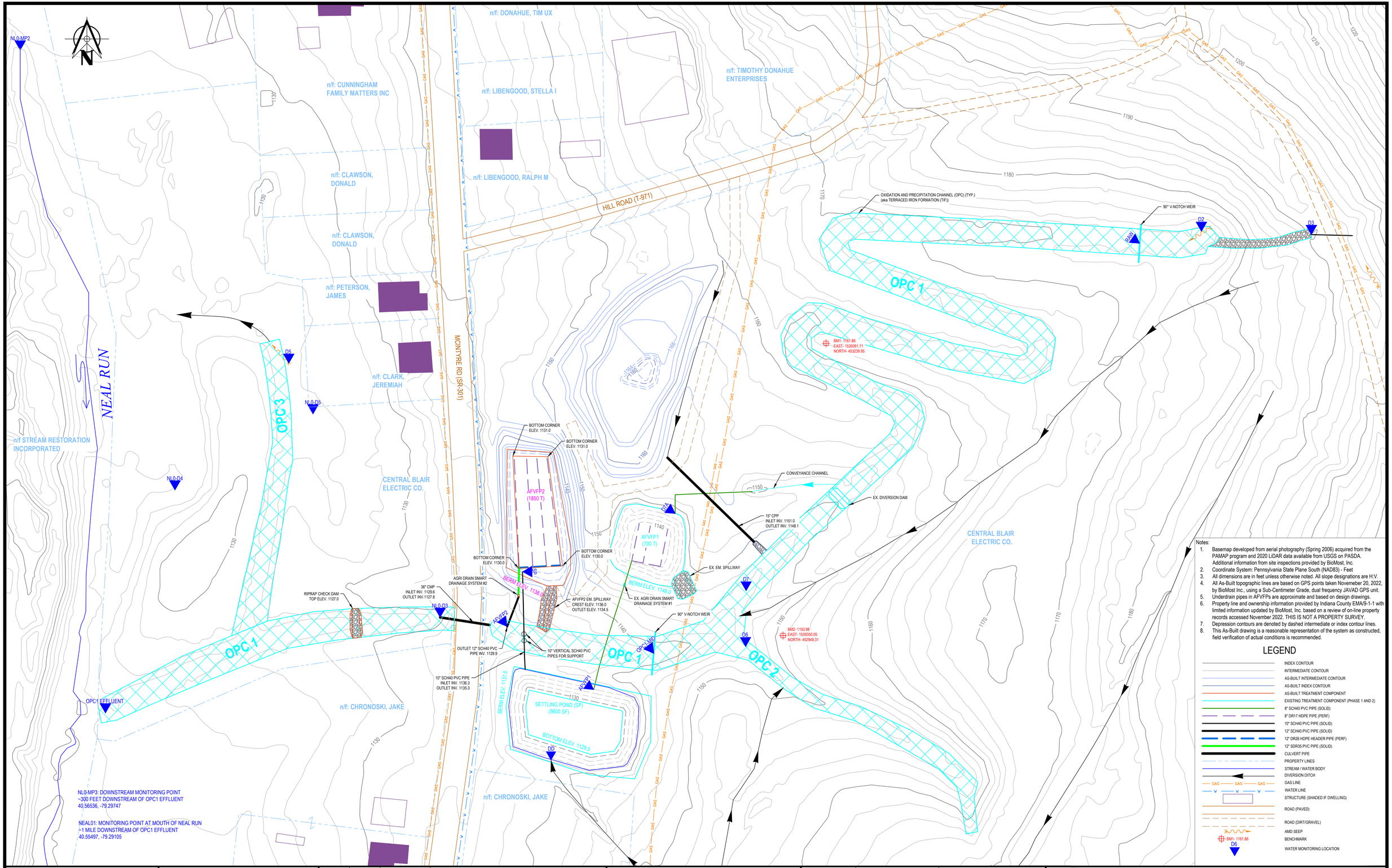
Fuse location shown below.

Fuse Specification: 5Ah 250Volts, slow blow/time delayed, 5x20mm (Qty 5).



Be sure to attach the battery to the system BEFORE connecting the solar panel. If you need to remove the battery from the system for charging or replacement, disconnect the solar panel FIRST.

Attachment 2
As-Built Drawing



Notes:

1. Basemap developed from aerial photography (Spring 2006) acquired from the PAMAP program and 2020 LiDAR data available from USGS on PASDA. Additional information from site inspections provided by BioMost, Inc.
2. Coordinate System: Pennsylvania State Plane South (NAD83) - Feet
3. All dimensions are in feet unless otherwise noted. All slope designations are H:V.
4. All As-Built topographic lines are based on GPS points taken Novemeber 20, 2022, by BioMost Inc., using a Sub-Centimeter Grade, dual frequency JAVAD GPS unit.
5. Underdrain pipes in AFVFPs are approximate and based on design drawings.
6. Property line and ownership information provided by Indiana County EMA/9-1-1 with limited information updated by BioMost, Inc. based on a review of on-line property records accessed November 2022. THIS IS NOT A PROPERTY SURVEY.
7. Depression contours are denoted by dashed intermediate or index contour lines.
8. This As-Built drawing is a reasonable representation of the system as constructed, field verification of actual conditions is recommended.

LEGEND

- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- AS-BUILT INTERMEDIATE CONTOUR
- AS-BUILT INDEX CONTOUR
- AS-BUILT TREATMENT COMPONENT
- EXISTING TREATMENT COMPONENT (PHASE 1 AND 2)
- 8" SCH40 PVC PIPE (SOLID)
- 8" DR17 HDPE PIPE (PERF)
- 10" SCH40 PVC PIPE (SOLID)
- 12" SCH40 PVC PIPE (SOLID)
- 12" DR26 HDPE HEADER PIPE (PERF)
- 12" SDR35 PVC PIPE (SOLID)
- CULVERT PIPE
- PROPERTY LINES
- STREAM / WATER BODY
- DIVERSION DITCH
- GAS LINE
- WATER LINE
- STRUCTURE (SHADED IF DWELLING)
- ROAD (PAVED)
- ROAD (DIRT/GRAVEL)
- AMD SEEP
- BENCHMARK (BM1- 1161.86)
- WATER MONITORING LOCATION (D6)

BioMost, Inc.
Mining & Reclamation Services
434 Spring Street Ext.
Mars, PA 16046
www.biomost.com

CLIENT:
STREAM RESTORATION INCORPORATED
www.streamrestorationinc.org

NO.	BY	DATE	DESCRIPTION

REVISIONS

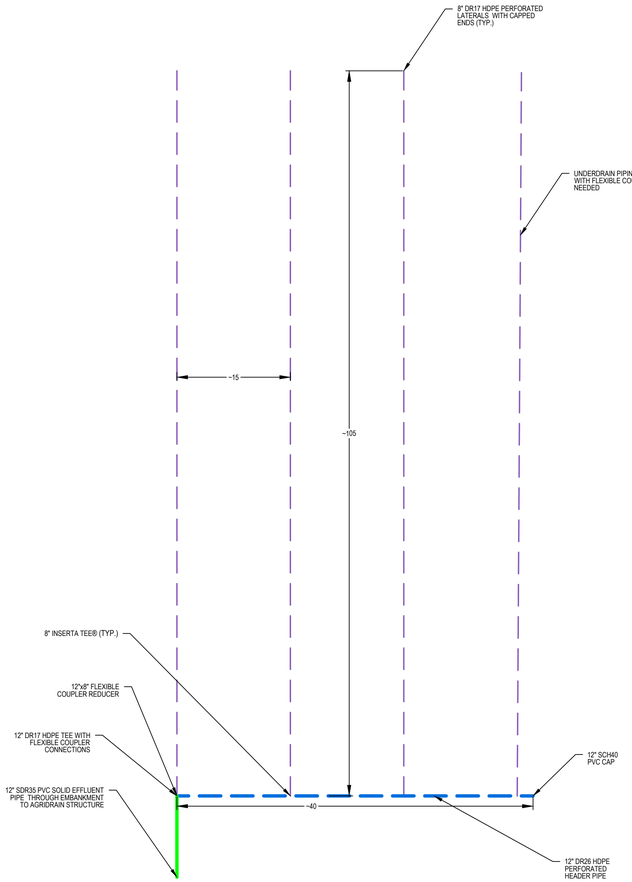
DATE: 12/15/2022
LATITUDE: 40.566511
LONGITUDE: -79.295047
SCALE: 1" = 40'
40' 20' 0 40'
DRAWN BY: LVH
CHECKED BY: - - -
UNLESS OTHERWISE NOTED
ACAD FILE NAME: 853 - Phase 3 As-Built.dwg
ALL EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED AT THE SITE PRIOR TO CONDUCTING MAINTENANCE

AS-BUILT DRAWING
NEAL RUN
RESTORATION PROJECT - PHASE III

Young Twp. Indiana County, PA

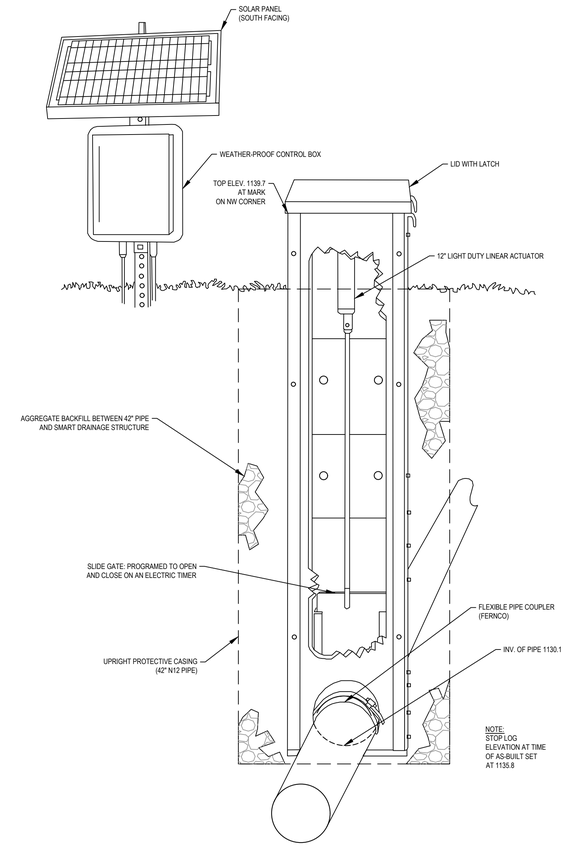
PLAN VIEW

DRAWING NUMBER: 1 of 2



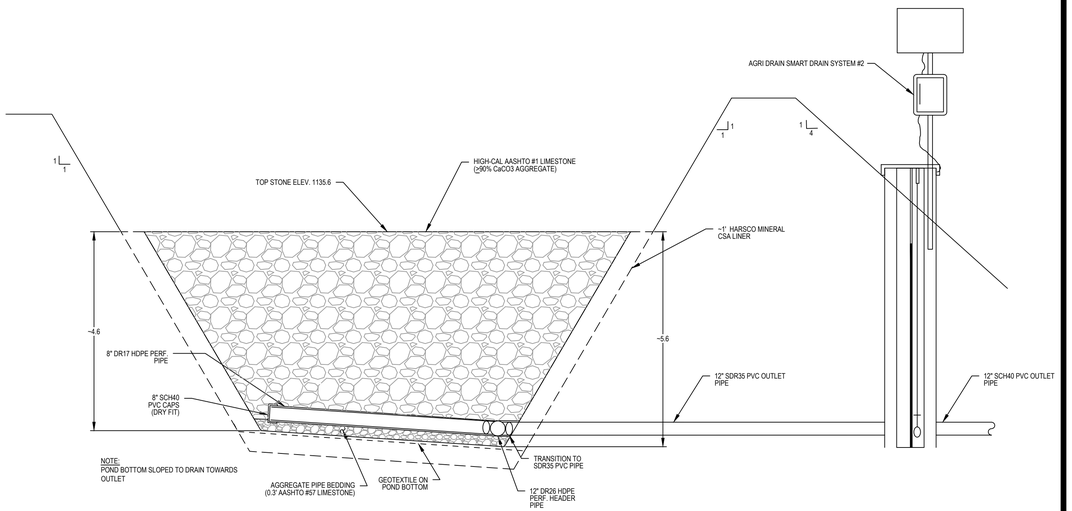
AFVFP2 UNDERDRAIN PIPE DETAIL

Horizontal Scale: None Vertical Scale: None



AGRI DRAIN SMART DRAINAGE SYSTEM® #2

Horizontal Scale: None Vertical Scale: None



AUTO-FLUSHING VERTICAL FLOW POND #2 (AFVFP2)

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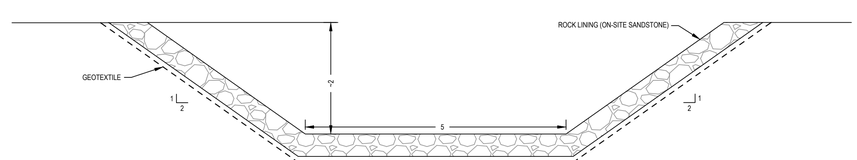

AFVFP2 EMERGENCY SPILLWAY

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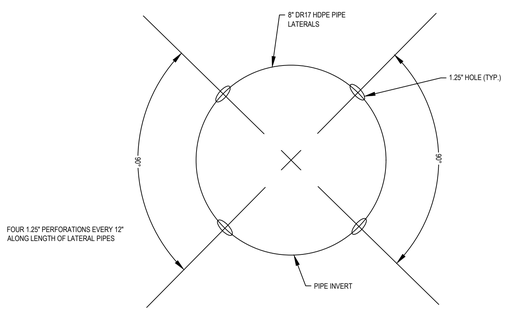
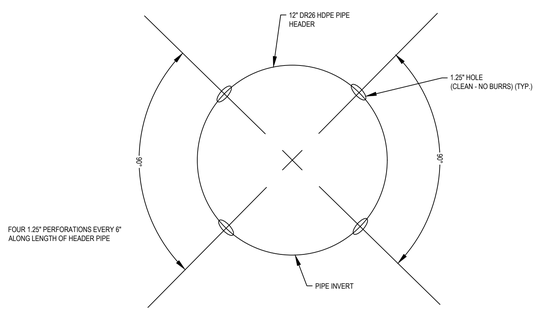


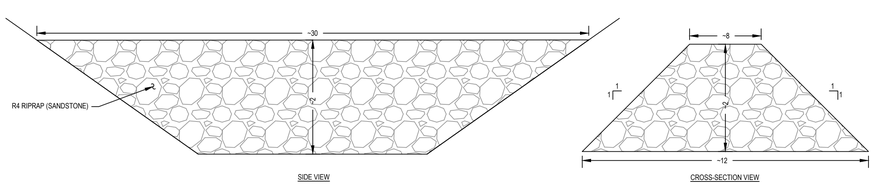
8" LATERAL PIPE PERFORATION DETAIL

Horizontal Scale: None Vertical Scale: None



12" HEADER PIPE PERFORATION DETAIL

Horizontal Scale: None Vertical Scale: None



CHECK DAM

Horizontal Scale: None Vertical Scale: None

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AS-BUILT DRAWING
NEAL RUN
RESTORATION PROJECT - PHASE III

Young Twp. Indiana County, PA

DETAILS

DRAWING NUMBER: 2 of 2