TECHNOLOGY PROVIDER

TECHNOLOGY INFORMATION REQUEST

Solution Name:	Subsurface Drip Irrigation-Effluent (SDI-E)		
Information by: (14.a)	Netafim USA	**Date:**	1/8/24

COMPANY INFORMATION

Company:	Netafim, Orbia Precision Agriculture		
Phone:	1-559-453-6800	**Web Site:**	https://www.netafimusa.com/
Address:	5470 East Home Avenue	**City:**	Fresno
State:	California	**Zip Code:**	93727

TECHNICAL CONTACT (14.a)

Name:	Jim Ed Beach
Phone:	1-515-661-7174
Email:	jimed.beach@netafim.com
Address:	5470 East Home Avenue
City:	Fresno (Jim Ed lives in IA, but use corporate address)
State:	California
Zip Code:	93727

DEMONSTRATION SITE CONTACT (15.a)

Site Name:	DeJager Farms
Contact:	Richie Mayo
Title:	CFO
Phone:	(209)723-9348
Email:	richie@dejagerfarms.com
Address:	10623 S Ivy Road
City:	Chowchilla
State:	CA
Zip Code:	93610

INITIAL TECHNOLOGY OVERVIEW

This information is to guide in the development of a more specific and detailed Technology Information Request.
Please answer the following questions for each Technology or Service Provided.

What is the name of the technology or service you provide?

Subsurface Drip Irrigation (SDI) and / or Subsurface Drip Irrigation-Effluent (SDI-E)

Please provide a brief (1-2 sentence) description and a full description of this technology.

Attach pages or separate document if necessary.

Summary: (1.a) SDI and SDI-E

Full description: (1.b) SDI stands for subsurface drip irrigation, the most efficient way to apply irrigation water and fertilizer underground to the crop's roots, virtually eliminating evaporative water losses and volatilization from fertilizer, reducing operational costs, improving plant productivity, soil health, and water / fertilizer use efficiency. SDI is a management tool that allows precise control over the root zone environment of your crop. This added management control results in consistently higher yields and better quality. In addition, better water and nutrient management can help reduce fertilizer inputs, water needs, and runoff.

SDI-E is a modified SDI system that uses manure nutrients instead of synthetic fertilizers to grow feed crops with fewer environmental impacts. More info can be found online: https://www.netafimusa.com/agriculture/solutions-for-your-crop/effluent/ SDI-E can be utilized as part of a manure management system in traditionally non-irrigated farming operations, as a method for in-season efficient nutrient delivery. Successful dairy implementation requires the following set-up: Maximum 5 cows to 1 acre ration for effective nutrient management; the use of 2 lagoons or settling ponds for effluent water filtration; Netafim's patented blending control technology for fresh / effluent water blending; use of sprinklers or flood irrigation for germination, then transition to SDI-E; optimized and engineered water intake; operations focus on dripline maintenance.

Please explain how this technology will improve water quality and/or air quality by one or more of the following: (2.a)

- **i. Reducing the nutrient content, organic strength, and/or pathogen levels of manure and agricultural waste.**
- **ii. Reducing odors and gaseous emissions**
- **iii. Facilitating desirable waste handling and storage**
- **iv. Producing value added byproducts that facilitate manure and waste utilization.**

i. Precision application of on-farm manure nutrients combined with water through underground driplines allows for control that the precise amount of nutrients and water are applied to the crop root zone at the time, frequency, rate, and location necessary to optimize root health and crop uptake (and therefore crop health and productivity). Improved water and nutrient management also contribute to soil health through maintaining optimal soil moisture and aeration, which helps maintain healthy and function soil microbe population dynamics. On-farm manure nutrients can be utilized in-season, especially throughout the midwestern US where manure often sits on the field before and after the crop growing season, where manure nutrients can cause air and/or water pollution.

ii. Containing the application of manure nutrients in driplines reduces orders and has been shown to reduce N20 emissions by 70% or more on corn and wheat crops.

iii. On-farm manure nutrients can be utilized in-season, especially throughout the midwestern US where manure often sits on the field before and after the crop growing season, where manure nutrients can cause air and/or water pollution.

iv. On-farm manure nutrients become a replacement for synthetic fertilizer and help farmers effectively utilize waste, reducing waste-related transportation and labor costs (and emissions).

Do you have a preferred region or area for the location of projects?

NRCS cost share is highest in California, but we are working to change that in other states by pursuing grants to increase adoption of SDI-E throughout the country. While SDI-E can work on any farm producing effluent (dairy, beef, swine), we see the greatest potential for expansion outside of California in: Iowa, South Dakota, Minnesota, Missouri, Illinois, Nebraska, Indiana, Kansas, Wisconsin, and Oklahoma.

Location of farm(s)?

There are multiple farms utilizing SDI-E in California's Central Valley, and there are also farms in Minnesota, Missouri, South Dakota, Iowa, Nebraska, North Carolina, and Kansas.

What's the smallest and largest farm using this system?

80 acres is the smallest. Most of the other farms are 160 acres, or multiple 160 acre fields on one system.

Input and output of this unit/system – do you have a mass balance analysis? (3.a)
If a mass balance is available, please include below or attach as a separate document.

N/A

Input material description and characteristics: (4.a)
For example: raw manure, digestate, screened digestate, suitable non-farm feedstocks, other.

Pre-filtered digestate from a methane digester, and pre-filtered raw manure

Please provide the expected performance of this technology related to the following: (5.a)

i. **Changes in form or handling characteristics**
ii. **Nutrient fate or end use projections**
iii. **Macro-nutrient reductions or transformations**
iv. **Pathogen reductions or elimination**
v. **Air emissions (including gaseous ammonia, hydrogen sulfide, and volatile organic compounds)**

i. N/A
ii. N/A
iii. N/A
iv. N/A
v. California studies showed a 70% or greater reduction in irrigation-related greenhouse gas emissions (primarily N20 which has 298x the global warming potential of CO2): https://suscon.org/wp-content/uploads/2018/10/N20-Study-Poster.pdf Hydrogen sulfide has been shown to be almost entirely eliminated on North Carolina swine farm. Ammonia decreases are expected but need to still be measured.

Do you consider this a mature system or ongoing farm development?

Mature, the technology has been in operation for 10 years in California.

Any weather constraints? **Yes** ☐ **No** ☑ *If so, please describe.*

Any bedding constraints? **Yes** ☐ **No** ☑ *If so, please describe.*

Output material description and characteristics:
Please include the % of the total stream for each material, i.e. 10% fiber and 90% screened liquid by weight.

The output of manure separation equipment needs to provide material that has a solids content of less than 2% solids for the easiest implementation of the technology. We have other solutions that can be incorporated to achieve that level of solids, when needed.

Do the outputs of the process have a resale market identified? **Yes** ☐ **No** ☑
If so, under what brand name or who is the contract with?

Please provide any alternative uses for the byproducts produced by this technology. (11.a)

Solids can be spread onto fields to supply Phosphorous and Potassium to crops.

Is this process scalable and to what extent (top and bottom limits)? **Yes** ☑ **No** ☐ *If so, please describe.*

We have not found and upper limit, and it is probably best suited for dairies that have at least 700-800 cows to make it economically viable.

Does this technology require any air input? **Yes** ☐ **No** ☑

What is the preferred air connection? *For example: psi, fitting size, air quality.*
If not distributed by the system, please list each connected device.

Does this technology require any water input? **Yes** ☑ **No** ☐ *If so, please describe.*

Water can come from a variety of sources including surface water, tile water, groundwater, feed pad runoff.

What is the preferred water connection? *For example: psi, fitting size, water quality, gpm.*
If not distributed by the system, please list each connected device.

The system can accommodate poor water quality.

Does this technology require any electrical input? **Yes** ☑ **No** ☐ *If so, please describe.*

It will require pumps to pump the manure and freshwater. In addition, there will be a requirement for the controls, which will only need a 110V outlet. The controller will also be able to be powered by 12V via battery and/or solar.

What is the preferred electrical connection? *For example: phase #, voltage, full load amps.*
If not distributed by the system, please list each connected device.

At a minimum, single phase power is required. Dependent upon pump requirements, a Variable Frequency Drive(VFD) and/or three phase power may be required.

Does this technology require any mechanical input? **Yes** ☑ **No** ☐ *If so, please describe.*

Usually, some type of solid separation is used. This technology exists within the dairy most of the time.

What is the preferred mechanical connection? *For example: horsepower, connection, rpms.*
If not distributed by the system, please list each connected device.

Does this system require any special plumbing? **Yes** ☑ **No** ☐ *If so, please describe what is required.*

There will need to be an injection port in the mainline to inject the manure water.

Does this system require any special foundations or pads? **Yes** ☑ **No** ☐ *If so, please describe.*

The filtration system will need to be located on a concrete pad. Some people also choose to put it in a covered and/or enclosed structure to keep it out of the elements.

Do you consider this technology part of a larger system that you provide? **Yes** ☐ **No** ☑ *If so, please describe.*

Does this system require any other components that you do not provide or are not included in this proposal? **Yes** ☑ **No** ☐
If so, please describe.

There needs to be some type of advanced pre-filtration added to the system that will reduce the solids down to a level that the material can go through our sand media filtration, so that it does not plug it up, and/or result in constant backflush.

How is the system delivered to the site? *For example: skid mounted, assembled on site, constructed on site.*

Construction on site.

Is this system portable or configured in such a way that it could be easily transported for use in several locations?
Yes ☑ **No** ☐ *If so, please describe.*

If needed, it can be assembled on a trailer. Most systems are stationary at the location of the initial installation.

Does this technology negatively impact another critical area or have other regulated characteristics (i.e. emissions, sound, odor)? If so, what are these impacts and what mitigation measures have been if required by state or local agencies?
If so, please describe the recommended means of mitigating these impacts.

No.

What spare parts and redundant components are included with the system?

None.

What equipment, time and resources are required for monitoring this technology and what equipment is included for monitoring this technology? (6.a)

It can be monitored from our controller, or through remote access of the controller from various modes of technology, i.e. phone, tablet, computer, etc.

What equipment, time and resources are required to control this technology and what equipment is included for controlling this technology? (6.b)

Once the controller is set up, it can be operated and monitored on site, or remotely.

What is the usable life of the system?

20-30 years with proper servicing and maintenance.

What is the salvage value at the end of the usable life?

$0

What is the educational and technical level of competence for the operation of the system?

Netafim's technical team is great at addressing any operating issues that you may have. Netafim is the only irrigation company with a team of agronomists designed to work directly with growers and support our dealer network with installations and maintenance.

What level of maintenance is required for the system? (7.a)
Please indicate if rebuilds or major components must be replaced and what the frequency is for these components.

Routine flushing and acidization of the system based upon the number of gallons that is put through the system.

Are consumables used in the process? Yes ☑ No ☐
Please provide the nature and purchase relationship for these consumables. For example: proprietary, special contract, generally available.

There are some wearable parts and the sand in the media tanks should be replaced every 5-7 years dependent upon the number of gallons put through the system.

Which of these NRCS codes would this technology be classified under? *Check all that apply. Add if necessary.*

CODE	NRCS DESCRIPTION	CHECK ALL THAT APPLY
472	Access Control	☐
560	Access Road	☐
309	Agrichemical Handling	☐
371	Air Filtration and Scrubbing	☐
591	Amendments for the Treatment of Agricultural Waste	☐
366	Anaerobic Digester	☐
672	Building Envelope Improvement	☐
372	Combustion System Improvement	☐
317	Composting Facility	☐
554	Drainage Water Management	☐
375	Dust Control from Animal Activity on Open Lot Surfaces	☐
373	Dust Control on Unpaved Roads and Surfaces	☐
374	Farmstead Energy Improvement	☐
512	Forage and Biomass Planting	☐

561	Heavy Use Area Protection	☐
516	Livestock Pipeline	☐
590	Nutrient Management	☑
521A	Pond Sealing or Lining, Flexible Membrane	☐
533	Pumping Plant	☑
588	Roof Runoff Structure	☐
367	Roofs and Covers	☐
318	Short-Term Storage of Animal Waste and By-Products	☐
570	Stormwater Runoff Control	☐
606	Subsurface Drain	☐
635	Vegetated Treatment Area	☐
601	Vegetative Barrier	☐
360	Waste Facility Closure	☐
632	Waste Separation Facility	☑
313	Waste Storage Facility	☐
634	Waste Transfer	☑
629	Waste Treatment	☐
359	Waste Treatment Lagoon	☑
441	Micro and Subsurface Irrigation	☑
632	Waste Separation Facility	☑
430	Irrigation Pipeline	☑
449	Irrigation Water Management	☑
433	Irrigation Flow Measurement	☑
610	Salinity + Sodic Soil Management	☑
434	Soil Moisture Measurement	☑
328	Conservation Crop Rotation	☑

Please provide an estimated installed capital cost for this technology and indicate the model, cow number or volume that this cost applies to. (8.a)
Please include all components and designate if provided by you or others.

Full turnkey installation of Netafim components is about $3,600 per acre. Other items may be required, dependent upon current setup.

Please provide an estimated annual operation cost for this technology and indicate the model, cow number or volume that this cost applies to. (8.b)
Please include all costs and designate if provided by you or others.

Operating costs depend and vary based on the amount of volume being put through the system; the pumping power needed to deliver the product which can be driven by depth of the well, topography of the field, etc. With farmer permission we can likely get a specific example in the state of Minnesota.

Is there financing available for this system? **Yes** ☑ **No** ☐ *If so, what are the conditions for this financing?*

20% down, Qualify through our finance partner DLL. Terms up to seven years.

Is the system available for lease? **Yes** ☐ **No** ☑ *If so, please describe.*

What sort of warrantee or guarantee do you provide with this technology? (9.a)
Do you provide any performance guarantees or strictly defects in parts and materials?

Our dealers usually provide 1 year for parts and labor. We provide the warranty listed in the terms and conditions of our catalog. See page 11 of this document: https://www.netafimusa.com/contentassets/4f3c4372b8ee4cd79e659e7be2859a39/agriculture-price-list_04012024.pdf

Explain how this system is unique or transformative and how does it improve upon or go beyond other technologies that are currently available.

It affords the producer the opportunity to apply manure throughout the growing season, when the crop needs it, all the while reducing greenhouse gas emissions.

Please provide the recommended record keeping procedures for end users of this technology. (10.a)

As per state agency requirements only. The control system maintains a record of gallons applied, EC, pH of the material, and soil moisture monitoring, if applicable.

NRCS considers it the responsibility of the technology provider to furnish information from a university or other independent research entity to document the effectiveness of the technology to achieve its intended purpose in order to be funded through its programs. This information must provide independent, verifiable data demonstrating results of the use of the facility, technology or process in other similar situations and locations and, if available, document the effectiveness of the technology under different climatic factors. Documentation from peer reviewed journals is preferable. Where use of a waste treatment facility or process to improve one resource concern negatively impacts another, impacts and mitigation measures, if required by state or local agencies, are to be documented.

Can you provide independent, verifiable data demonstrating results for the use of this technology in other similar situations and locations? Would you be willing to provide this data in order to qualify for NRCS funding? (12.a)

Yes. Sustainable Conservation, a nonprofit partner of Netafim's in California, has provided research as part of the USDA Conservation Innovation Grants they have received that helped initially pilot and fund the SDI-E technology. See the "Dairy Industry Sustainability" section of their website for technical resources: https://suscon.org/technical-resources/

If information is provided related to the previous question, please provide the credentials of the individual collecting the data and analyzing the results along with disclosure of potential conflicts of interest. (13.a)

Sustainable Conservation was founded in 1993 and is a 501c3 California nonprofit that advances the collaborative stewardship of California's land, air, and water for the benefit of nature and people. A summary of findings from their Conservation Innovation Grant #69-3A75-17-53 can be found here: https://suscon.org/wp-content/uploads/2022/05/Manure-Subsurface-Drip-Irrigation-Summary-Evaluation_5-2022.pdf

Newtrient has developed a third-party evaluation protocol that can be used in conjunction with a local university or state extension agency to evaluate technologies in a way that will meet the NRCS requirements. Please contact mstoerm@newtrient.com if you are interested in contracting for this service.

TECHNOLOGY REFERENCES

Please provide customers with whom we can discuss this technology and its performance. (15.a)
Include a company name, location, contact name and contact information.

Reference 1

Company Name:	Sustainable Conservation

Company Location:	201 Needham Street, Modesto, CA 95354
Contact Name:	John Cardoza, Project Director
Contact Information:	jcardoza@suscon.org 209.576.7731

Reference 2

Company Name:	NutraDrip
Company Location:	2991 Goldfinch Road, Hiawatha, KS 66434
Contact Name:	Kurt Grimm, CEO
Contact Information:	kurt@nutradrip.com, 785-547-5209

Reference 3

Company Name:	De Jager Farms
Company Location:	Chowchilla, CA
Contact Name:	Richie Mayo
Contact Information:	209-723-9348

Reference 4

Company Name:	Riverview, LLP
Company Location:	Morris, MN
Contact Name:	Adam Zeltwanger
Contact Information:	320-760-5092

Are there any other facts about this technology that you feel should be included in this document?

In 2022, SDI-E was named the Irrigation Association's Vanguard Award recipient. The IA's Vanguard Award honors an innovative project in the irrigation industry executed by a team of individuals, companies, organizations, or other group entities. Projects chosen for this award exemplify the IA's mission of promoting efficient irrigation. In 2020, SDI-E earned the US Dairy Sustainability Award for Outstanding Community Impact. The award partners included: Sustainable Conservation, De Jager Farms, McRee Dairy, and Western United Dairies of California. The US Dairy Sustainability Awards recognize dairy farms, businesses, and collaborative partnerships for practices that demonstrate outstanding economic, environmental, and social benefits; a longstanding commitment to continuous improvement; and a replicable model to inform and inspire others in advancing dairy sustainability leadership.

The questions above have been adapted to attempt to glean as much information as possible in order to help Newtrient develop technology documentation that will meet the standards of what is required in a review package for technology to be approved under NRCS Practice Standard 629 (CPS 629 - Waste Treatment) **Note the definition of Waste Treatment is "The use of unique or innovative mechanical, chemical or biological technologies that change the characteristics of manure and agricultural waste".**

NRCS documentation specifies that the review package shall contain the following 15 items (in black) and from these Newtrient has developed the questions in this document (in red):

1. **A description of the technology. If lengthy, this may be placed in an appendix.**
   a. **Please provide a brief (1-2 sentence) description of this technology.** Netafim's innovative subsurface drip irrigation-effluent (SDI-E) system utilizes advanced filtration and proprietary, patented technology to blend dairy, swine, or beef manure effluent wastewater with fresh water, enabling consistent and reliable in-season application as a nutrient-rich fertilizer through underground and contained subsurface drip lines. This practice reduces air and water pollution associated with current manure and nutrient management applications by maximizing crop nutrient uptake and minimizing nitrate, nutrient volatilization, and phosphorus leaching into waterways and communities. The system blends effluent wastewater with fresh water at an optimum ratio. This is accomplished through monitoring of the electrical conductivity (EC) in the water as it passes by a sensor. As the EC of the water changes, Netafim's system is able to make real-time adjustments to the blending valves in order to keep the fertilizer mixture in a prescribed ratio as it is delivered to the plant's roots though drip irrigation tubing buried below the surface.
   b. **Please provide a full description of this technology. (Attach pages if necessary)** Subsurface drip irrigation (SDI) is a management tool that allows precise control over the root zone environment of crops. This added management control results in consistently higher yields and better quality. Additionally, better water and nutrient management can help reduce fertilizer inputs, water needs, and runoff. Two pumps are required at the head of the filter station for blending of the effluent water and fresh water before filtration. Water meters are an essential component to monitor flow, system operation and crop water use. Pressure gauges maintain system performance and are placed at key locations. Electronically powered mixing valves isolate and regulate flow of the fresh/effluent water mix. The filtration system protects the drip system from the fine sand and other small particles that can plug the emitters. Sand media filters utilize depth filtration which is most effective at removing suspended particles from the water. A small air compressor is recommended for flushing valves. Monitoring and controllers allow chemical injection to regulate EC and pH levels while also helping to monitor the performance of the irrigation system. EC and pH sensors can be utilized for reliable measurement of salinity in the fresh/effluent water mix. Pressure reducing valves control and optimize drip irrigation systems. Manifolds are used after control valves to supply the fresh/effluent water mix to the driplines. A manifold design incorporating friction loss is critical in distribution uniformity of the water mis. Air vents added to the lower end of the pipeline ensures system operation. They are used downstream of all freshwater pumps and upstream of all field valves. Netafim and their dealer network help farmers specify the proper dripline product for the farm. Flush manifolds properly flush the driplines and reduce the labor requirement.
2. **An explanation of how this technology will accomplish one or more of the purposes of the standard.**
   a. **Please explain how this technology will improve water quality and/or air quality by one or more of the following:**
      i. **Reducing the nutrient content, organic strength, and/or pathogen levels of manure and agricultural waste.** SDI-E doesn't reduce nutrient content, it just directs nutrients to where they are needed – to the crop roots. It does reduce wasting these valuable nutrients by reducing leaching into water bodies and volatilization into the air.
      ii. **Reducing odors and gaseous emissions** Because the manure effluent is applied underground through driplines, odor is virtually eliminated, and greenhouse gas emissions are reduced significantly, primarily nitrous oxide. Research is currently underway with North Carolina State on swine farms, but the published research is from Sustainable Conservation in California, which showed a 70% decrease in N20 emissions on wheat and 90% on corn (link to research: https://suscon.org/wp-content/uploads/2018/10/N20-Study-Poster.pdf).
      iii. **Facilitating desirable waste handling and storage** Midwest manure management practices rely

upon out-of-season (before crop planting and after crop harvest) application of manure nutrients through dragline or tanker application. This results in nutrient leaching, volatilization, odor, and runoff. Consider spills encountered by producers using dragline hoses spanning distances of 1.5-2 miles, featuring diameters as wide as 12 inches, and transporting up to 2,000 gallons per minute of liquid. In an unexpected rupture, a rapid discharge of 2,000 gallons ensues within a minute, potentially escalating to a substantial and costly incident if not promptly addressed. Another challenge is the application window and more erratic weather conditions. Currently, the Department of Natural Resources (DNR) has advanced its deadline for manure application in some Midwestern states. A continual shift toward an earlier deadline narrows the timeframe for completing the manure application process, leaving producers with excess manure nutrients and expensive disposal methods. Unfavorable weather conditions can impede the timely application of manure, leading to the dilemma of managing and storing large volumes of manure in lagoons when the application window is curtailed. There is also leaching and volatilization potential that exists with the standard practice of applying manure via dragline or tanker from September to April. While properly set up equipment will get 90+% of the manure in the ground, it is being applied 3-9 months before the crop will utilize the nutrients. During that time, there will be periods of saturation, which will lead to nutrient leaching, an increase in greenhouse gas (GHG) emissions, and an increase in erosion and runoff. Current manure management practices provide no upfront investment but incur higher operating costs over time, especially for producers that need to haul their manure off-site, potentially escalating labor and hauling costs and increasing emissions associated with transportation. Cost of dragline or tanker application of manure costs Midwestern growers $.015 to $.1 per gallon. The cost of application with SDI-E will range from $.001 to $.003 per gallon.

iv. **Producing value added byproducts that facilitate manure and waste utilization.** Dry material is separated from the manure effluent, extracting the valuable water and nutrients, while also leaving behind dry matter that can be reused on the farm.

3. **The range of volumetric and mass flow rate capacities and hydraulic retention times of the waste streams including the influent, effluent, and recycle streams.**
    a. **Please provide a detailed mass balance that demonstrates the range of volumetric and mass flow rate capacities and hydraulic retention times of the waste streams including the influent, effluent, and recycle streams for this technology by model number or as related to a specific flow or number of animals (i.e.1,000 cows per day or 100,000 gallons per day).** In California, the SDI-E system mixed up to a 50:50 ratio of effluent water/freshwater as delivered to the pump and filter station by the dairy. Blending ratios will vary by farm and type of effluent and how livestock waste is managed. The waters are mixed proportionally based on the EC of the water measured downstream of the Mixing Valve. Fresh and Nutrient-Rich Effluent water samples are taken, and analyses are done to determine nutrient content. The water is again measured as it goes out to the field by the Main Flow Meter. The manager adjusts EC (Nutrient Level) based on samples taken. In an effluent water application system, there are 3 meters: the main meter measuring water ultimately being delivered to the crop and both effluent and freshwater meters measuring water coming into the system.
4. **The characteristics of the influent waste stream important to the waste treatment or process.**
    a. **Are there any characteristics of the influent waste stream important to the proper operation of this technology?** The filtration area is increased to properly filter extremely poor water quality. By adding more tanks and filter area, the flow per tank is reduced allowing the filters more time to clean. Flow recommendations per 48-inch sand media tank, are in the range of 120-150 GPM rather than 200-300 range with good water quality. Filters flush automatically either by pressure differential or by a set time interval. To open a specific flush valve an electric signal is sent to a solenoid on the flush valve that opens a small orifice letting water into the bonnet on the valve. This forces the valve from an open operation position to a closed flushing position. The orifices in the solenoid valve are very small requiring 120 mesh filtration. Therefore, we avoid using a Command Filter for the effluent water, to operate the solenoid valves. We instead use a small air compressor to flush all valves pneumatically. Always collect a sample of the new media used, sand in this case, to compare in the future with worn sand in the tanks. Silica sand filters the water very effectively, due to its sharp irregular angles. However, as water and particulate flow through the sand, the angular nature starts to wear, reducing filtration efficacy over time. Sand should be replaced every 3-5 years, potentially more often with effluent water's high particulate load.
5. **Expected system performance related to changes in form, nutrient fate projections, macro-nutrient reductions, pathogen reductions and air emissions including gaseous ammonia, hydrogen sulfide, and**

volatile organic compounds.

a. **Please provide the expected performance of this technology related to the following:**
   i. **Changes in form or handling characteristics** Changes in nutrient density could affect the number of gallons allowed to be applied based upon the individual nutrient management plan. Changes in properties of the manure (i.e. solid content) could affect the performance of filtration.
   ii. **Nutrient fate or end use projections** N/A
   iii. **Macro-nutrient reductions or transformations** N/A
   iv. **Pathogen reductions or elimination** N/A
   v. **Air emissions (including gaseous ammonia, hydrogen sulfide, and volatile organic compounds)** SDI-E has been shown to virtually eliminate hydrogen sulfide. There is a reduction in ammonia as well, but that is still being measured through the NC State research.

6. **Process monitoring and control system requirements.**
   a. **What equipment, time and resources are required for monitoring this technology and what equipment is included for monitoring this technology?** The controller opens and closes irrigation values and integrated all control features in one unit, so that the irrigation system can be operated and monitored from a central location. Irrigation schedules can be repeated and modified as needed, with up to 60 valve run time programs using time or volume-based scheduling. There are up to 15 external condition programs with programmable parameters for triggering irrigation events. Multiple pumps and valves can be controlled, delaying start or shut down times. Scheduling backflush programs eliminates the need for additional external backflush controllers. A range of nutrient and chemical dosing options are available – by time, quantity, or proportion along with detailed alarm messages. A range of alarm protects the system by isolating problems and providing event details.
   b. **What equipment, time and resources are required to control this technology and what equipment is included for controlling this technology?** Netafim dealers and Netafim Agronomists work with farmers to be trained and authorized to use Digital Farming Products.
7. **A typical operation and maintenance plan that includes performance monitoring requirements and a replacement schedule for components that do not have a minimum life span of ten or more years.**
   a. **Please provide a typical operation and maintenance plan that includes performance monitoring requirements and a replacement schedule for components that do not have a minimum life span of ten or more years**. N/A
8. **Estimated installation and annual operation cost.**
   a. **Please provide an estimated installed capital cost for this technology and indicate the model, cow number or volume that this cost applies to.** Full turnkey installation of Netafim components is about $3,600 per acre. Other items may be required, dependent upon current setup.
   b. **Please provide an estimated annual operation cost for this technology and indicate the model, cow number or volume that this cost applies to.** Operating costs depend and vary based on the amount of volume being put through the system; the pumping power needed to deliver the product which can be driven by depth of the well, topography of the field, etc. With farmer permission we can likely get a specific example in the state of Minnesota.
9. **An example of a warranty on all construction or applied processes not covered by other NRCS Conservation Practice Standards.**
   a. **Please provide an example of a warranty on all construction or applied processes included with this technology.** See page 11 of this document: https://www.netafimusa.com/contentassets/4f3c4372b8ee4cd79e659e7be2859a39/agriculture-price-list_04012024.pdf
10. **Recommended record keeping procedures for end users.**
    a. **Please provide the recommended record keeping procedures for end users of this technology.** As per state agency requirements only. The control system maintains a record of gallons applied, EC, pH of the material, and soil moisture monitoring, if applicable.
11. **Alternatives for the use of the byproducts produced by the system.**
    a. **Please provide the alternative uses for the byproducts produced by this technology.** Solids can be spread onto fields to supply Phosphorous and Potassium to crops.

It is the responsibility of the technology provider to furnish information from a university or other independent research entity to document the effectiveness of the technology to achieve its intended purpose.

Provide independent, verifiable data demonstrating results of the use of the facility or process in other similar situations and locations. If available document the effectiveness of the technology under different climatic factors. Documentation from peer reviewed journals is preferable. Where use of a waste treatment facility or process to improve one resource concern negatively impacts another, impacts and mitigation measures, if required by state or local agencies, are to be documented.

12. **Independent, verifiable data demonstrating results for the use of the facility or process in other similar situations and locations.**
    a. **Can you provide independent, verifiable data demonstrating results for the use of this technology in other similar situations and locations? Would you be willing to provide this data in order to qualify for NRCS funding?** Yes. Sustainable Conservation, a nonprofit partner of Netafim's in California, has provided research as part of the USDA Conservation Innovation Grants they have received that helped initially pilot and fund the SDI-E technology. See the "Dairy Industry Sustainability" section of their website for technical resources: https://suscon.org/technical-resources/
13. **The credentials of the individual collecting the data and analyzing the results along with disclosure of potential conflicts of interest.**
    a. **If information is provided related to the previous question, please provide the credentials of the individual collecting the data and analyzing the results along with disclosure of potential conflicts of interest.** Sustainable Conservation is an independent nonprofit and their research partnered with UC Davis, so while they utilized and researched Netafim systems, there is no conflict of interest.
14. **Contact information for the technology provider.**
    a. **Please provide a technical contact and a business contact to answer questions regarding the information provided for this technology.** Jim Ed Beach 1-515-661-7174 jimed.beach@netafim.orbia.com
15. **Contact information for individuals that have implemented this technology at the farm scale.**
    a. **Please provide contact information for individuals that have implemented this technology at the farm scale.** DeJager Farms, Richie Mayo, CFO, 209-723-9348 richie@dejagerfarms.com