





# **BMP DE 101:** Passive Water Treatment – Lay-Flat Hose Lactate Dispenser Using ChitoVan<sup>™</sup> Brand Lactate Cartridges

**Purpose:** To protect construction site water quality by treating sediment-contaminated stormwater passively using a *Lay-Flat Hose Dispenser* with ChitoVan<sup>TM</sup> cartridges.

#### **Conditions of Use**

Controlling soil erosion and sediment loss from sites under development using traditional BMPs may not be adequate to ensure compliance with water quality standards for turbidity. Passive water treatment with chitosan lactate will cause the coagulation of fine sediment particles so that the water may subsequently be gravity settled in a tank or pond.

Chitosan lactate is environmentally safe and worker friendly – however, a comprehensive plan<sup>1</sup> for use should be developed prior to construction and local and state regulatory personnel should be given access to the plan. In some states regulatory approval may have to be obtained before this BMP can be implemented.



<sup>&</sup>lt;sup>1</sup> See Dungeness Environmental's *Treatment Plan Template*.





#### **Background Information**

Traditional BMPs attempt to protect water quality by minimizing sedimentation. With diligent application and maintenance of these sedimentation BMPs and with a properly-sized stormwater detention basin, it is still difficult to meet ever more stringent water quality standards. Many states are revising their construction stormwater NPDES permits to include turbidity thresholds, benchmarks and numeric limits. To meet these new standards something more than sedimentation BMPs is required.



Sediment particles remain suspended in water because of their extremely small size and their static electric charge. This static charge causes the particles to repel one another, preventing agglomeration from naturally occurring. Passive dosing with ChitoVan<sup>™</sup> accomplishes the critical step of coagulating these sediment particles, allowing them to be settled by gravity or filtered from the water.







## **Treatment Process Description**

- 1. Unroll the lay-flat passive treatment hose.
- 2. Install one or two ChitoVan<sup>™</sup> cartridges in the lay-flat hose (attach the cartridge handle to the anchor bolts installed through the camloc fittings).
- 3. Connect the passive treatment assembly above to a pump (limit treatment flow rate to less than 300 gpm for best results).
- 4. Connect the discharge of the passive treatment assembly to at least 50-feet of hose (to promote proper mixing).
- 5. The 50-foot hose can be connected to a dewatering filter bag, a settling pond, settling tank, or it may be connected to a biofiltration dispersal system.





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# **BMP DE 102:** Passive Water Treatment with Gravity Settling

Using ChitoVan<sup>™</sup> Brand Lactate Cartridges

**Purpose:** To protect construction site storm water quality by treating sediment-contaminated stormwater passively with chitosan lactate and gravity settling.

#### **Conditions of Use**

Controlling soil erosion and sediment loss from sites under development using traditional BMPs may not be adequate to ensure compliance with water quality standards for turbidity. Passive water treatment with chitosan lactate will cause the coagulation of fine sediment particles so that the water may subsequently be gravity settled in a tank or pond.

ChitoVan<sup>TM</sup> is environmentally safe and worker friendly – however, a comprehensive plan<sup>1</sup> for use should be developed prior to construction and local and state regulatory personnel should be given access to the plan. In some states regulatory approval may have to be obtained before this BMP can be implemented.



BMP DE 102 Passive Water Treatment with Gravity Settling



<sup>&</sup>lt;sup>1</sup> See Dungeness Environmental's *Treatment Plan Template*.



#### **Design and Installation Specifications**



#### **Background Information**

Traditional BMPs attempt to protect water quality by minimizing sedimentation. With diligent application and maintenance of these sedimentation BMPs and with a properly-sized stormwater detention basin, it is still difficult to meet ever more stringent water quality standards. Many states are revising their construction stormwater NPDES permits to include turbidity thresholds, benchmarks and numeric limits. To meet these new standards something more than sedimentation BMPs is required.

Sediment particles remain suspended in water because of their extremely small size and



their static electric charge. This static charge causes the particles to repel one another, preventing agglomeration from naturally occurring. Passive Dosing with ChitoVan<sup>™</sup> cartridges accomplishes the critical step of coagulating the very small sediment particles so that they may be settled by gravity or filtered from the water.

| Why is dirty water bad for the environment?<br>Relationship of suspended solids to fish health |  |  |
|--|--|--|
| Suspended solids (ppm)   | Effect on fisheries                              |  |
| < 25   | No harmful effects on fish                       |  |
| 25-80  | Good to moderate fisheries but diminished yields |  |
| 80-400   | Unlikely to support good fisheries               |  |
| > 400  | Only poor fisheries are likely                   |  |

BMP DE 102 Passive Water Treatment with Gravity Settling





## **Treatment Process Description**

- 1. Unroll the lay-flat passive treatment hose.
- 2. Install one or two ChitoVan<sup>™</sup> cartridges in the lay-flat hose (attach the cartridge handle to the anchor bolts installed through the Cam-Loc fittings).



- 3. Connect the passive treatment assembly above to a pump (limit treatment flow rate to less than 300 gpm for best results).
- 4. Connect the discharge of the passive treatment assembly to at least 50-feet of hose (to promote proper mixing).
- 5. Connect the 50-foot hose can be connected to a settling tank(s).





# Diagram of a typical set up:





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BMP DE 102 Passive Water Treatment with Gravity Settling



# **BMP DE 103: Passive Water Treatment with Gravity** Settling followed by Biofiltration

Using ChitoVan<sup>™</sup> Brand Lactate Cartridges



**Purpose:** To protect construction site storm water quality by treating sediment-contaminated stormwater passively with chitosan lactate followed by biofiltration.

## Conditions of Use

Controlling soil erosion and sediment loss from sites under development using traditional BMPs may not be adequate to ensure compliance with water quality standards for turbidity. Passive water treatment with chitosan lactate will cause the coagulation of fine sediment particles so that the water may subsequently be gravity settled in a tank or pond.

ChitoVan<sup>TM</sup> is environmentally safe and worker friendly – however, a comprehensive plan<sup>1</sup> for use should be developed prior to construction and local and state regulatory personnel should be given access to the plan. In some states regulatory approval may have to be obtained before this BMP can be implemented.







#### **Background Information**



(425) 481-0600

Traditional BMPs attempt to protect water quality by minimizing sedimentation. With diligent application and maintenance of these sedimentation BMPs and with a properly-sized stormwater detention basin, it is still difficult to meet ever more stringent water quality standards. Many states are revising their construction stormwater NPDES permits to include turbidity thresholds, benchmarks and numeric limits. To meet these new standards something more than sedimentation BMPs is required.

Sediment particles remain suspended in water because of their extremely small size and



their static electric charge. This static charge causes the particles to repel one another, preventing agglomeration from naturally occurring. Passive Dosing with ChitoVan<sup>™</sup> cartridges accomplishes the critical step of coagulating the very small sediment particles so that they may be settled by gravity or filtered from the water.

| Why is dirty water bad for the environment?<br>Relationship of suspended solids to fish health |  |  |
|--|--|--|
| Suspended solids (ppm)   | Effect on fisheries                              |  |
| < 25   | No harmful effects on fish                       |  |
| 25-80  | Good to moderate fisheries but diminished yields |  |
| 80-400   | Unlikely to support good fisheries               |  |
| > 400  | Only poor fisheries are likely                   |  |



BMP DE 103 Passive Stormwater Treatment with Gravity Settling followed by Biofiltration www.dungenessenviro.com



# Equipment List

- Pump (2-inch, 3-inch, or 4-inch)
- Suction Hose (floating suction unit recommended)
- Lay-Flat Hose Assembly
- ChitoVan<sup>™</sup> cartridges
- 50-feet discharge hose
- Perforated pipe (1 foot of pipe for each gpm of output)
- Fittings as required

#### **Treatment Process Description**

- 1. Unroll the lay-flat passive treatment hose.
- 2. Install one or two ChitoVan<sup>™</sup> Lactate Cartridges in the lay-flat hose (attach the cartridge handle to the anchor bolts installed through the Cam-Loc fittings).



- 3. Connect the passive treatment assembly above to a pump (limit treatment flow rate to less than 300 gpm for best results).
- 4. Connect the discharge of the passive treatment assembly to at least 50-feet of hose (to promote proper mixing).
- 5. Deploy the perforated dispersal pipe in vegetated area (keep on grade if possible)
- 6. Connect the 50-foot hose to the perforated pipe used for biofiltration.



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# BMP DE 104: Passive Pond Recirculation Treatment

Using ChitoVan<sup>™</sup> Brand Lactate Cartridges

**Purpose:** To protect construction site storm water quality by treating sediment-contaminated stormwater passively with ChitoVan<sup>TM</sup> cartridges and pond recirculation.

#### **Conditions of Use**

Controlling soil erosion and sediment loss from sites under development using traditional BMPs may not be adequate to ensure compliance with water quality standards for turbidity. Passive water treatment with chitosan lactate will cause the coagulation of fine sediment particles so that the water may subsequently be gravity settled in a tank or pond.

ChitoVan<sup>TM</sup> is environmentally safe and worker friendly – however, a comprehensive plan<sup>1</sup> for use should be developed prior to construction and local and state regulatory personnel should be given access to the plan. In some states regulatory approval may have to be obtained before this BMP can be implemented.



<sup>&</sup>lt;sup>1</sup> See Dungeness Environmental's *Treatment Plan Template*.

BMP DE 104 Passive Stormwater Treatment with Pond Recircuation



#### **Background Information**

Traditional BMPs attempt to protect water quality by minimizing sedimentation. With diligent application and

maintenance of these sedimentation BMPs and with a properly-sized stormwater detention basin, it is still difficult to meet ever more stringent water quality standards. Many states are revising their construction stormwater NPDES permits to include turbidity thresholds, benchmarks and numeric limits. To meet these new standards something more than sedimentation BMPs is required.



Sediment particles remain suspended in water because of their extremely small size and their static electric charge. This static charge causes the particles to repel one another, preventing agglomeration from naturally occurring. Passive Dosing with ChitoVan<sup>™</sup> cartridges accomplishes the critical step of coagulating the very small sediment

particles so that they may be settled by gravity or filtered from the water.

| Why is dirty water bad for the environment?<br>Relationship of suspended solids to fish health |  |  |
|--|--|--|
| Suspended solids (ppm)   | Effect on fisheries                              |  |
| < 25   | No harmful effects on fish                       |  |
| 25-80  | Good to moderate fisheries but diminished yields |  |
| 80-400   | Unlikely to support good fisheries               |  |
| > 400  | Only poor fisheries are likely                   |  |



(425) 481-0600

BMP DE 104 Passive Stormwater Treatment with Pond Recircuation



#### **Treatment Process Description**

- 1. Unroll the lay-flat passive treatment hose.
- 2. Install one or two ChitoVan<sup>™</sup> Lactate Cartridges in the lay-flat hose (attach the cartridge handle to the anchor bolts installed through the Cam-Loc fittings).



- 3. Connect the passive treatment assembly above to a pump (limit treatment flow rate to less than 300 gpm for best results).
- 4. Connect the discharge of the passive treatment assembly to at least 50-feet of hose (to promote proper mixing).
- 5. Connect the 50-foot hose to the other side of the detention basin.



BMP DE 104 Passive Stormwater Treatment with Pond Recircuation





# BMP DE 105: Passive ChitoVan<sup>™</sup> Treatment on Check Dams

Using ChitoVanTM Brand Lactate Cartridges

**Purpose:** To protect construction site storm water quality by treating sediment-contaminated stormwater passively with ChitoVan<sup>™</sup> cartridges attached to the downstream spill way of check dams.

#### Conditions of Use

Controlling soil erosion and sediment loss from sites under development using traditional BMPs may not be adequate to ensure compliance with water quality standards for turbidity. Passive water treatment with chitosan lactate will cause the coagulation of fine sediment particles so that the water may subsequently be gravity settled in a tank or pond.

ChitoVan<sup>™</sup> is environmentally safe and worker friendly – however, a comprehensive plan<sup>1</sup> for use should be developed prior to construction and local and state regulatory personnel should be given access to the plan. In some states regulatory approval may have to be obtained before this BMP can be implemented.



Note: not to Scale





<sup>&</sup>lt;sup>1</sup> See Dungeness Environmental's *Treatment Plan Template*.





#### **Background Information**

Traditional BMPs attempt to protect water quality by minimizing sedimentation. With diligent application and maintenance of these sedimentation BMPs and with a properly-sized stormwater detention basin, it is still difficult to meet ever more stringent water quality standards. Many states are revising their construction stormwater NPDES permits to include turbidity thresholds, benchmarks and numeric limits. To meet these new standards something more than sedimentation BMPs is required.

Sediment particles remain suspended in water because of their extremely small size and



their static electric charge. This static charge causes the particles to repel one another, preventing agglomeration from naturally occurring. Passive Dosing with ChitoVan<sup>™</sup> cartridges accomplishes the critical step of coagulating the very small sediment particles so that they may be settled by gravity or filtered from the water.

| Why is dirty water bad for the environment?<br>Relationship of suspended solids to fish health |  |  |
|--|--|--|
| Suspended solids (ppm)   | Effect on fisheries                              |  |
| < 25   | No harmful effects on fish                       |  |
| 25-80  | Good to moderate fisheries but diminished yields |  |
| 80-400   | Unlikely to support good fisheries               |  |
| > 400  | Only poor fisheries are likely                   |  |



BMP DE 105 Passive Stormwater Treatment Using Check Dams







## **Treatment Process Description**

- 1. Attach one ChitoVan LC cartridge to the check dam so that when water is flowing over the dam spill way it comes into contact with the cartridge. More than one cartridge may be attached to each check dam and it may be necessary to use more than one check dam.
- 2. Cartridges are best attached to the check dam using the straps on both ends of the cartridge.

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BMP DE 105 Passive Stormwater Treatment Using Check Dams



# BMP DE 106: Passive Treatment with Filtration through Dewatering/Dispersal Tubes/Bags

Using ChitoVan<sup>™</sup> Brand Chitosan Lactate Cartridges

**Purpose:** To protect construction site storm water quality by treating sediment-contaminated stormwater passively with ChitoVan<sup>TM</sup> cartridges, then filtering the treated water through dewatering/dispersal tubes or bags.

# Conditions of Use

Traditional BMPs used to control soil erosion and sediment loss from sites under development may not be adequate to ensure compliance with water quality standards for turbidity. This BMP has 3 steps:

- 1.) Pump turbid water through pipe or lay-flat hose containing ChitoVan<sup>™</sup> cartridge(s).
- 2.) Convey this treated water to a settling tank with a floating suction boom.
- 3.) Once the sediment has settled drain the tank through one or more dewatering/dispersal tubes or bags.

The dewatering/dispersal tube is a non-woven geotextile filter designed to work on chitosantreated gravity flows from a tank. Tube dimensions are 12"-diameter by 50 feet in length (tubes may be linked together to increase the length. The tube not only filters – it also disperses treated water evenly over significant distances which is important when discharging to vegetated areas. The tubes may also be laid on the side walk and allowed to drain to storm drains in urban construction where no vegetation exists. Dewatering bags may be substituted for the tubes but filling them with gravity flows is still recommended. Pumping into a tube or a bag will drastically shorten the life of the filter.

ChitoVan<sup>™</sup> is environmentally safe and worker friendly – however, a comprehensive plan<sup>1</sup> for use should be developed prior to construction and local and state regulatory personnel should be given access to the plan. In some states regulatory approval may have to be obtained before this BMP can be implemented.



<sup>&</sup>lt;sup>1</sup> See Dungeness Environmental's *Treatment Plan Template*.





#### **Background Information**

Traditional BMPs attempt to protect water quality by minimizing sedimentation. With diligent application and maintenance of these sedimentation BMPs and with a properly-sized stormwater detention basin, it is still difficult to meet ever more stringent water quality standards. Many states are revising their construction stormwater NPDES permits to include turbidity thresholds, benchmarks and numeric limits. To meet these new standards something more than sedimentation BMPs is required.

Sediment particles remain suspended in water because of their extremely small size and



their static electric charge. This static charge causes the particles to repel one another, preventing agglomeration from naturally occurring. Passive Dosing with ChitoVan<sup>™</sup> cartridges accomplishes the critical step of coagulating the very small sediment particles so that they may be settled by gravity or filtered from the water.

| Why is dirty water bad for the environment?<br>Relationship of suspended solids to fish health |  |  |
|--|--|--|
| Suspended solids (ppm)   | Effect on fisheries                              |  |
| < 25   | No harmful effects on fish                       |  |
| 25-80  | Good to moderate fisheries but diminished yields |  |
| 80-400   | Unlikely to support good fisheries               |  |
| > 400  | Only poor fisheries are likely                   |  |



BMP DE 106 Passive Stormwater Treatment – Dewatering Tubes/Bags



### **Treatment Process Description**

- Set up a 6" lay-flat hose (15 feet long) or 6" diameter pipe and install one or two ChitoVan<sup>™</sup> cartridges.
- 2. Connect the ChitoVan<sup>™</sup> cartridge set-up to a pump and pump turbid water to a settling tank.
- 3. Fill tank and allow sediment to settle.
- 4. Discharge treated water to dewatering tube(s) or dewatering bag(s) using gravity flows.
- 5. For best results place dewatering tubes or bags on vegetated areas draining away from construction areas.



Note: diagrams are not to Scale



2222

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Treatment Tank 21,000 gal.

100' 12" diameter dewatering/dispersing tube (10 gpm per tube) 7,200 gallons per 12 hours

3 Tubes will treat 22,000 per 12 hours

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BMP DE 106 Passive Stormwater Treatment – Dewatering Tubes/Bags





# BMP DE 107: Passive Water Treatment with Trough (Channel) Dosing/Gravity Settling

Using ChitoVan<sup>™</sup> Brand Chitosan Lactate Cartridges

**Purpose:** To protect construction site water quality by treating sediment-contaminated stormwater passively using a *Lay-Flat Hose Dispenser* with ChitoVan<sup>TM</sup> cartridges.

# Conditions of Use

Controlling soil erosion and sediment loss from sites under development using traditional BMPs may not be adequate to ensure compliance with water quality standards for turbidity. Passive water treatment with chitosan lactate will cause the coagulation of fine sediment particles so that the water may subsequently be gravity settled in a tank or pond.

ChitoVan<sup>™</sup> is environmentally safe and worker friendly – however, a comprehensive plan<sup>1</sup> for use should be developed prior to construction and local and state regulatory personnel should be given access to the plan. In some states regulatory approval may have to be obtained before this BMP can be implemented.



# ChitoVan LC Cartridge Trough (side view)

<sup>&</sup>lt;sup>1</sup> See Dungeness Environmental's *Treatment Plan Template*.

BMP DE 107 Passive Stormwater Treatment with Trough (Channel) Dosing www.dungenessenviro.com





#### **Background Information**

Traditional BMPs attempt to protect water quality by minimizing sedimentation. With diligent application and maintenance of these sedimentation BMPs and with a properly-sized stormwater detention basin, it is still difficult to meet ever more stringent water quality standards. Many states are revising their construction stormwater NPDES permits to include turbidity thresholds, benchmarks and numeric limits. To meet these new standards something more than sedimentation BMPs is required.

Sediment particles remain suspended in water because of their extremely small size and



their static electric charge. This static charge causes the particles to repel one another, preventing agglomeration from naturally occurring. Passive Dosing with ChitoVan<sup>™</sup> cartridges accomplishes the critical step of coagulating the very small sediment particles so that they may be settled by gravity or filtered from the water.

| Why is dirty water bad for the environment?<br>Relationship of suspended solids to fish health |  |  |
|--|--|--|
| Suspended solids (ppm)   | Effect on fisheries                              |  |
| < 25   | No harmful effects on fish                       |  |
| 25-80  | Good to moderate fisheries but diminished yields |  |
| 80-400   | Unlikely to support good fisheries               |  |
| > 400  | Only poor fisheries are likely                   |  |

BMP DE 107 Passive Stormwater Treatment with Trough (Channel) Dosing www.dungenessenviro.com





**Object of the BMP:** The ChitoVan LC Cartridge is an ideal passive dosing technology but, it needs to be placed in rapidly flowing water in order to release the chitosan and treat the water. The Channel was designed to increase the velocity of the water and to create turbulence. One or more ChitoVan Cartridges are anchored in the Channel and then the water is pumped through it. The Channel can be mounted on top of a tank or it can be on the ground discharging into a settling basin.

# **Treatment Process Description**

- 1. Attach the Channel to the top of the tank using the metal supports.
- 2. Install one to four ChitoVan<sup>™</sup> Lactate Cartridges in the Channel they can be connected to the hooks in the Channel using carabineers.
- 3. Connect the discharge of the pump to the quick connect fitting on the high end of the Channel.
- 4. Connect the discharge header from the end of the Channel down into the settling tank.
- 5. Connect the discharge piping to your point of discharge (it is recommended that the discharge water be dispersed in a biofilter, grass swale, additional settling basin, dewatering bag, etc.
- 6. Begin pumping turbid water to the channel (50-200 gpm).
- When the tank is full and beginning to flow out of the discharge, stop the system for 30 minutes then continue pumping. This system can also be used in a batch mode for low treatment volumes.



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