OSCAR-III **Treatment System Design Manual**
January 2019, WA

Manufactured by:

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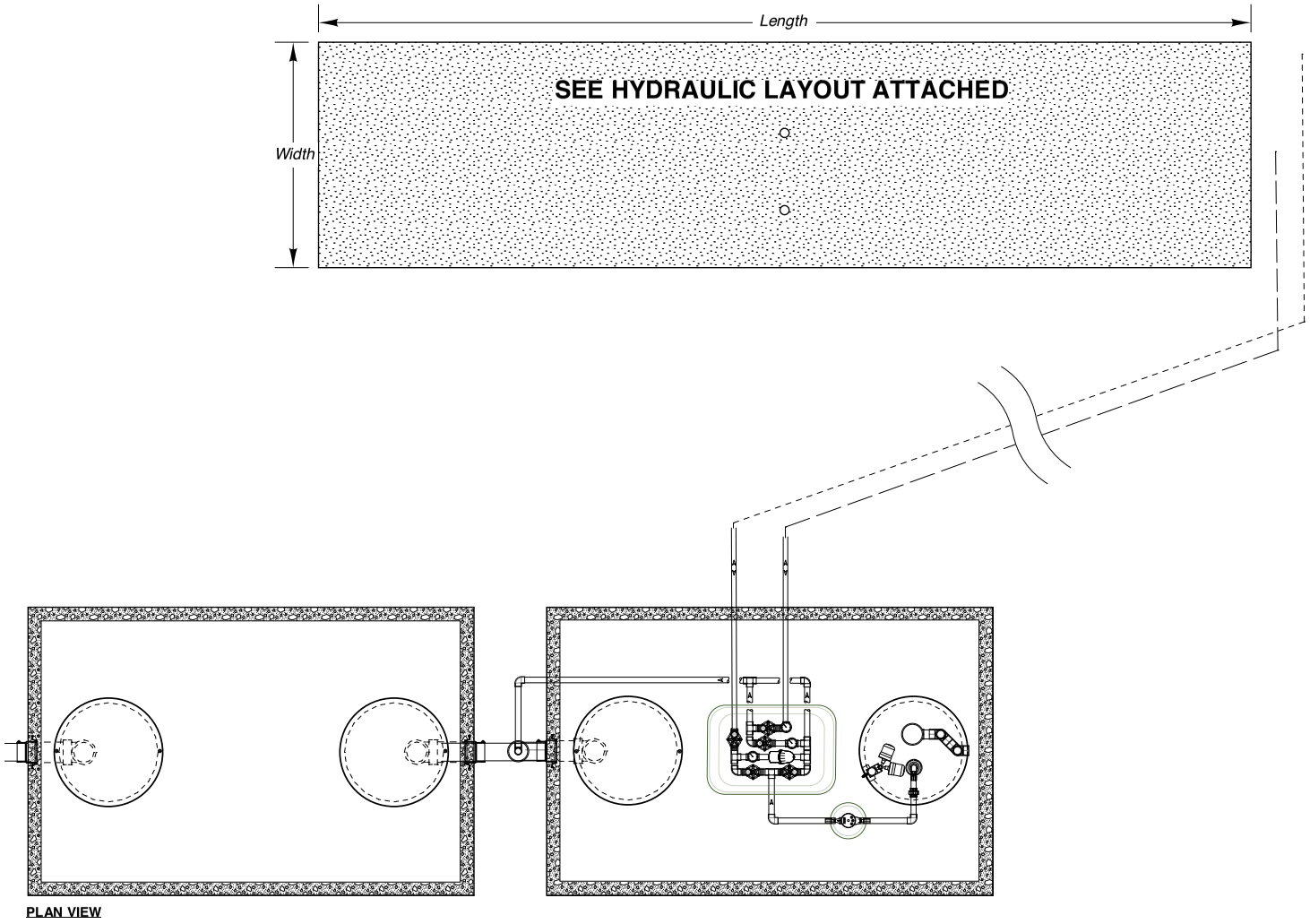


PLAN VIEW

1500 gallon
Treatment

1000 Gallon Pre-cast Concrete
Single Compartment Discharge Tank

Introduction:

The *OSCAR-III* is an onsite sewage treatment and dispersal component for use with residential wastewater. Wastewater first passes through a treatment vessel and then into a dosing tank where it is dosed to the *OSCAR* coils. Effluent is micro dosed into a layer of ASTM C-33 sand where physical, biological, and chemical treatment processes remove organic compounds and pathogens from the waste stream. Treated liquid then migrates downward to the receiving soil where final discharge of treated wastewater enters the soil environment.

The *OSCAR-III* is comprised of a 12" layer of C-33 sand media and a series of custom manufactured Netafim Bioline drip tubing coils. The sand media is placed on a prepared soil surface creating a level surface for the coils. *OSCAR-III* coils are then placed on the sand media and then covered with another 6" of sand media. No other cover material is needed. To control erosion or inadvertent disturbance from children or animals the sand can be covered with jute mat or cover with a shallow layer of mineral soil. Another option is to spread straw over final cover until vegetative cover takes hold: plant grass seed or other ground cover as soon as possible. See appendix for more details.

The sand/soil interface is the discharge point of the treated wastewater. Vertical separation is measured from the original soil surface prior to basal area preparation and the restrictive layer. If enough soil depth is present, the basal area can be excavated to lower the profile of the *OSCAR*.

The *OSCAR-III* system meets treatment level "B" (15 mg/l CBOD5, 15 mg/l TSS, and 1,000 FC/100 ml MPN), without UV disinfection. The *OSCAR-III* with the OS-50's must be used in soil depths of at least 12"-18" (except in soil type I where 18" minimum is required). In soil depths 18" or greater, the OS-100 coils can be used.

The single family residence packages are designated as: *OSIII-240, OSIII-300, OSIII-360, OSIII-450, and OSIII-480* and have the corresponding design flows of 240, 300, 360, 450, and 480 gallons per day. The *OSIII-240, 300, 360, 450, and 480* are standard packages. Design flows greater than 500 gallons per day are considered custom and will require design assistance from *Lowridge Onsite Technologies, LLC*.

The *OSCAR-III* units can be designed in increments of 25 or 50 gallons per coil per day (OS-50 coil and OS-100 coil, respectfully). Consequently, an *OSCAR-III* system could be designed for 850 gpd. This design flow is comprised of 34 *OSCAR* OS-50 coils (34 x 25 gallons = 850 gallons per day).

Design:

Each ***OSCAR-III*** coil is designed to treat and dispose of 25 or 50 gpd of residential strength effluent, depending on soil depth and *OSCAR* coil model specified. Minimum vertical separation depth is 12", except in soil type 1 where a minimum of 18" of vertical separation is required.

There are two models of *OSCAR-III* coils: OS-50 and OS-100. The OS-50 coils form a 5' wide single row and the OS-100 coils form a 7.1' wide single row. Tables III and IV dictate the overall minimum "shoulder" length for the corresponding design flow for each coil model. See appendix for details of OS-50 & OS-100 foot print and specifications.

An *OSCAR-III* has four (4) sizing criteria: *treatment vessel, pump tank, hydraulic layout,* and *basal* area. The hydraulic layout criterion includes the number of coils and how they are to be connected. The basal area refers to the overall foot print of the *OSCAR-III* sand/soil interface. See below for treatment vessel requirements.

Treatment Vessel:

The treatment vessel for the *OSCAR-III* shall be posted on the *Washington State Department of Health's Registered Wastewater Containment Vessel* list, minimum volume 1,500 gallons.

For design flows greater than 500 gpd the treatment vessel must be proportionately upsized for higher design flows.

Pump Tank:

Pump tank must be at least 1,000 gallons for design flows of 500 gpd or less. For design flows greater than 500 gpd, the pump tank must be upsized proportionally to the increase in design flow above 500 gpd.

Hydraulic Layout:

Coils are arranged in laterals. Each lateral is a single coil or a group of coils linked in series between the supply and flush manifolds. The *OSCAR-III* coils are timed dosed and flushed automatically.

The standard single family residence *OSCAR-III* packages with design flows between 240 to 480 gpd include a headworks (model HWN-.7-RF) for dosing the *OSCAR-III* coils. Table I depicts the number of OS-50 coils and laterals required for a given design flow using an *AY McDonald* 30 gpm, 1/2 hp, 110 volt turbine pump, model 22050E2AJ. Table II depicts the number of OS-100 coils and laterals required for a given design flow using the same pump. The criteria in these tables ***must be*** followed. If a deviation is required, contact *Lowridge* for assistance.

The tables also indicate how much excess head, under the pump curve, is available for supply line elevation lift and friction loss. All manifolds, supply and flush lines are assumed to be 1" sch 40 PVC. The designer must calculate the total dynamic head (TDH) for the *OSCAR-III* supply line. Use the flow rate indicated under the heading "Flush GPM" in Table I or II for the corresponding design flow and coil model to calculate the friction loss of the supply line. If the calculated TDH is greater than the "Excess TDH" value in Table I or II, call *Lowridge* for assistance. TDH is calculated by adding the friction loss of the supply line to the elevation lift from liquid level in pump tank to the *OSCAR-III* coils. Use the following Hazen-Williams formula to calculate friction loss. Always use the Flush Flow Rate valves when calculating fiction loss.

$$f=L(Q/K)^{1.85}$$

F= friction loss through pipe in feet of head
L= length of supply line in feet
Q= Flush GPM
K=47.8 (1" sch 40 PVC pipe)

TABLE I
Hydraulic Layout
OS-50 coils

Design Flow	Total Coils	# of Lats.	Coils per lat.	Dose GPM	Flush GPM	Excess TDH
240	10	5	2	3.5	12	50'
300	12	3	4	4.2	12	50'
360	16	4	4	5.6	12	50'
450	18	6	3	6.3	12	50'
480	20	5	4	7	12	50'
600	24	6	4	8.4	12	50'

TABLE II
Hydraulic Layout
OS-100 coils

Design Flow	Total Coils	# of Lats.	Coils per lat.	Dose GPM	Flush GPM	Excess TDH
300	6	3	2	4.2	12	50'
360	8	4	2	5.6	12	50’
480	10	5	2	7	12	50’
600	12	6	2	8.4	12	50'

TABLE III
Minimum Shoulder Lengths
OS-50

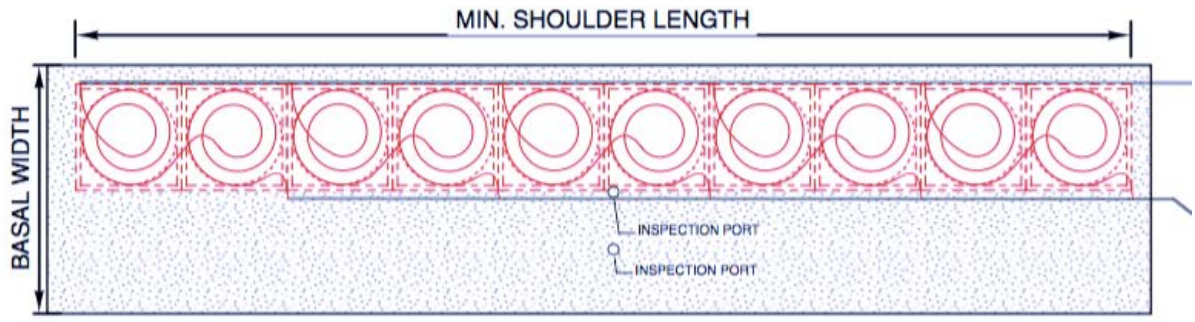
Design Flow	Minimum Shoulder Length in Feet
240	55.5
300	66.5
360	88.5
450	100
480	110.5
600	132.5

The dimensions in Table III represent the minimum required length of the outer shoulder which include coils, spacing between coils, and shoulders. These lengths can be extended to match site conditions. Minimum shoulder spacing is 6”. See illustration below for example of shoulder length.

TABLE IV
Minimum Shoulder Lengths
OS-100

Design Flow	Minimum Shoulder in Feet
240	35.5
300	42.5
360	57
450	64
480	71
600	85

The dimensions in Table IV represent the minimum required length of the shoulder which include coils, spacing between coils, and shoulder. These lengths can be extended to match site conditions. Minimum shoulder spacing is 6". See illustration below for example of shoulder length.



Basal Area:

The basal area is comprised of the total area where the sand media is in contact with the receiving soil. The minimum required basal area is calculated by dividing the design flow rate by the soil loading rate specified in WAC 246-272A (local codes may have differing loading rates).

Example, Soil type 4 at 240 gpd.

240 gpd ÷ 0.6 gpd/ft2 = 400 sq. ft.

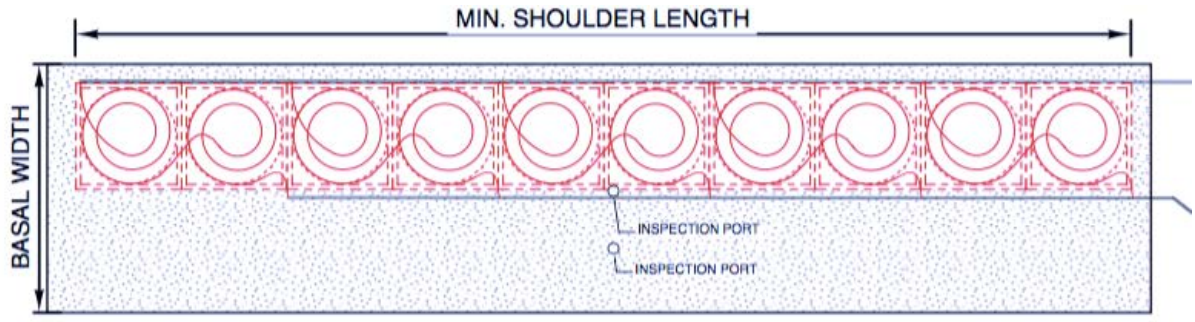
Combining Hydraulic Layout and Basal Area Requirements:

To combine the coil layout and the basal area, start with the coil layout. Refer to Tables III or IV for minimum shoulder lengths. Zero to 5 percent slopes (0-5% slope) are considered flat for basal area calculations and set back considerations. On flat sites, the coils should be placed in the center of the basal area. The coils will be arranged in a single line, although the line can be curved to match site contours. Also, no emitter shall be placed within 6" of the sand media shoulder. Basal area width must be a minimum of 7.5' in all applications

On sloping sites (>5 to 20% slope) the coils will be placed parallel to the contour and one edge of the coils must be placed about 12" from the upslope basal boundary. There must be at least 6" separation between sand shoulder and an emitter. With the OS-50 coils there must be at least 6" between the drip tubing in different coils. With the OS-100 coils there must be 12" spacing between the drip tubing in different coils. Side slopes of the sand media is at least a 1 to 1 slope. Two inspection ports must be installed: one in the coil area and the other in the basal area as shown. For inspection port construction, see Appendix.

The following are examples of an *OSCAR-III* design with OS-50 coils.

FLAT SITE (12-18" soil, OS-50)



Example: (refer to illustration above and Table III).

240 gpd design flow, soil type 4 (0.6 gpd/ft2), flat site

Basal area required = daily design flow ÷ soil loading rate

400 sq. ft. = 240 gpd ÷ 0.6 gpd/ft2

Minimum shoulder length (see Table III) is **55'**.

Minimum side slopes at 1 : 1 slope @ 6" (2 x 6" = 1') = **1'**

Minimum basal length= shoulder length + side slopes
55' + 1' = 56'
Basal area width = required basal area ÷ minimum basal length
= 400 sq. ft. ÷ 56' = 7.149 or 7.5'

Basal area dimensions for soil type 4 = 56' long x 7.5' wide.

SLOPING SITE (12-18" of soil, OS-50)

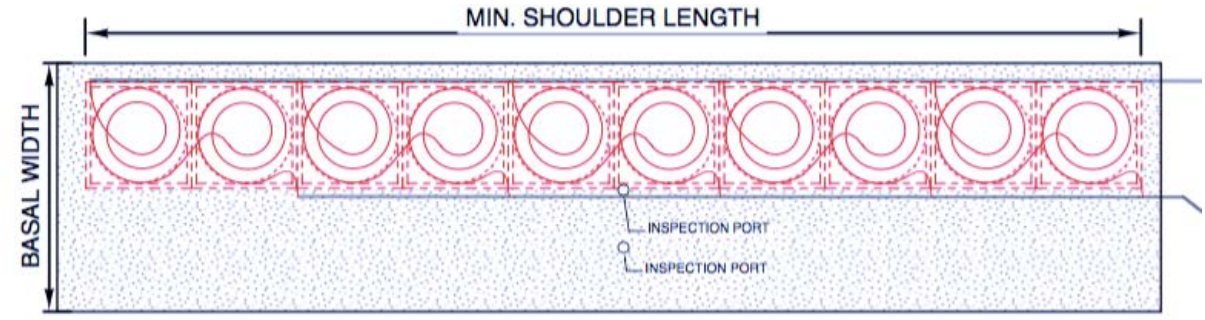
When calculating the required basal area for a sloping site the same process is used as a flat site except for one criterion. The side slope value must include the increased sand depth due to the sloping site. In order to keep the coils level on a sloping site, additional sand must be placed under the downslope side of the coil. The greater the sand hight, the greater the side slope. To calculate the additional sand depth use the following formula:

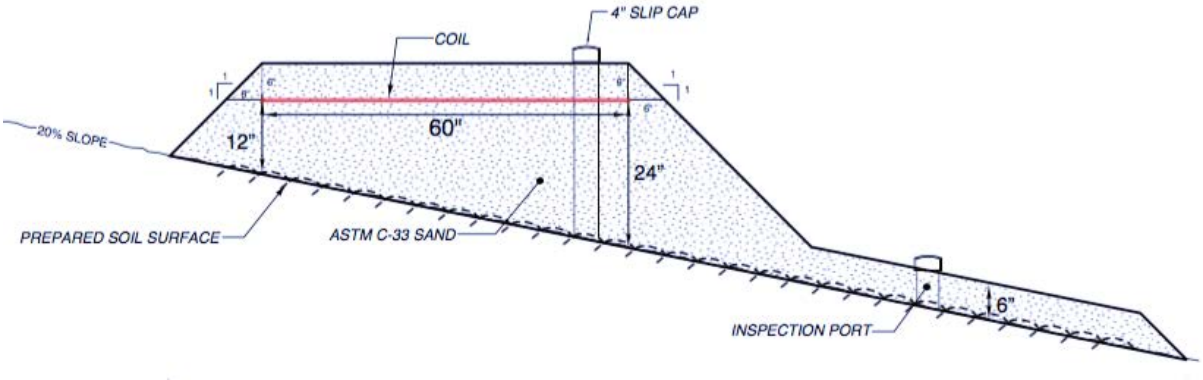
Diameter of coil x % slope of site

In the illustration below the 20% slope needs an additional 12" of sand to maintain a level coil network.

60" (diameter of coil) x 20% = 12"

The additional 12” of sand needs to be added to the minimum required sand of 12” to equate to the **24”** of sand on the downslope side of the coil.





Example:

240 gpd design flow, soil type 4 (0.6 gpd/ft2), sloping site

Basal area required = daily design flow ÷ soil loading rate

400 sq. ft. = 240 gpd ÷ 0.6 gpd/ft2

Minimum shoulder length (see Table III) is **55’**.

Minimum side slopes at 1 : 1 slope @ 24” (24” x 2) = 4’

Minimum basal area length = shoulder length + side slopes

55’ + 4’ = 59’

Basal area width = required basal area ÷ minimum basal length

400 sq. ft. ÷ 59’ = 6.9’ or 7.5’

Minimum basal area dimensions for soil type 4 = 59’ long x 7.5’ wide.

Controller:

The *LF1P-RF-BLWR* control panel shall be used to operate the timed dosing sequencing of the *OSCAR-III*. Timer settings for the *OSCAR-III* are short and very frequent (7 minutes and 38 seconds off and 22 seconds on).

It is expected that the supply line will stay charged between doses, unless in eastern Washington where the supply and flush lines drain. It is therefore strongly recommended to site the OSCAR coils at or above the discharge tank. If supply and flush lines drain between doses, additional “on” time must be added to dose cycle.

Set-backs:

When the item to be setback[1] from is:	Upgradient[2]	Downgradient[3]
Setback distance from **property lines**, **other soil dispersal components**, **driveways**, **buildings**, **ditches** or **interceptor drains**, **subsurface storm water infiltration systems**, or any other development which would either impede water movement away from the mound or channel groundwater to the mound area	10 feet	30 feet
Setback distance from **well**, **suction line** or **surface water**.	100 feet	100 feet

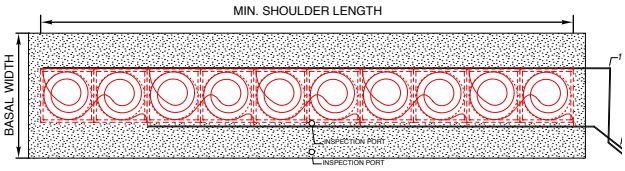
[1] The edge of required basal area
[2]The item is upgradient when liquid will flow away from it upon encountering a water table or restrictive layer.
[3]The item is downgradient when liquid will flow toward it upon encountering a water table or restrictive layer.

All other set backs are according to local code or WAC 246-272A.

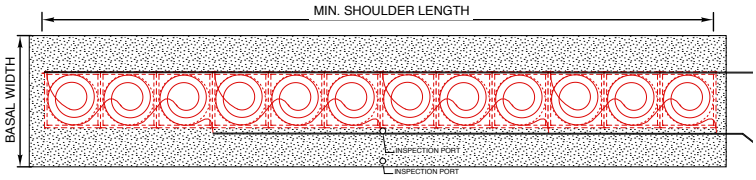
Appendix

Sample Design layouts

240 gpd



300 gpd



Headworks: HWN-.7-RF-OS

- 1” Arkal disc filter, mesh, 130 micron
- 1” Arad flow meter
- Three oil filled pressure gauges
- 5 Netafim normally closed solenoid valves

OSCAR-III Parts list.

Each OSCAR-III unit will include:

- LF1P-RF-BLWR control panel
- 1/2 hp, 30 gpm *AY Mc Donald pump*
- OS-50 or OS-100 Coils
- PVC fittings and drip tubing adapters
- HWN-.7-RF-OS automatic headworks
- Solid ½” poly tubing for connections
- 2 float switches

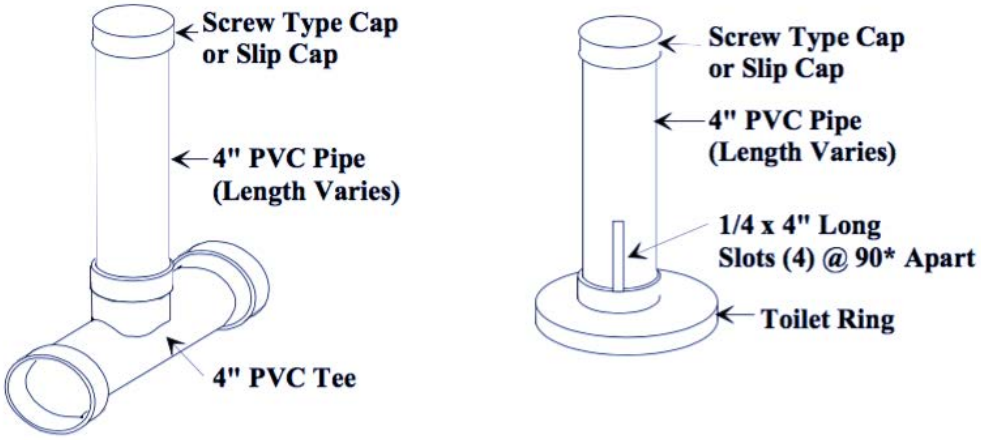
***OSCAR-III* coil Connections**

Manifolds and supply lines are 1” Sch 40 PVC

Manifold and blank tech line adapter and connection.

Blank tech liner and Bioline connection with internal coupling

Inspection ports.

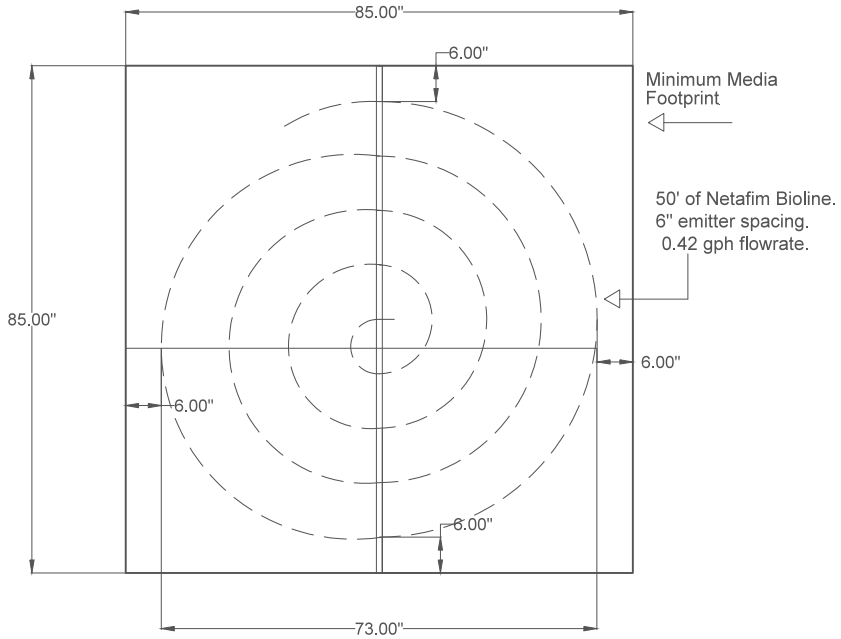


OS-50 & OS-100 Coil Detail.

OS-50: The OS-50 OSCAR coil is made with 25' of custom Netafim Bioline with 0.42 gph emitters @ 6" spacing (50 emitters), an average of 2 emitters per sq. ft. Each pre-assembled coil has a minimum area of 25 sq. ft. (5' x 5'). There must be a minimum of 6" spacing between each coil and a minimum of 6" spacing between any coil and the should edge. Table III contains the minimum shoulder length for a given design flow. The "shoulder length" is the total minimum distance from the outside shoulder edge of the first coil to the opposite end shoulder of the last coil. This dimension includes all the coils, coil spacing, and shoulder spacing on each end. OS-50 Coils equal 25 gpd with the *OS-III* system

OS-100: The OS-100 OSCAR coil is made with 50' of custom Netafim Bioline with 0.42 gph emitters @ 6" spacing (100 emitters), an average of 2 emitters per sq. ft. Each coil has a minimum area of 50 sq. ft. (85"x85"). The actual coil diameter is 73". There must be a 12" minimum spacing between the tubing of differing OS-100 coils and a 6" spacing between any tubing and the shoulder edge. Table IV contains the minimum shoulder length for a given design flow. The "shoulder length" is the total minimum distance from the outside shoulder edge of the first coil to the opposite end shoulder of the last coil. This dimension includes all the coils, coil spacing, and shoulder spacing on each end. See illustration below. OS-100 Coils equal 50 gpd with the *OS-III* system.

OS-100 Coil Detail:



The OS-100 OSCAR coil contains 100 0.42 gph Netafim emitters in a 50 sq. ft. foot print. Emitter concentration is 2 emitters per sq. ft. Design flow for each OS-100 is 50 gpd.

OSCAR-III Cover Options.

There may be a desire to cover the OSCAR with something additional to the specified ASTM C-33 sand. Options include:

- landscaping jute mat with grass seed or ground cover plantings
- a thin layer of mineral soil low in organic content (<10% organics)

Do Not Cover Sand with:

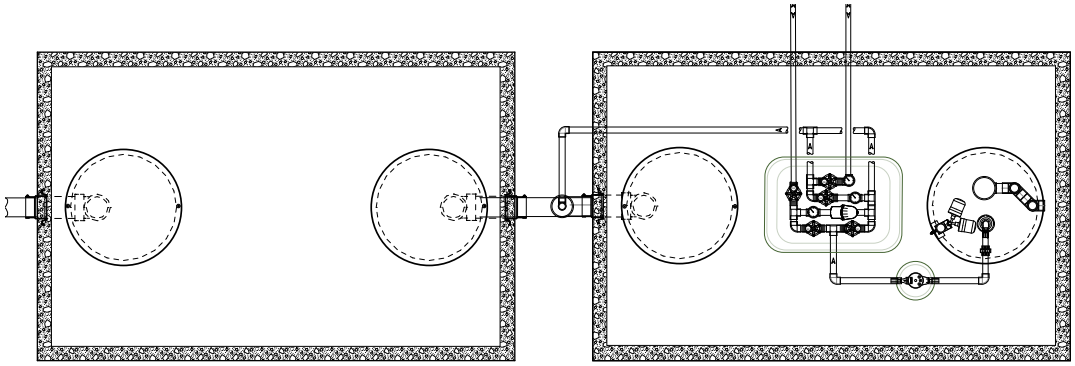
- organic mix (manufactured top soil from compost)
- filter fabric

The intent is not to have too much additional cover over the final sand layer. Placing too much cover will inhibit plant root growth. Because the sand is sub-surface irrigated, grass and other ground cover will grow rapidly, forming a firm protective cover over the OSCAR-III. At the end of the first growing season the sand layer will be as firm as native soil to walk on.

On a standard mound system, where soil cover is required, the soil cap can dry out in the summer months requiring additional irrigation to maintain vegetative cover.

Cold Weather Options.

In colder climates (eastern Washington) it may be necessary to prevent freezing in the *OSCAR-III* headworks. This is especially true with vacation homes where the houses are vacant in the winter and all power is turned off. In these situations Lowridge recommends allowing the internal portion of the HWN-.7-RF headworks to drain between doses. Install the “King Fitting” as shown on the cold weather tank diagrams.



PLAN VIEW

Reverse Flush Headsdworks Installation Instructions

The reverse flush headworks can be used in cold weather and non-cold weather applications. In cold weather applications use the cold weather adapter. In non cold weather applications use the cap.

Cold weather adapter **Non-cold weather**

The standard reverse flush headworks comes assembled to allow for easy conversion to a cold weather option or non-cold weather option.

Cold Weather

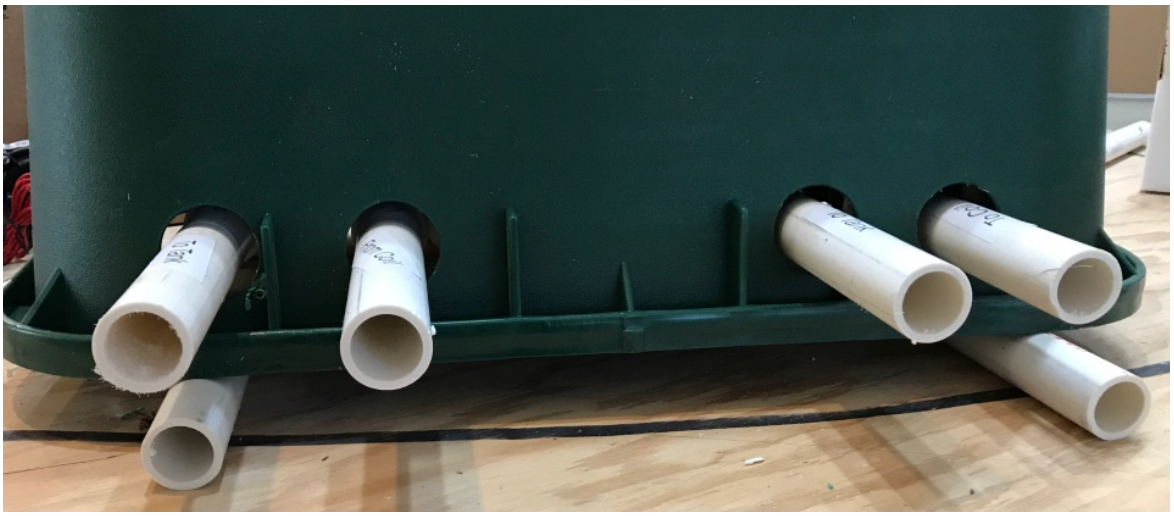
To convert to a cold weather application install the cold weather adapter as shown below.

Cold weather adapter

Glue tail pieces “A, B, C, & B” to their corresponding positions. Do not glue “D” yet.

Place headworks inside box in pre-drilled holes. Then glue tail piece “D”. Replace bottom on headworks.

Turn headworks right side up on top of tank. Place two 1” spacer pipes under headworks as shown. Place some soil around spacer pipes to stabilize.



Use the 1” St El 90s and tee to connect both “B” tail pieces together. Connect this pipe to the 4”x1” tee on the inlet side of the settling tank. Make sure the two “B” tail pieces drain back to the inlet pipe.

Non-cold weather option

Glue “Cap” on tee and plumb the rest of the headworks as in installation instructions.