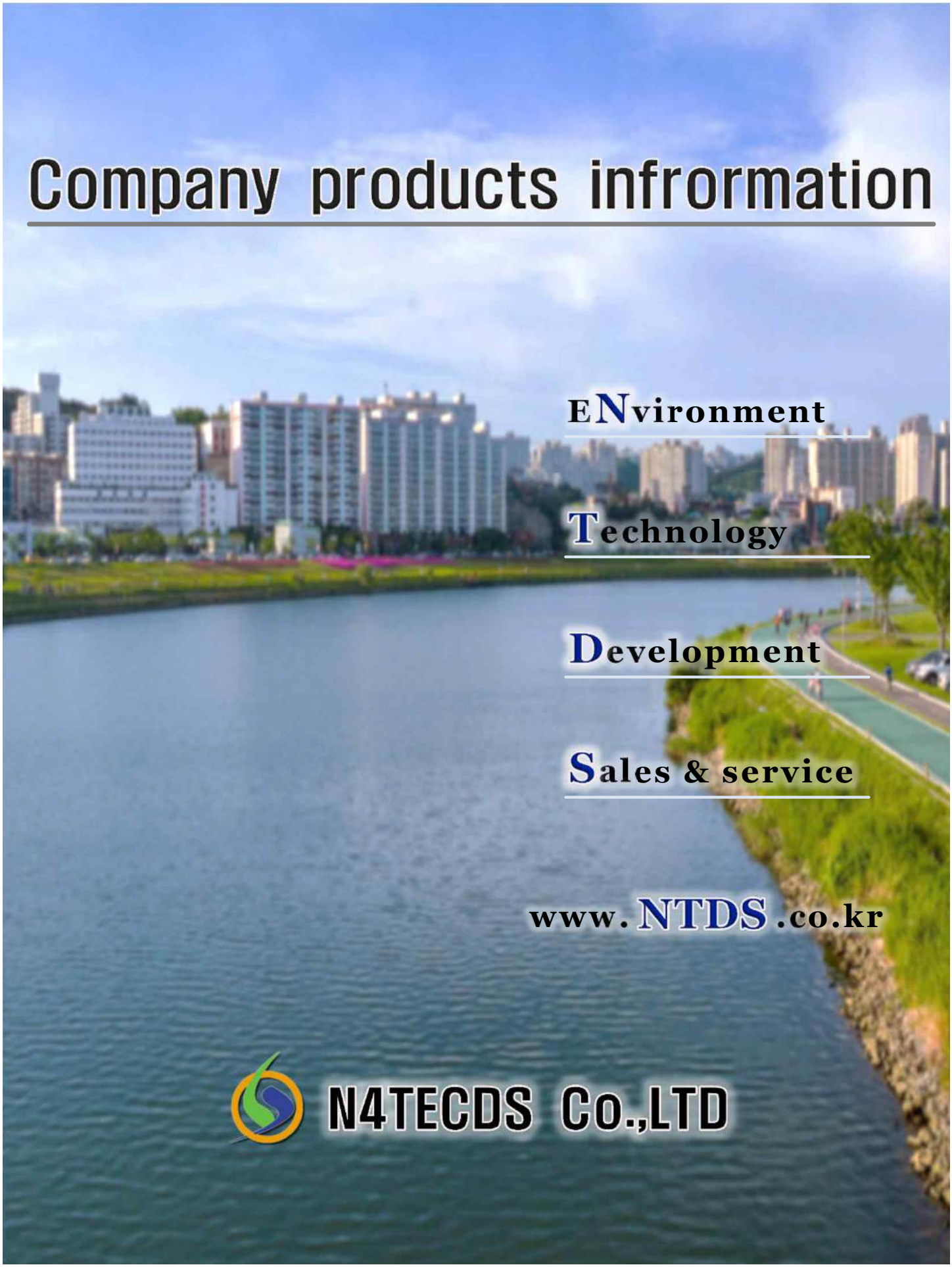
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ENvironment
Technology
Development
Sales & service
www.NTDS.co.kr
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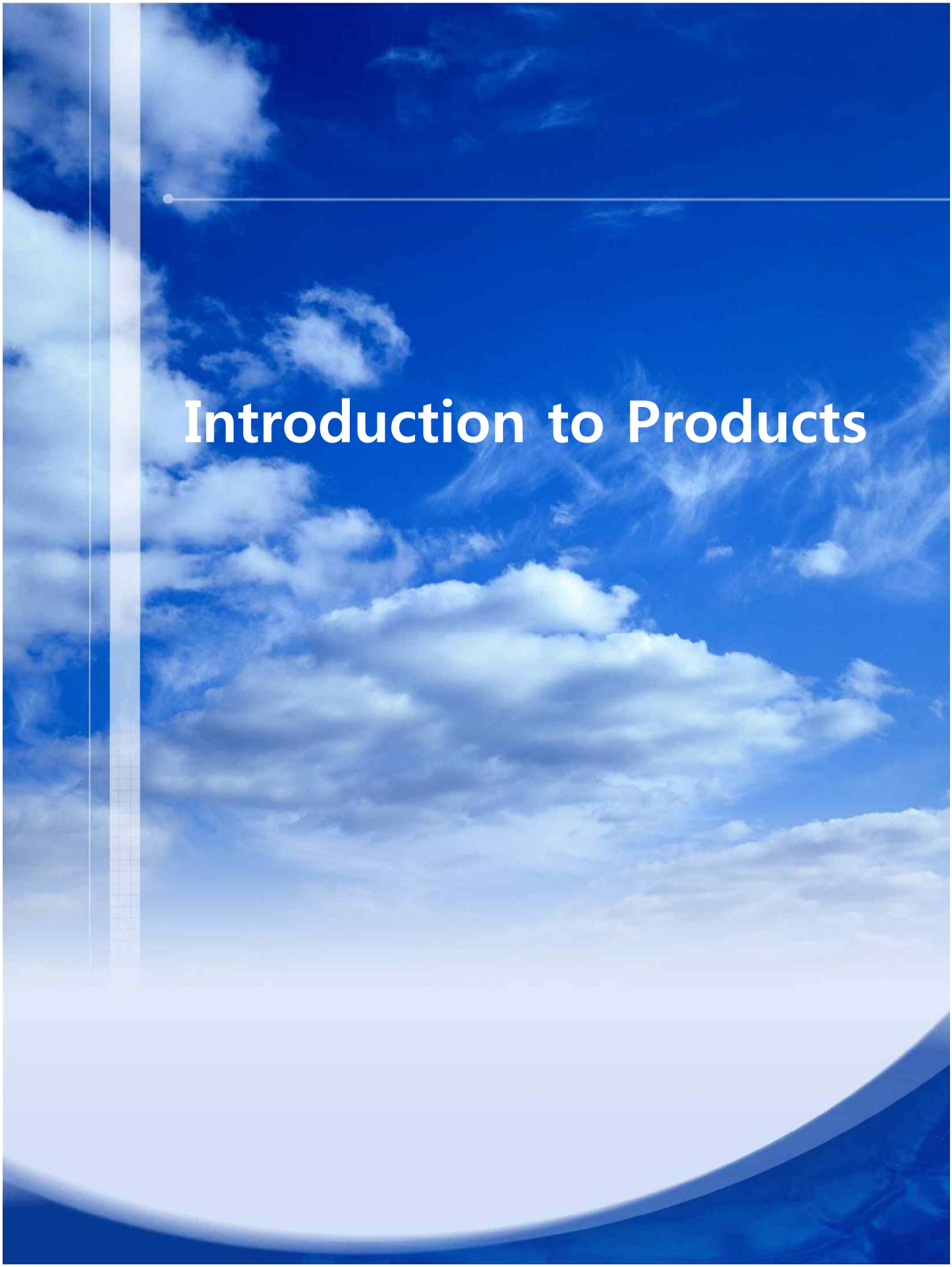
Dreaming of clean water environment as blue sky …


Introduction to Products

The Best Water resources
& Environmental Company
On 21C Global Network

1. Nonpoint Source Reduction Facility

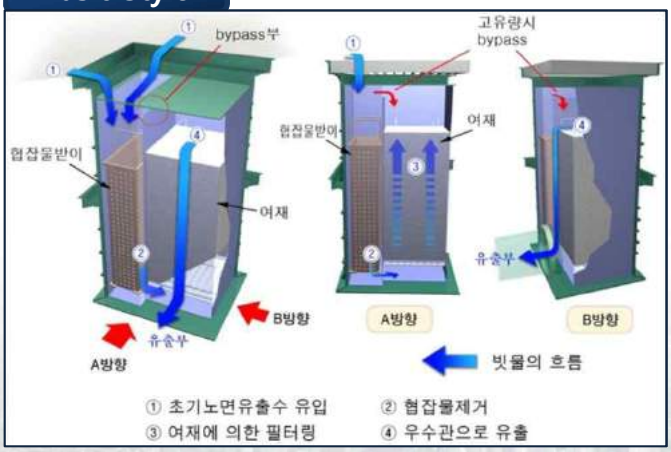
1) Device-type Facility (Eco-Cab)

◈ Non-point Source Reduction Facility Using the EPP Filter Medium

Processing Technique	• Gravity Precipitation(remove great specific gravity contaminants) + Upflow Filtration Method
Decontamination	• SS, COD, T-N, T-P, PAHs(hydrophobic filter medium characteristics), 200~300μm Microparticle and heavy metal treatment
Type of Filter Medium	• Expanded Polypropylene(EPP)
Characteristics of Filter Medium	• Securing hydrophobic, floating, and liquidity with with unformatted shape and surface fine micro-air structure

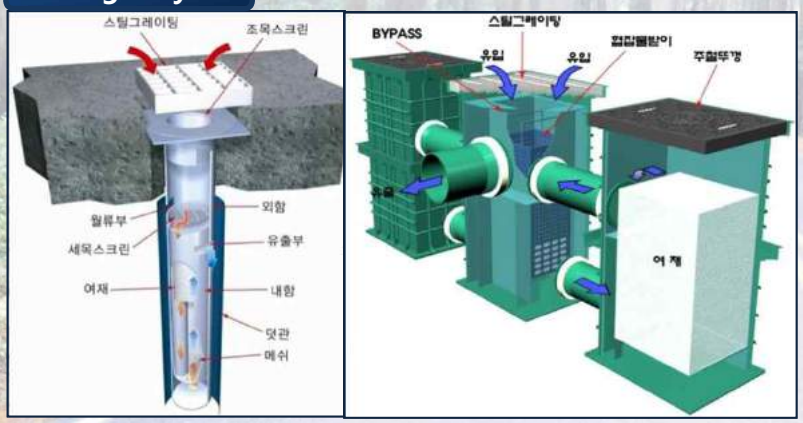
◈ Method of the Various Application of Nonpoint Source Reduction Facilities

Basic Style

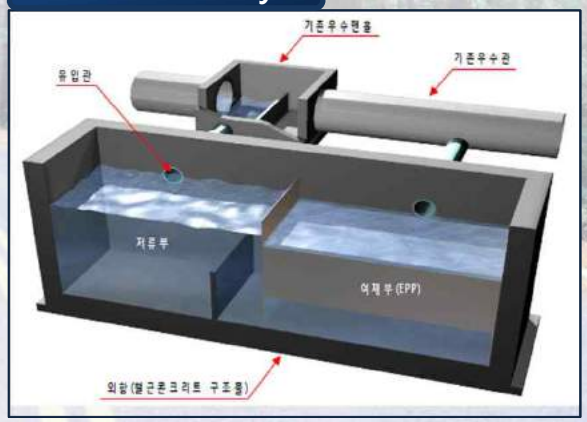


Device Style

Bridge Style



Concentrated Style



◈ EPP(Expanded Polypropylene) Filter Media

Existing media : Natural material, Sand, Anthracite, etc.

Particle properties : floatable & crushed

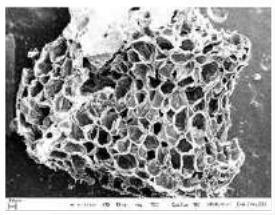
- excellent in removing pollutants
- high linear speed operation possible
- Less clogging
- Large surface area of media

Material properties : polymer

- excellent workability
- easy to maintain
- easy field application
- hydrophobic contaminant removal

Floating Crushed polymer media

- Material selection : polypropylene
  - → non-toxic & low chemical reactivity
- floatable → bed foaming



EPP media

◈ Throughput Efficiency

◎ Standard of Throughput Efficiency (DoE, in KOREA)

· Device type(Filter Type) : TSS Elimination Efficiency
= 80% /year

TSS Elimination Efficiency → over 85% per year

[Influent Water]

[Treated Boiler Feed Water]

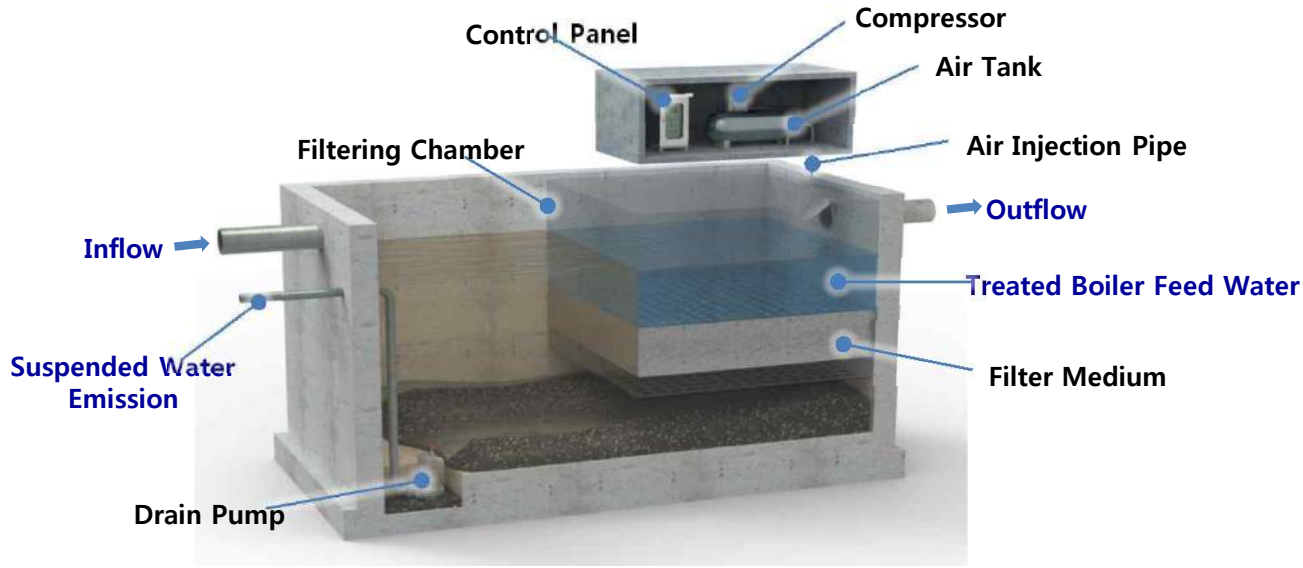
[Test Report by KICT]

Items		원수* (평균 농도)	처리수 (평균 농도)	처리 효율
COD		102.0 mg/L	34.0 mg/L	66.7%
SS		95.9 mg/L	8.0 mg/L	91.7%
T-N		-	-	-
T-P		0.65 mg/L	0.25 mg/L	61.5%
중금속	Pb	0.058 mg/L	0.004 mg/L	93.1%
	Cr	0.021 mg/L	0.002 mg/L	90.5%
	Cu	0.054 mg/L	0.001 mg/L	98.1%
	Zn	0.300 mg/L	0.06 mg/L	80.4%
PAHs	Fluorene	0.21 μg/L	0.08 μg/L	61.9%
	Phenanthrene	0.61 μg/L	0.14 μg/L	77.0%
	Anthracene	0.65 μg/L	0.12 μg/L	81.5%
	Fluoranthene	1.47 μg/L	0.27 μg/L	81.6%
	Pyrene	1.40 μg/L	0.26 μg/L	81.4%
	Benz[a]anthracene	0.49 μg/L	0.20 μg/L	59.2%
	Chrysene	0.83 μg/L	0.26 μg/L	68.7%
	Benzo[b]fluoranthene	1.30 μg/L	0.20 μg/L	84.6%
	Benzo[K]fluoranthene	1.02 μg/L	0.18 μg/L	82.4%
유분		-	-	흡유량(g/g) : 2.4

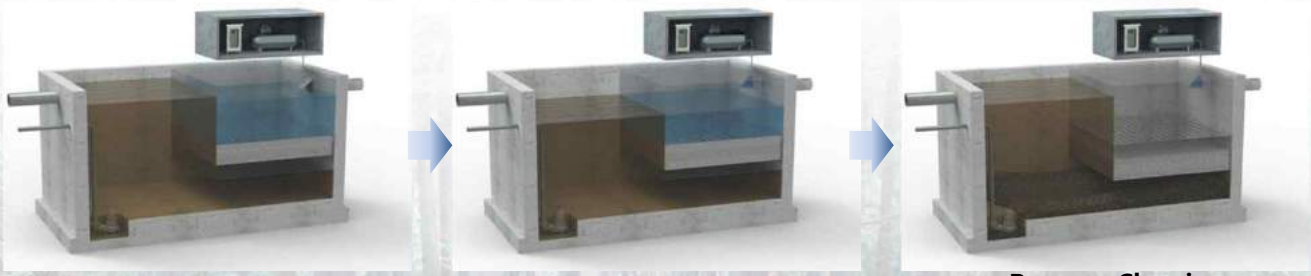
* 원수는 강우에 의해 발생된 도로면 유출수임.

◈ Non-point Source Reduction Facility (Eco-Cab)
with added to automatic reverse taxing

- **Reverse Cleaning System Using Compressed Air (Eco-Cab)**



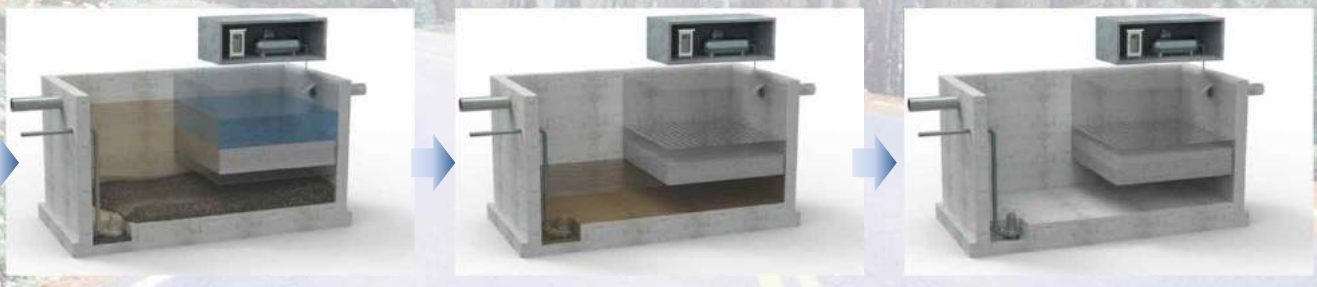
- **Operating Sequence**



Upflow Filtration in case of rain

Start Back Washing
After the end of the rainfall

Reverse Cleaning
by Compressed Air

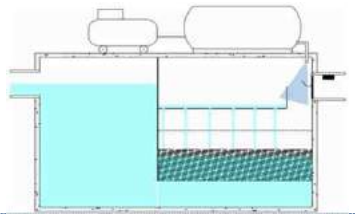
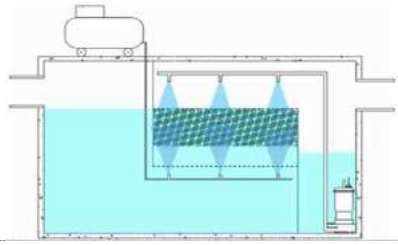


Reverse Cleaning Termination

Suspended Water Emission

Completion

● Reverse Cleaning System Using Compressed Air (Eco-Cab) – Compare with Basic System

	Eco-Cab System	Basic System
COMPOSITION		
	Compressor + Air Tank, Outflow Gate	Blower, Pump, Drain Pipe, Nozzle
FEATURE	● No plumbing required. ● Install a treatment tank at the top of the leftover and secure treatment water level for cleaning by placing a deviation from the drain. ● If compressed air is stopped, the level of the spare parts is restored, allowing additional backwater. ● Low power consumption enables solar cells to be utilized.	● The operation is complicated and the installation cost is high because the pipes for cleaning and cleaning are installed separately. ● The size of the structure is large by installing a separate treatment water tank at the rear of the spare part. ● The power usage of fans and pumps is high. ● Maintenance is complicated because many devices are needed.

● Features and Advantage

- Use High Efficiency Upflow Filter (EPP)
- Automatic Reverse Cleaning System Using Treated Water and Compressed Air
- Various models can be applied depending on the initial rainfall quantity
- High pollutant removal efficiency (excellent for simultaneous removal of both precipitation and suspended fine contaminants) → excellent in heavy metal removal efficiency and ability to absorb oil
- Reflective facilities that do not require filter replacement
- Very Low Maintenance Cost Processing System
- With reverse cleaning method using compressed air and treated water, separate reverse water bath, reverse pump, and constant water are unnecessary. (Excellent economy due to miniaturization of facilities)
- If installed in an area where power supply and demand is difficult, solar cells can be utilized because only power to the air compressor is secured.

◈ Application performance and construction pictures

Owner	Project name	Type	Num.(EA)
Hyundai Rotem	현대로템-배수종말비점오염원설치공사	집중형	2
Paldang water quality improvement headquarters, Gyeonggi-do	경안천 수질정화사업	수집형	2
Youngjin Corp.	평택 당진항 시멘트전용부두 조성사업	집중형	2
Gyeonggi-do road office	삼숭-회암 도로건설공사	집중형	4
Daesung development Corp.	홍천군 생활폐기물 소각시설 건설사업	집중형	1
Korea Hydro&Nuclear power	신월성 원자력 1,2호기 주설비공사	집중형	1
SK construction Corp.	SK케미칼연구소 신축공사	수집형	2
Busan·Jinhae free economic zone authority	의곡교차로~부산과학단지간 도로개설공사	개별형	55
Pocheon city hall	포천 동교3통-국지도 56호선간 도로확포장공사	수집형	4
ENF technology Corp.	ENF TECHNOLGY 아산 프로젝트 아산공장	집중형	1
Cntech. Korea	씨엔텍 코리아 증설공사	집중형	1
Gyeongsangnam-do office	경남혁신도시 서측진입교량 가설공사	집중형	5
Hyundai Samho heavy industries Corp.	서측안벽 매립 및 부지조성공사	집중형	2
⋮	⋮	⋮	⋮
Korea water resources	낙동강 하구둑 수문 증설공사	집중형 교량수집형	3 14

● Construction pictures of non-point reduction facilities

Basic Type

Existing M/H Insertion Type

Bridge Drain Insertion Type

Bridge Collection Type

◈ Application performance and construction pictures

Concentrated Type

[Installation of External Structure]

[Installation of External Structure]

[Complete Installation of Structure]

[Installation of Filter Medium]

[Installation of Filter Medium]

[Installation Completed]

Eco-Cab

[Excavation]

[Laying Drain Pit Laying]

[Installation of External Structure]

[Installation of Filter Medium]

[Installation of Flat Valve]

[Installation Completed]

1. Nonpoint pollution reduction facility

2) Natural type (Eco-Branch)

◈ Low impact development (LID) variety & design criteria

Form of reduction facility	Type of reduction facility	Size design criteria
Storage facilities	Storage basin	WQv
	Underground storage tank	
Artificial wetland	Ground surface flow wetland	
	Subsurface flow wetland	
Penetration facilities	Porous pavement	
	Penetration ditch	
	Penetration trench	
	Penetration lateral ditch	
	Infiltrating equipment, Infiltration street inlet	
Vegetational type facilities	Vegetation filter bed	WQF
	Vegetation waterway	
	Vegetation retention basin	WQv
	Wood Filter box	
	Plant cultivation pot	

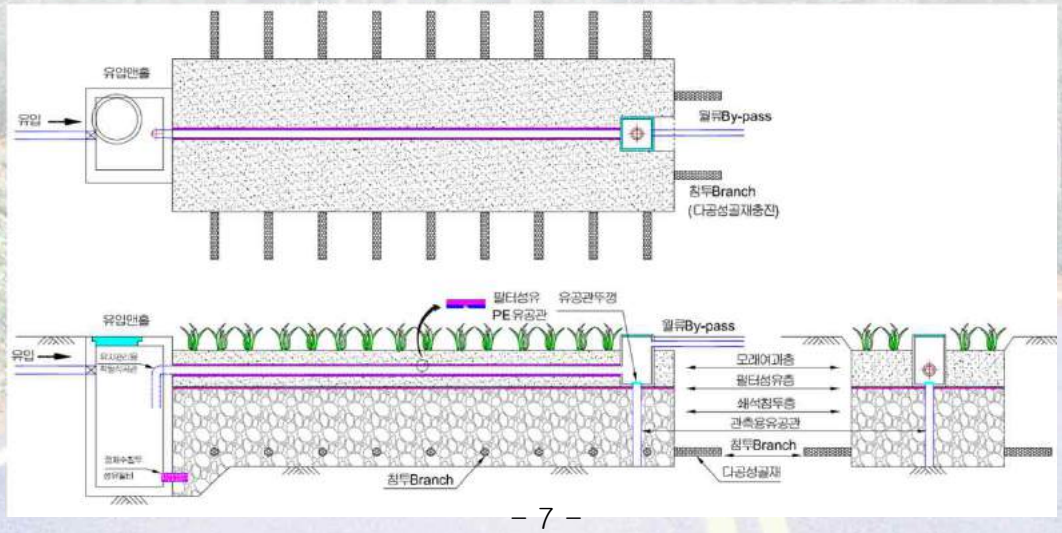
WQF
$CI \times A \times 10^{-3}$

CI : standard rainfall intensity(2.5mm/h)
A : processing target area(㎡)

WQv
$P1 \times A \times 10^{-3}$

P1 : depth of runoff converted from design storm(mm)
A : drainage area(㎡)

◈ mimetic diagram of Eco Branch



◈ Characteristics of Eco Branch

- Eco-friendly facility using natural drainage system
- It can use rented ground efficiently by installing in limited space.
- It can be installed in small required area compared with other technologies.
- Installation expense is inexpensive and low frequency of maintenance.
- Groundwater filling effect according to ground penetration
- Settling tank for maintainance of function

Processing principle

Runoff reduction effect

- soil infiltration
- adsorption
- evaporation

Reduction of pollution load

Captured in filter media,
Removal of pollutant
through soil remediation

Inflow (Q_{in}, C_{in})

- Soil infiltraion (Q_1, C_1)
  - Filtration and adsorption through soil iniltration
- Pass through filter media (Q_2, C_2)
  - First flush purification

Total amount of water pollution Discharge load(kg/day) reduction

$Q_{out}=Q_{in}-Q_1$

$C_{out}=(Q_1xC_1+Q_2xC_2)/(Q_1+Q_2)$

◈ application actual result and construction pictures –Jeonui general industrial complex (infiltraion ditch)

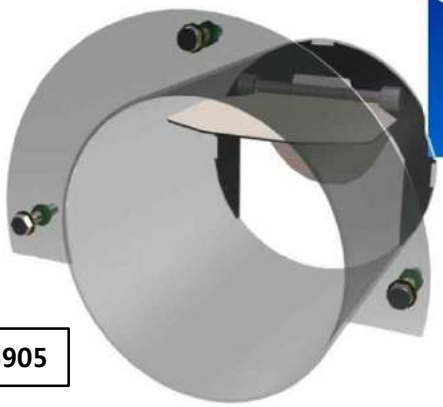


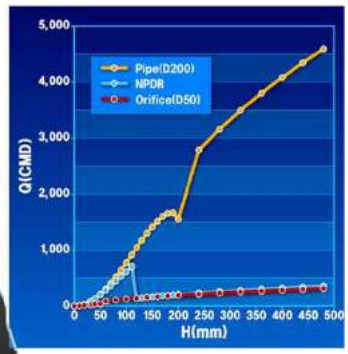



2. Combined Sewer Overflows (CSOs) improvement technology

1) Non-Power Discharge chamber Regulator (NPDR)

NPDR (Non-Power Discharge Regulator)





Patent #1185905

CSOs control effect

Cost-effective

Improvement of CSOs storm overflow chamber

◈ Characteristics of product

• developed technology from one of the next generation core environmental technology project「Developing discharge chamber and sewerage manhole modernization technology」by ministry of environment (patent #0615675)

• 50~95% cost effective compared to existing method because no extra cost of construction is required

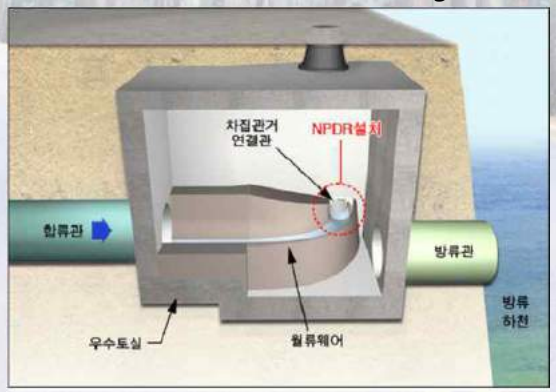
• selective collection of highly polluted first flush(CSOs) in initial rain

• it can change collection amount by regulating water level perception panel

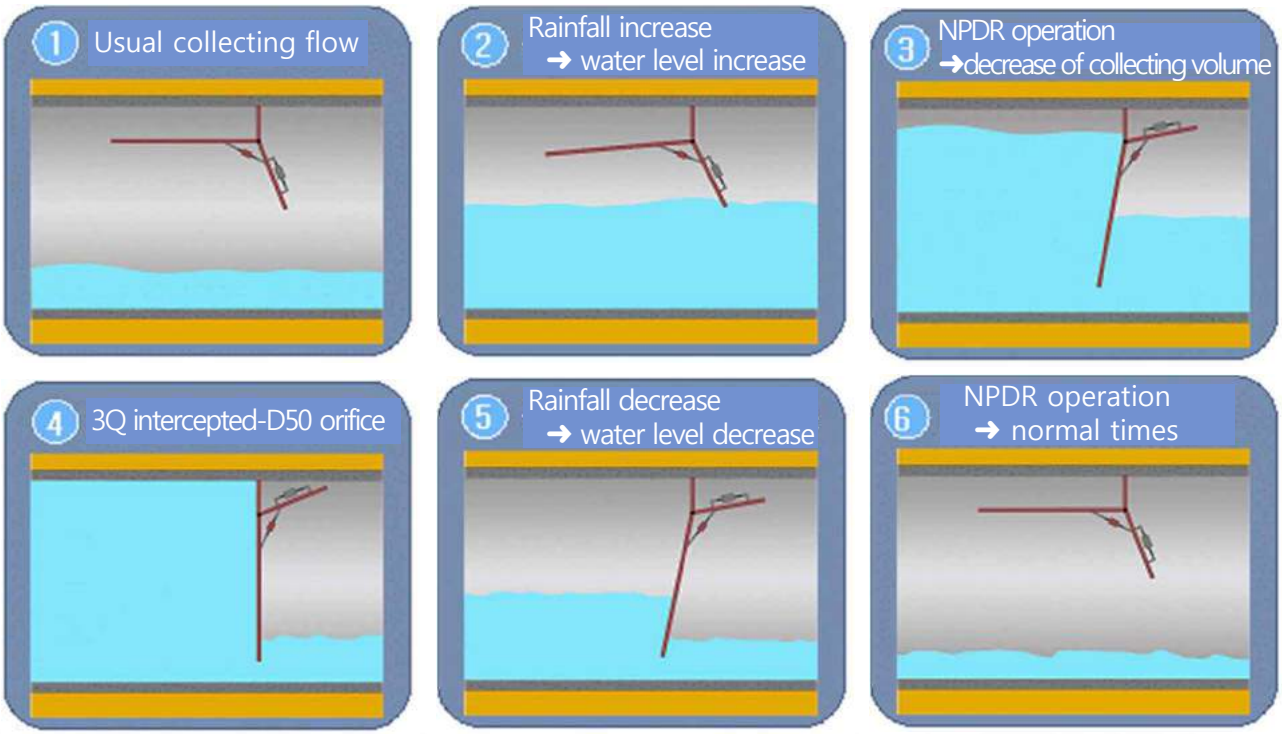
• customized product design according to various conditions and structures of discharge chamber and calculation of appropriate collection amount

• applicable switch sensor for easy maintenance

[NPDR installation mimetic diagram]



◈ NPDR (Non-Power Discharge chamber Regulator) operation principle



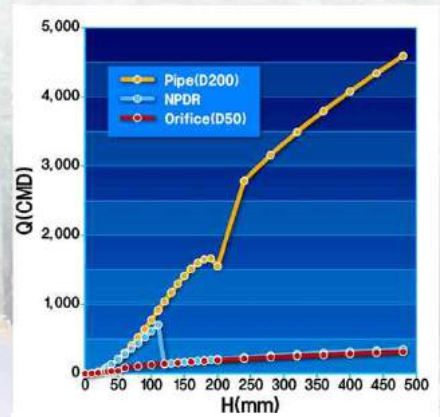
• In normal times, only usual collecting flow is collected.

• As the water level in discharge chamber is increased in rainfall, the gate reacts and closes. After rainfall, the gate is opened by the weight of balance plate as the water level is decreased.

• It is possible to collect first flush with high pollution load by closing after collecting to about 50~70% water level during rainfall. (see the hydraulic characteristic curve)

• By closing the gate, the initial rainfall with high pollution load is collected and 3 times of normally collecting volume(3Q) or design collection capacity is introduced into the intake pipe.

• Normally, the water level corresponding to about 50~70% of the collection joint pipe is accepted, the obstruction by the foreign matter can be prevented as much as possible.



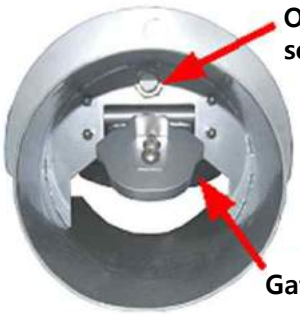
< NPDR hydraulic characteristic curve >

◈ Gate opening/closing state check device

• Gate opening and closing status can be verified by using a check machine from outside of storm overflow chamber.

• Confirm opening/closing status by using portable check machine from outside without going directly into the storm overflow chamber

• No need for power with principle of operation with small battery in check machine




Tie hole


Check machine

◈ Review of installation effects of storm overflow chamber discharge regulator

• Summary data of high flow occurrence date when bypass occurred at the treatment plant during rainfall

year	Initial inflow amount			bypass			BOD		
	average	Min.	Max.	average	Min.	Max.	average	Min.	Max.
2009 (before installation)	66,880	44,575	89,096	22,380	75	44,596	72.0	66.4	84.5
2010 (after installation)	59,599	44,963	83,738	15,099	463	39,238	102.1	96.0	108.3
2011 (after installation)	57,578	54,874	61,462	13,078	10,374	16,962	102.7	97.8	105.6

• Analysis : As compared to 2009, the average of initial inflow volume decreased by 14%, the untreated bypass volume decreased by 42%, BOD increased by 43%

◈ Application results of Non-Power Discharge chamber Regulator(NPDR)

- Discharge chamber improvement work for Byukjae eco-friendly business (32set)
- Goyang-si flow control device installation work(7set)
- Changneungcheon discharge chamber maintenance project(22set)
- Busan environment corporation intercepting flow control device installation work in discharge chamber(3set)
- Seongnam-si discharge chamber maintenance project
- Siheung-si discharge chamber maintenance project
- Installation of flow control device in Daegu Seongseo 5th advanced industrial complex
- Iljukjuksan public sewage treatment facility installation project in Anseong-si (flow control in discharge chamber)
- Discharge chamber maintenance project in Taebaek-si
- Saemangeum CSOs business(19set)
- sewage pipe maintenance BTL project in Tongyeong-si
- interceptor performance improvement project in Seoul-si., etc.

◈ Installation example of Non-Power Discharge chamber Regulator

2. Combined sewer system(CSOs) improvement technology

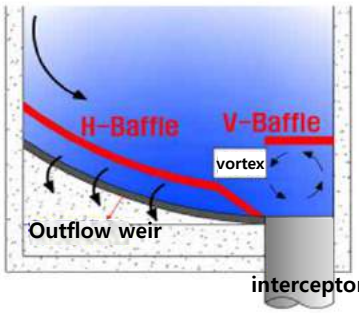
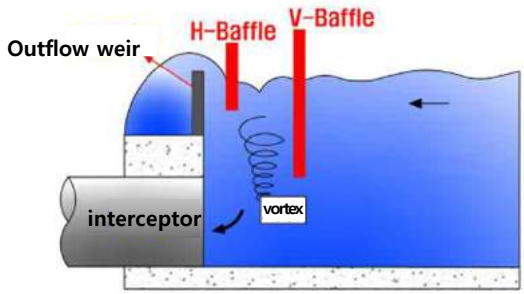
2) CSOs water surface control system (WSC)

◈ CSOs Water Surface impurity Control (WSC) outline

The CSOs surface impurity control system is constructed by installing H-baffle and V-baffle in the discharge chamber and it induce floating pollutants of CSOs to the intercepting sewer and transfer to treatment plant. So it can prevent contamination by floating pollutants of CSOs.

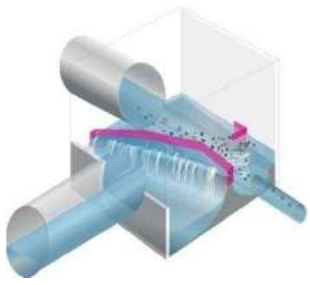
◈ The principle of Water Surface impurity Control(WSC)

The WSC is constructed by installing V-baffle on the front of interceptor and generating a vortex in the direction of the interceptor. H-baffle is installed at the front of overflow weir to prevent the decrease of water level in the overflow direction and inducing floating pollutants to the interceptor.

Plane figure	Cross-section
	

◈ The characteristics of WSC

• It can be installed not only in the new discharge chamber but also in the existing discharge chamber.
• It is easy to construct with simple structure and economical compared to other facilities.
• Environmental-friendly system that does not require any additional power after construction
• It is easy to supplement the system when changes are made through post monitoring.



◈ Comparison with existing technology

● Domestic impurity control technology status

➡ Some technologies for reducing CSOs in Korea have been developed, but most of them are developed in foreign countries, and there are no such thing except for the control using screen.

● Disadvantages of existing impurity control technology

- most of screan-based foreign technology
- separate power and civil engineering work
- High cost on maintenance and installation
- depend entirely on import
- foreign currency outflow and insignificant industrial impact

● Comparison between this technology and existing screen technology

division	WSC	CSO Screen	Brush Screen	Raked Bar Screen
Removal of water surface impurities	63.4~99.5%	47.7~100.0%	33.4~88.3%	47.6~80.2%
Relative cost	1	2.9 ~ 5.7times		

➡ Water Surface Control(WSC) has no concern of malfunction due to simple hydrodynamic principle. Unlike a screen type facility, the vortex generated by the rise of water level in rain causes impurities to be transferred to intercepting pipe in real time. It is eco-friendly because no power is needed to drive and easy to maintain.

● Application example in overseas(Japan)

- 57% of impurity control discharge chamber applied WSC system
- 82% of discharge chamber(517 places) planning impurity control is designed for application of WSC system. (출처 : Sewer new technology promotion organization in Japan)

◈ On-site evaluation of WSC (Water Surface Control)

- **The purpose of experiment**

➡ **Evaluation of WSC field applicability and review of vortex generation of V-baffle according to design conditions.**

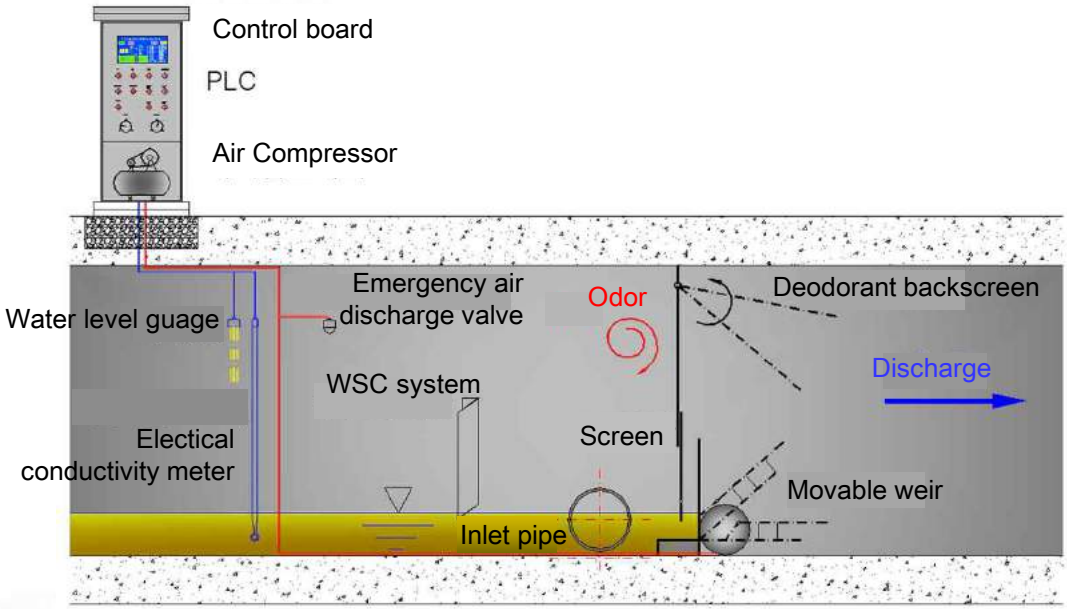
Pictures of field application

2. Combined sewer system Overflows(CSOs) improvement technology

3) Discharge chamber Multiple Control system (DMC)

◈ Overview of the technology

- **Movable weir with screen + smart tube gate + WSC system + deodorant back screen**



1. Movable weir system ➜ Active control of overflow weir height **prevents overflow accident** such as fish kill, **improvement of water quality in public waters** by CSOs control according to retention in pipe, **improving public health safety in public waters** by reducing the number of overflows, blocking the backflow of sea water or river water.
2. Smart gate system using EC(electrical conductivity) ➜ **maximize efficiency of sewage treatment plant** by blocking inflow of low-concentration wastewater
3. Water surface control system ➜ improving efficiency in public waters by real-time collection of pollutant
4. Deodorant back screen system (if necessary) ➜ minimize the causes of civil complaints by **avoiding leakage of odor** in discharge chamber and blocking visually

◈ The key element technologies of DMC system

Movable weir with screen

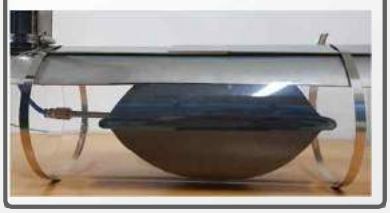
Standing state

Lying down state

- ❖ Excellent durability with special synthetic rubber and steel plate
- ❖ Easy maintenance by compressed air operation

Tube gate

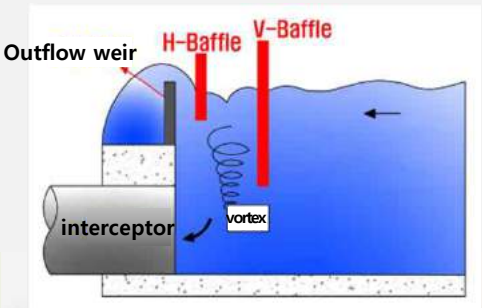
Closed state



Open state

- ❖ No restriction on the installation place with special synthetic rubber tube gate
- ❖ Easy maintenance due to no jammed problem of debris

Water surface control system

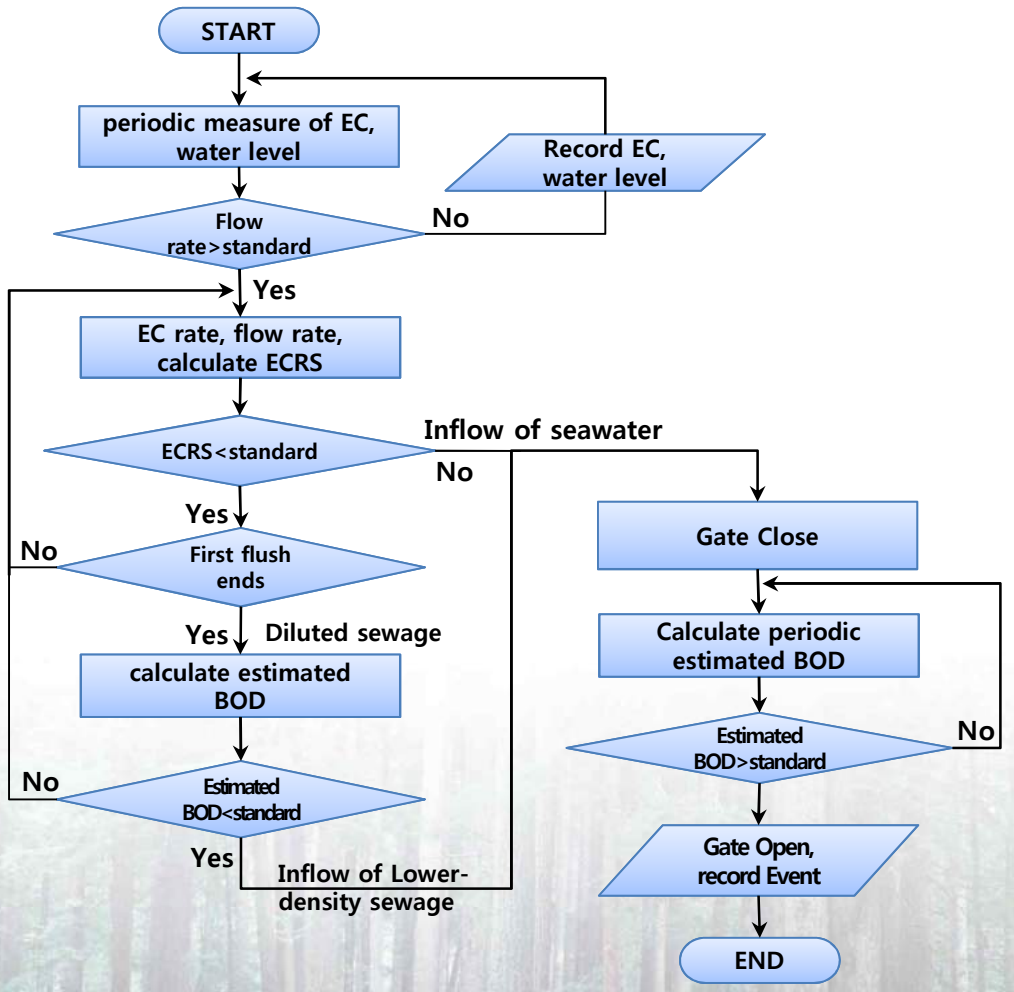


- ❖ Prevent the outflow of contaminants by installing H-baffle to movable weir
- ❖ Real-time control of floatable materials by installing V-baffle at the entrance of interceptor

➜ control of pollutant discharge and high-concentration sewage, prevent inflow of low-concentration sewage

◈ Real-time control by EC and flow

● **The flow chart of flow control in discharge chamber**

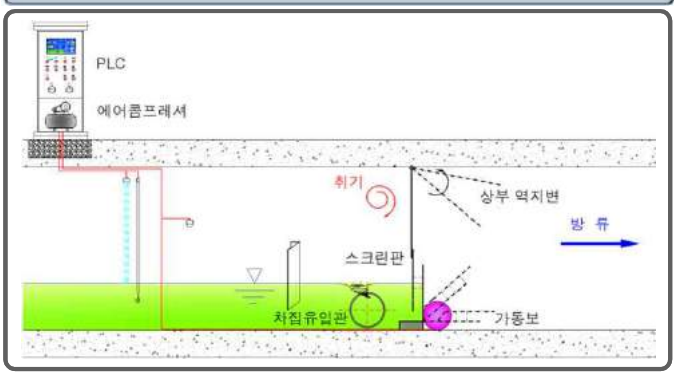
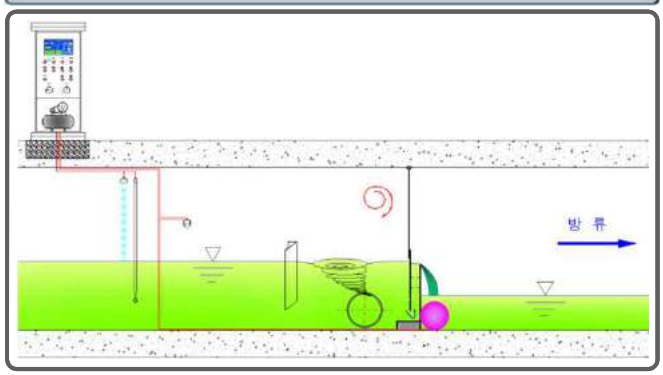
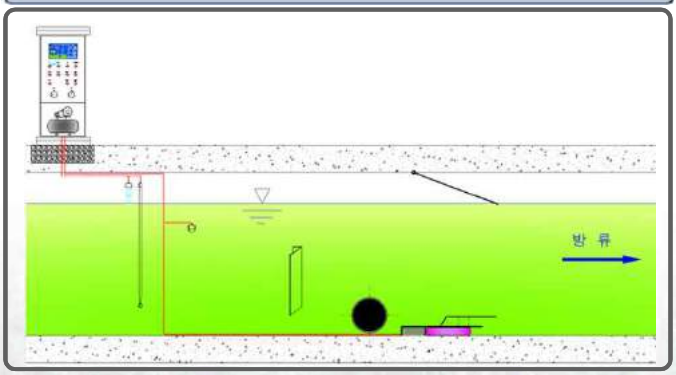
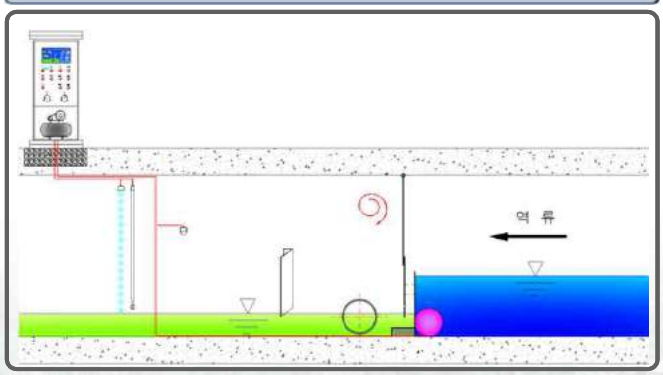


❖ Establishment of electrical conductivity (EC) and flow database, control water quality-flow by real-time data in rainfall

❖ Real-time interlocking control of movable weir and tube gate

◈ Operating model of DMC system

- **Control in joining pipe by movable weir**

First Flush	Continuous rainfall
	
Heavy rain	**Backflow of seawater (river water)**
	

❖ **Dry weather :** tube gate opens, standing state of movable weir ➜ intercept sewage and control floatable materials, odor blocking

❖ **First flush :** rising water level ~ before the water level when movable weir lies down (stay upright) ➜ intercepting first flush according to retention in pipe, controlling floatable materials

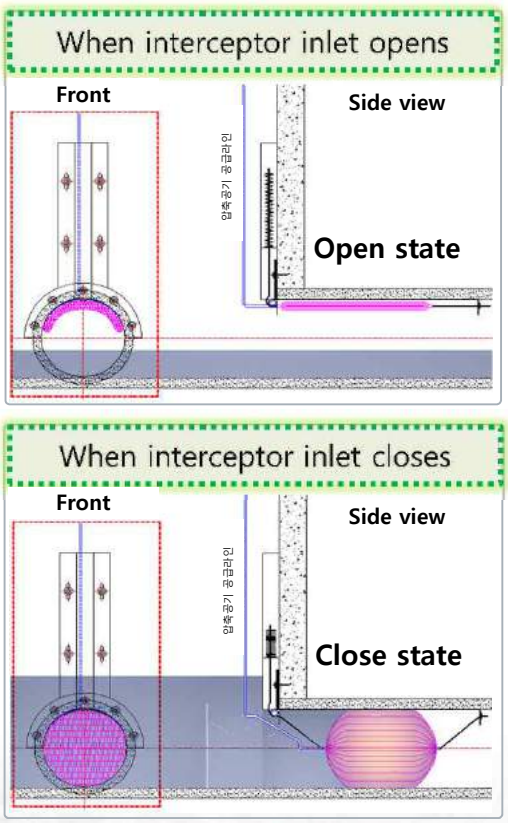
❖ **Heavy rain :** sewage dilution by continuous rainfall ➜ movable weir lies down and tube gate closes ➜ block intercepting, discharge diluted sewage by rainfall

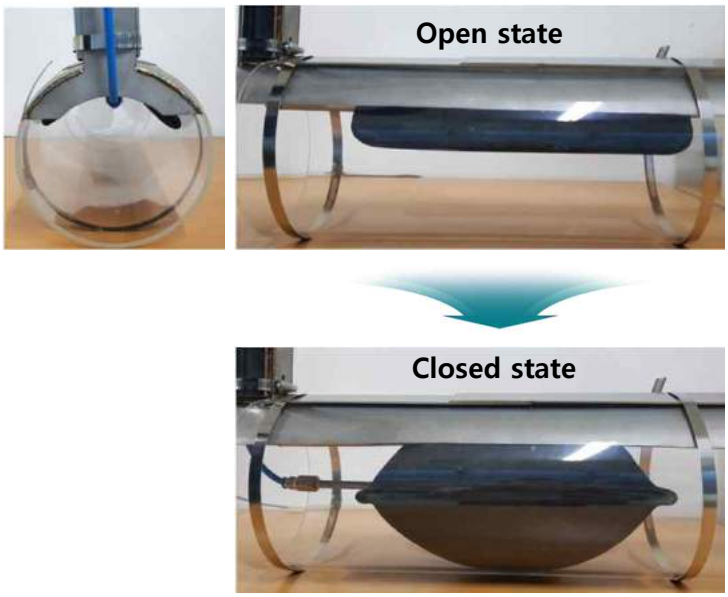
❖ **End of rainfall :** water level drops and reaches the level when movable weir stands up ➜ movable weir stands up and tube gate opens ➜ intercepting sewage and blocking odor

❖ **When the water level rises :** block the backflow of seawater(river water) to interceptor by movable weir

◈ Overview and features of tube gate

● Control interceptor by tube gate

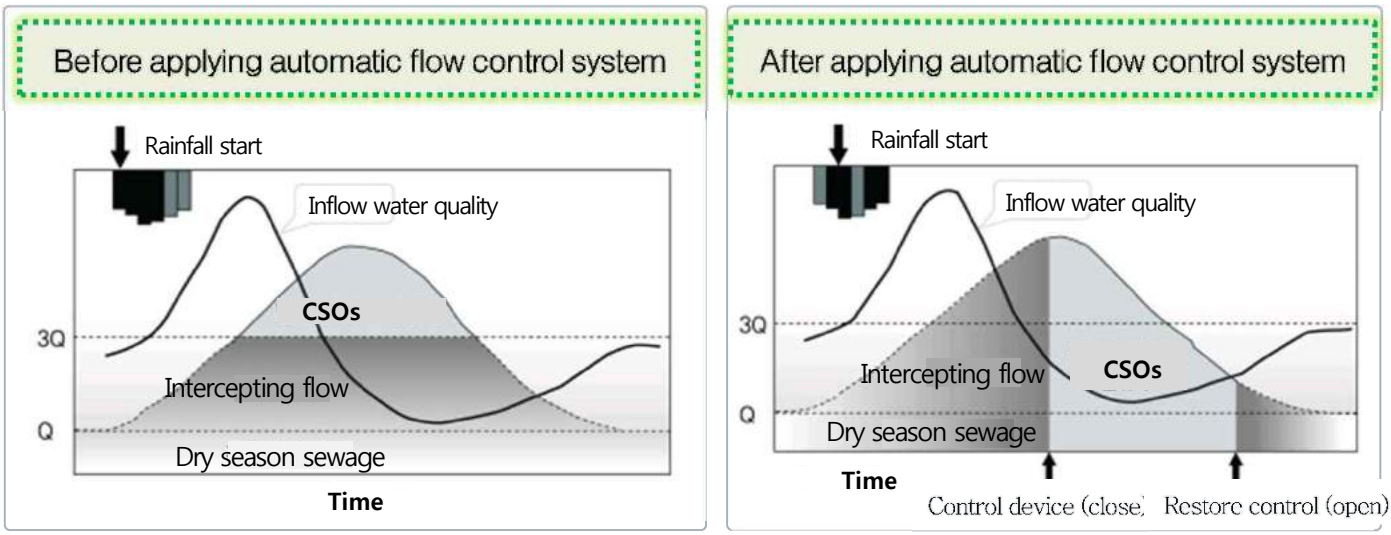




- ❖ Made of SUS304 & synthetic EPDM rubber with excellent chemical resistance, excellent durability to withstand air pressures of up to 6kg/cm^2
- ❖ Minimize solid deposits and fluid flow disturbance in a shape that takes into account mathematical conditions
- ❖ Exercise the gate without being disturbed by floatable materials in the inlet
- ❖ Flow control by compressed air and tube gate ➜ applicable regardless of irregular pipe shape, power transmission extension and route
- ❖ Installed inside the interceptor ➜ no additional civil engineering works required
- ❖ Reduced power consumption and breakthrough maintenance compared to mechanical switchgear

◈ Real-time water quality control

● Control of intercepting flow by real-time water quality control system



division	thermometer	pH	DO	EC	COD	Turbidity
Instability of measurement	2	18	49	0	17	5
Bad electrode	3	51	71	1	19	1
Defective amplifier	3	10	14	1	11	0
Measurement error occurrence	7	31	59	0	20	7
Light sensor error	0	0	0	0	44	18
Non-metric	2	5	0	0	35	4
etc	2	13	6	1	56	2
Sum total	19	128	199	3	202	37

source : Japan sewer association magazine, 1991
205 sewage treatment plant in Japan (31 watershed STPs, 174 public STPs)

- ❖ The real-time water quality is estimated by the water quality, the electrical conductivity in rainfall and the dilution factor by the flow rate.
- ❖ No control is required in first flush because the water quality is unstable and the concentration is high. (total high concentration sewage is intercepted)
- ❖ Collection and discharge are decided by real-time estimation based on the determination of the dilution interval of the flow rate and the electric conductivity in the middle of rainfall. (block the low concentraion sewage)

◈ Installation effect of DMC System

● Environmental and technical aspects

- Real-time measurement of EC and flow enables active handling of high concentration sewage and CSOs ➜ improve effluent quality by holding first flush and selective interception of high concentration sewage
  ➜ Blocking low concentraion sewage maximizes efficiency of interceptor and sewage treatment plant.
- Improve waterside environment due to epoch-making outflow control of floating matters, correspond to fish kill
- Prevent backflow of seawater or river water by rise of coastal water level
- Contribution to the needs of waterfront space by improving odor problem in the riverside

● Goal of improving combined sewer system in Japan and effect of applying this system

Goal and content of improving combined sewer system		Expected effect of applying DMC System
Reduction of pollutant load	Improve the amount of pollution load reduction in maintenance area to the same level as separate sewer system ➜ improved to 40 or 70mg/L BOD	Induce active intercepting of high concentration first flush by in-pipe storage, Improve watershed water quality and maximize the efficiency of interceptor by not collecting low concentration sewage
Ensuring safety in public health	Reduction in the number of annual releases ➜ Raise weir height, increase/reinforcement of interceptor, install retention basin, in-pipe storage	Achieve the goal of securing public sanitation safety by reducing the times of overflow due to raised weir height of movable weir
Floating matters reduction	Prevent outflow of floating matters ➜ Installation of CSOs screen, etc	Movable weir with screen peform CSOs screen function to prevent outflow of floatable materials and capture in real-time

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