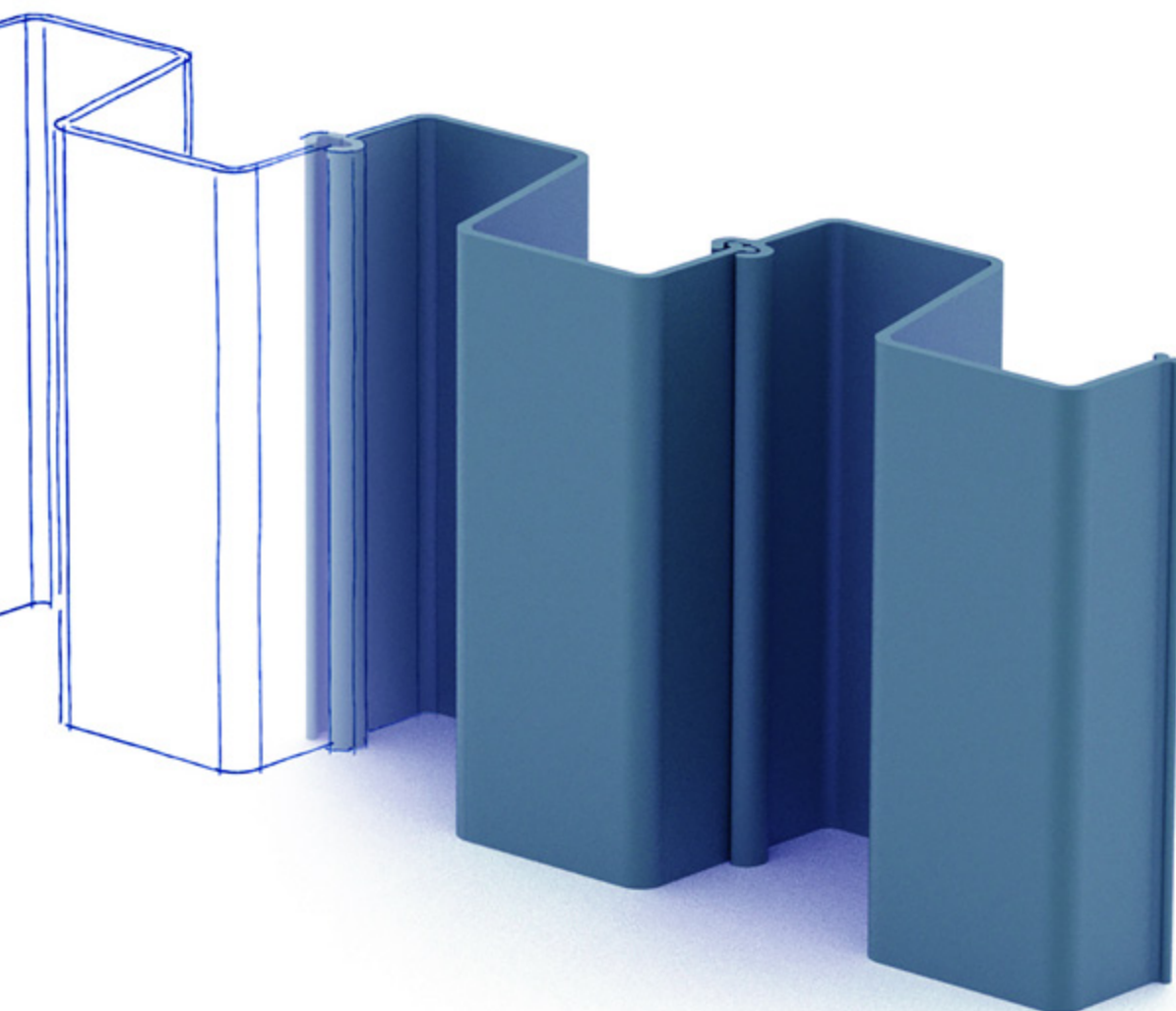




Pietrucha
Established 1960

The EcoLock System

A durable, maintenance-free and costs efficient
alternative to the traditional solutions



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The Pietrucha Group

Proudly Polish, Truly International

The Pietrucha Group is an efficiently managed, competitive and innovative group of companies, which specializes in the manufacturing and distribution of top-class geosynthetic products as well as providing a comprehensive range of geotechnical services broadly used in civil engineering.

Geosynthetic products manufactured by the Pietrucha Group are delivered to nearly 3500 customers in 34 countries on 5 continents, especially in regions sensitive to the impact of climate change. Despite the scope and global reach of our operations, the Pietrucha Group has remained a family business, managed by a third generation of entrepreneurs.



Vinyl sheet piling used to reinforce flood-walls.

The EcoLock System Advantages

The Pietrucha Group is the global leader in manufacturing and distribution of high quality EcoLock vinyl sheet piling broadly used in the civil engineering sector in land and water infrastructure investments.

Durable, resistant and water-tight solution

- | 50-year limited guarantee. Do not require maintenance as they retain parameters perfectly.
- | Highly resistant to corrosion and the impact of atmospheric and biological factors, including UV radiation, extreme temperatures and sea water.
- | Resistant to mechanical damage, including scratches, cracks and abrasions.
- | Water-tight due to bindings located far from the greatest pressure area.

Costs and time saving

- | Costs efficient in comparison to the traditional solutions.
- | Logistics - and assembly - friendly thanks to lightweight construction and the unique flat surface design.
- | Simple and fast installation using standard tools and machinery.
- | Easily forming curvatures adjusted to fit the natural coastline and riverbank.



Vinyl sheet piles are an environmentally friendly, lightweight, extremely durable and costs efficient alternative to the traditional materials such as steel, concrete or wood. They are used in construction projects more and more broadly because of their excellent parameters and the possibility of lowering investment costs.

Environmentally friendly and aesthetic

Eco-friendly solution with the material for the piling obtained from recycled PVC that may be recycled further.

Clean and aesthetic design, easily matching the surroundings thanks to invisible bindings and neutral colors.

Standard colors include grey, olive-green and brown but, upon request, EcoLock vinyl sheet piles are also available in any color in the RAL scheme.

Full service, complete system

The Pietrucha Group offers services at any stage of the project – from technical consultancy, design, logistics, installation to general contracting and investment supervision.

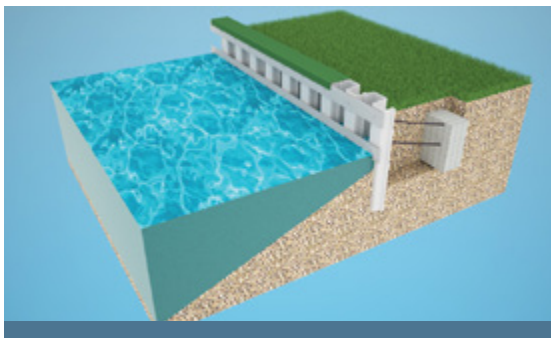
The product range includes as many as 15 sheet pile types and a full range of accessories. It also includes earth anchors and installation equipment.

The EcoLock system is supplemented with TerraDeck composite planks. The compatibility of the EcoLock and the TerraDeck systems brings excellent results in construction of private and utility wharves, piers and yacht marinas.



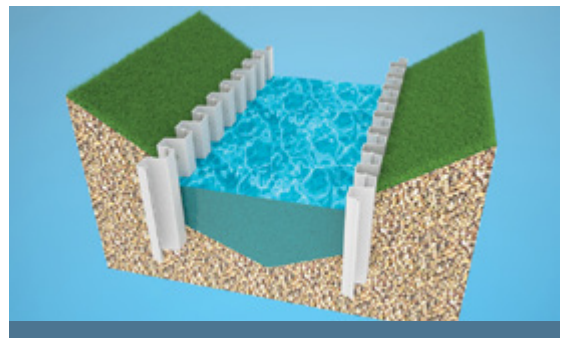
The EcoLock System Application

Sheet pilings and cut-off walls with a system of stays



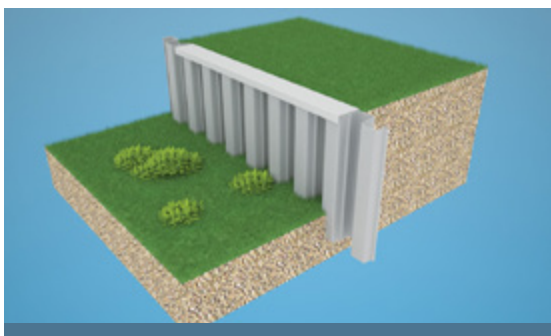
In order to protect the banks of different water reservoirs or rivers they can be used with a special system of stays and anchors, providing additional protection and increasing the durability of the system.

River bank protection and regulation



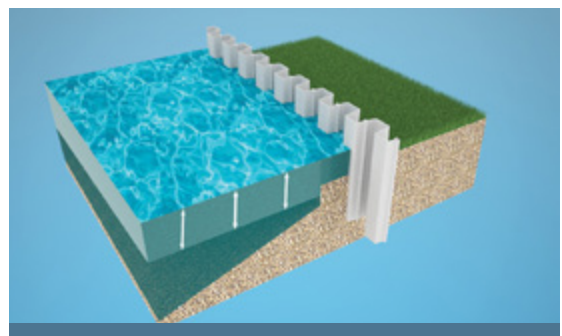
PVC piling may be used to protect and regulate rivers, ditches or channels. Thanks to their structure, EcoLock piling systems easily adjust to the natural curvatures of the terrain.

Retaining systems



The EcoLock system may be applied to protect slopes, landslides and various excavation sites. The retaining systems not only secure them, but also allow for easy and aesthetic shaping of the given terrain.

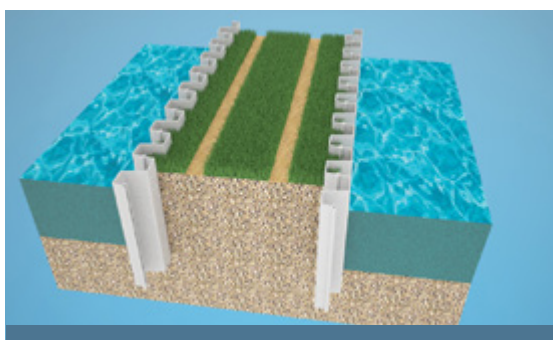
Protection of banks with variable water levels



Tightness, combined with aesthetic look, allow for the use of the EcoLock piling to protect the banks with variable water levels. The system always blends in perfectly with the surrounding area.

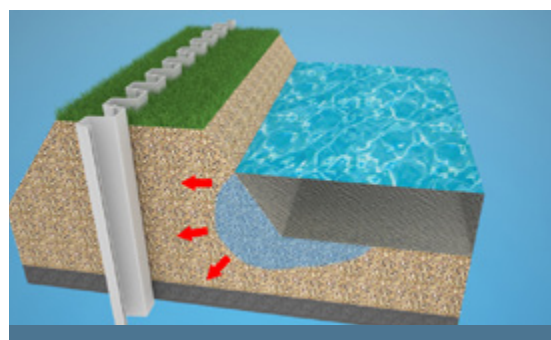
Taking into account their complete resistance to biological and atmospheric factors, as well as mechanical damage, PVC sheet piling may be used in a wide range of civil engineering projects. The EcoLock sheet piling used in place of steel retaining walls reduces the costs of installation and materials. As an alternative to wooden solutions, EcoLock ensures higher durability and resistance to external factors.

Causeways



The EcoLock used in the construction of causeways at water reservoirs result in their higher durability and better resistance of the whole structure against scouring.

Strengthening of flood walls



PVC solutions are used more and more frequently in the construction of flood walls. They significantly strengthen and increase the durability and tightness of the structure, preventing water leaks during floods.

Cut-off walls



Used to protect places with variable or raised groundwater level, PVC sheet piling efficiently reduces water infiltration as well as secures the terrain against gradual erosion and degradation.

Cut-off walls in ecologically threatened areas

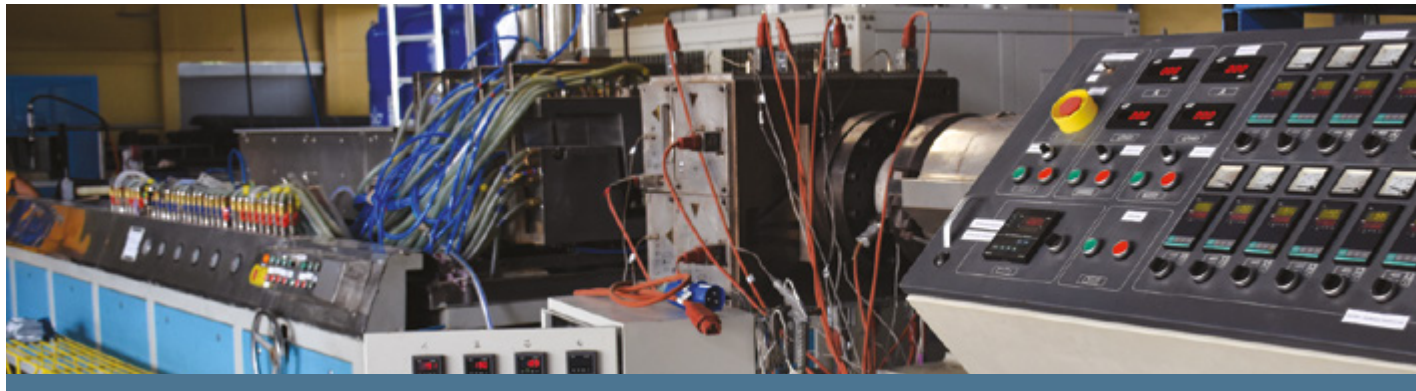


The EcoLock retaining systems may be used to separate water reservoirs or groundwater from environmentally challenged places (for instance, in the vicinity of landfills and factories).

The EcoLock System Technology

Manufacturing Technology

The EcoLock Vinyl sheet piles are made from tough polyvinyl chloride, modified with refining agents (e.g. toughness modifiers, UV and thermal stabilizers and mineral filling components). The EcoLock sheet piles are manufactured using the extrusion molding method as monolithic profiles or the co-extrusion molding method, with the core made from the material obtained from PVC construction recycling, covered with a layer of the primary plastic material. Thanks to the use of this closed-cycle recycling method, vinyl sheet piles are an environmentally friendly solution.



Consistent quality and parameters

Thanks to the continuous monitoring and implementation of strict manufacturing procedures, we guarantee high and consistent quality of our products. The quality and the endurance parameters of our sheet piles are systematically validated by accredited laboratories, institutes and technical universities.

ISO 9001:2008

An advanced machine park coupled with over 20 years' experience in plastics processing guarantee the highest quality of the vinyl sheet piles manufactured by the Pietrucha Group. Manufacturing of PVC sheet piling is a process requiring utmost care. Application of the ISO 9001:2008 standard has enabled us to provide and maintain high quality products, while introduction of specially designed procedures has systematized our operations in the company, which are now an integral part of it.



Parameter	Unit	Standard	Value
Density	kg/m ³	PN-EN ISO 1183-3:2003	1400-1480
Charpy impact test	kJ/m ²	PN-EN ISO 179-1:2004	≥ 30
Shore durometer	Shore'a D	PN-EN ISO 868:2005	≥ 75
Softening point Vicat method	°C	PN-EN ISO 306:2004	≥ 77
Tensile strength	MPa	PN-EN ISO 527-2:1998	≥ 44
Tensile modulus of elasticity	MPa	PN-EN ISO 527-2:1998	≥ 2600
Bending modulus of elasticity	MPa	PN-EN ISO 178:2006	≥ 2600
Bending strength	MPa	PN-EN ISO 178:2006	≥ 65
Resistance to climatic ageing, energy radiation of 2,6 GJ/m ² :	%	PN-EN 513:2002	not less than 4
- resistance to changes in the surface coloring		PN-EN ISO 4892-2 met. A	in gray scale
- change in the impact resistance (the Charpy test)		PN-EN 20105-A03:1996	≤ 30
		PN-EN ISO 179-1:2004	

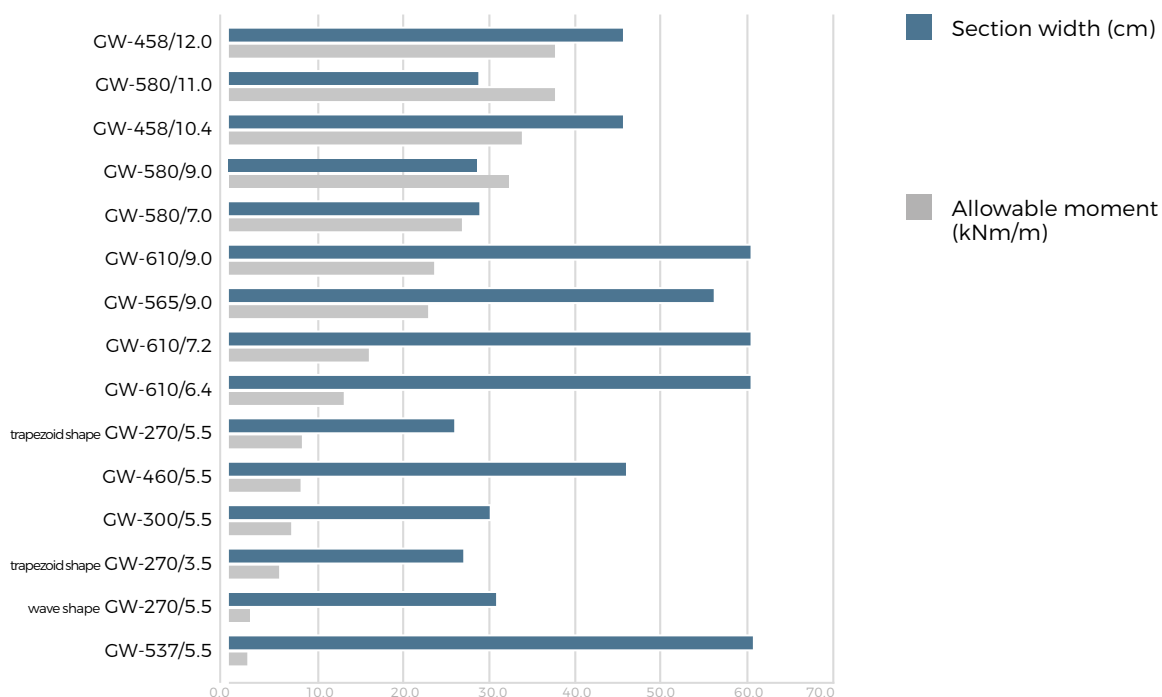
Data applicable to all types of vinyl sheet plies excluding bumpers.



Technology partners

The Łódź University of Technology	The Warsaw University of Technology
Pro-Lab Sp. z o.o.	The Road and Bridge Research Institute
The Institute of Technology and Life Sciences	The Textile Research Institute
The Institute of Polymer and Colouring Agents Engineering	

Comparison of the most important parameters of the EcoLock vinyl sheet piles



Products

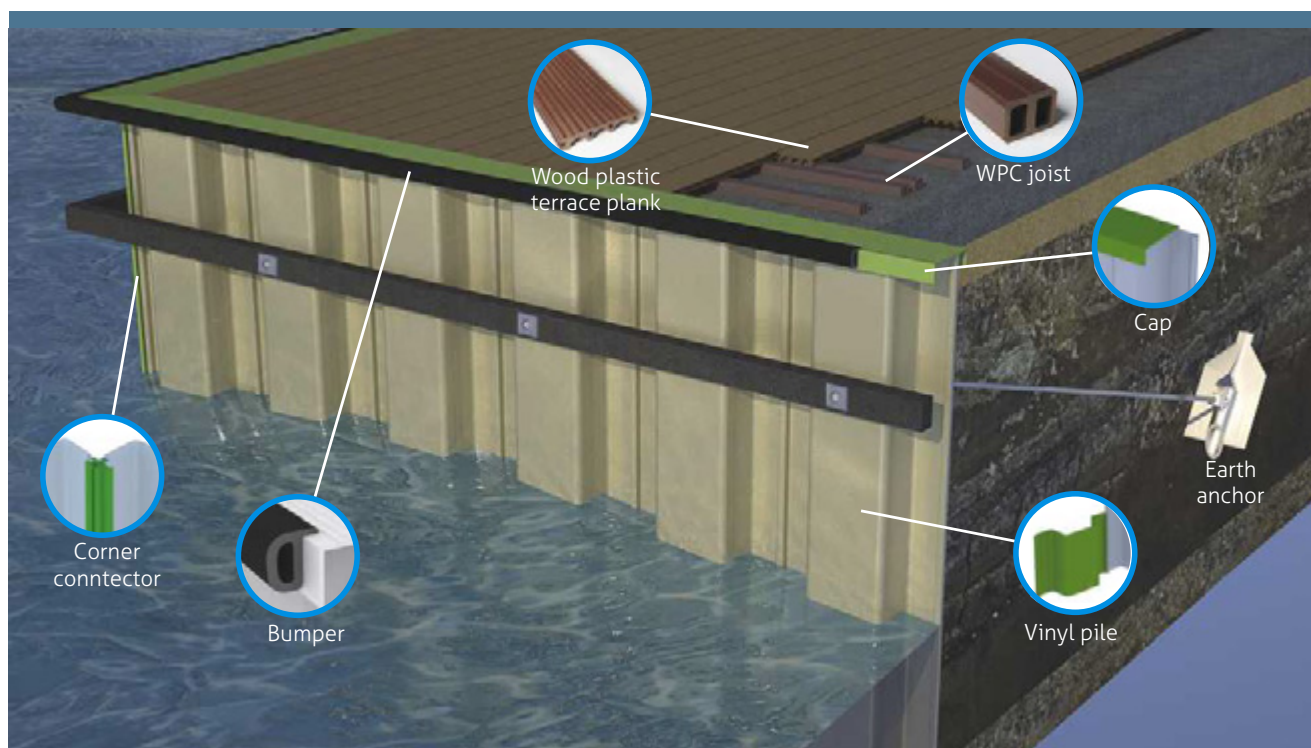
The EcoLock vinyl sheet piles have various profiles and uses, but all are made of the same highest-quality raw material which determines the physical and mechanical parameters of the product.

The complete system

The system consists of 15 types of sheet piles used for various purposes and a full range of accessories including corner connectors, allowing connection to the wall at 90 degrees, a top plate protecting the wall from the top, and a flexible fender, often used in canoeing marinas. The entire system is complemented with anchors. The Pietrucha Group offers full service at all stages of the project, from technical advice and design support through transport services, general contracting, and construction work supervision.

EcoLock and TerraDeck: a perfect match

The PVC piling system is complemented with a TerraDeck composite plank system used in challenging atmospheric conditions where water resistance is one of the key parameters. The TerraDeck planks are made from wood flour and PVC and combine the aesthetics of natural wood with functionality and endurance of a plastic material. The compatibility of the EcoLock and TerraDeck systems gives excellent results when constructing tourist and utility wharves, piers and yacht marinas.

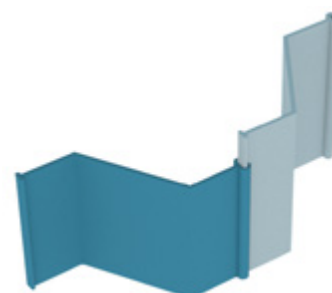
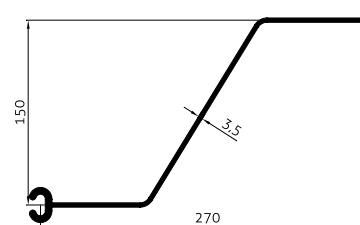


The product range

GW-270 / 3.5 Trapezoid shape

	unit	value
Section width	mm	270
Section depth	mm	150
Thickness	mm	3.5
Section modulus	cm ³ /m	254
Moment of inertia	cm ⁴ /m	2327
Allowable moment*	kNm/m	5.6
Ultimate moment	kNm/m	11.2

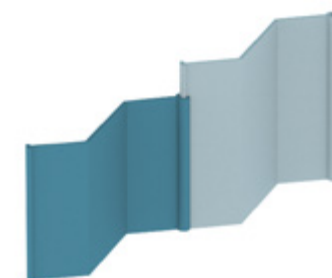
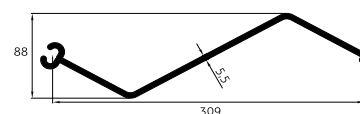
* Safety factor = 2



GW-270 / 5.5 Wave shape

	unit	value
Section width	mm	309
Section depth	mm	88
Thickness	mm	5.5
Section modulus	cm ³ /m	87.3
Moment of inertia	cm ⁴ /m	385
Allowable moment*	kNm/m	1.9
Ultimate moment	kNm/m	3.8

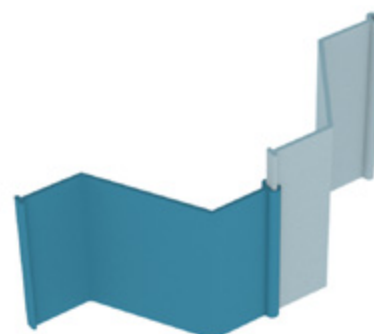
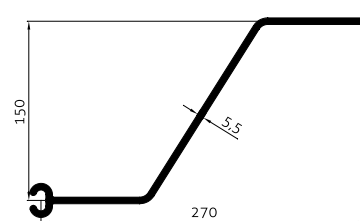
* Safety factor = 2



GW-270 / 5.5 Trapezoid shape

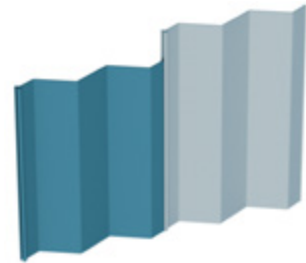
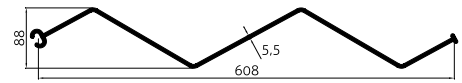
	unit	value
Section width	mm	270
Section depth	mm	150
Thickness	mm	5.5
Section modulus	cm ³ /m	369.5
Moment of inertia	cm ⁴ /m	3266
Allowable moment*	kNm/m	8.1
Ultimate moment	kNm/m	16.3

* Safety factor = 2



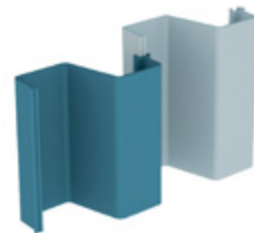
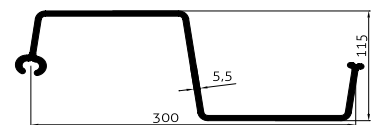
GW-537 / 5.5	unit	value
Section width	mm	608
Section depth	mm	88
Thickness	mm	5.5
Section modulus	cm ³ /m	86.6
Moment of inertia	cm ⁴ /m	382
Allowable moment*	kNm/m	1.9
Ultimate moment	kNm/m	3.8

* Safety factor = 2



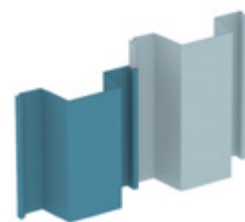
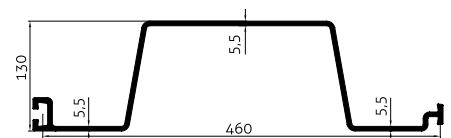
GW-300 / 5.5	unit	value
Section width	mm	300
Section depth	mm	115
Thickness	mm	5.5
Section modulus	cm ³ /m	320
Moment of inertia	cm ⁴ /m	1842
Allowable moment*	kNm/m	7.0
Ultimate moment	kNm/m	14.1

* Safety factor = 2



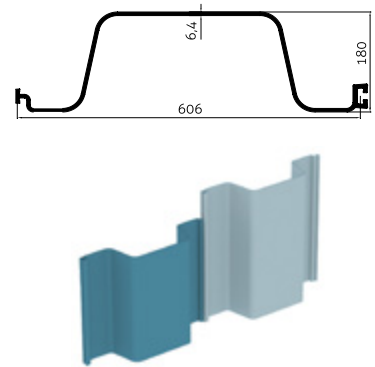
GW-460 / 5.5	unit	value
Section width	mm	460
Section depth	mm	130
Thickness	mm	5.5
Section modulus	cm ³ /m	360
Moment of inertia	cm ⁴ /m	2527
Allowable moment*	kNm/m	7.9
Ultimate moment	kNm/m	15.8

* Safety factor = 2



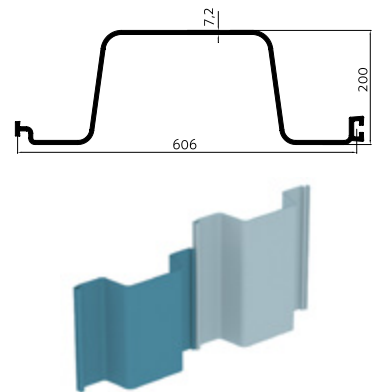
GW-610/6.4	unit	value
Section width	mm	606
Section depth	mm	180
Thickness	mm	6.4
Section modulus	cm ³ /m	589.7
Moment of inertia	cm ⁴ /m	5325
Allowable moment*	kNm/m	13.0
Ultimate moment	kNm/m	25.9

* Safety factor = 2



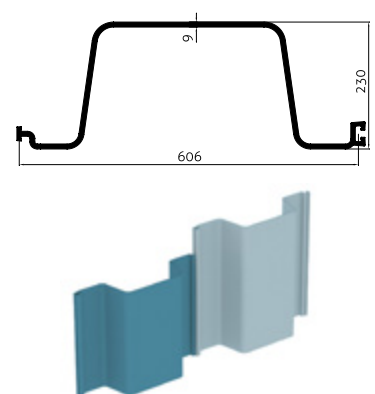
GW-610/7.2	unit	value
Section width	mm	606
Section depth	mm	200
Thickness	mm	7.2
Section modulus	cm ³ /m	728.7
Moment of inertia	cm ⁴ /m	7724
Allowable moment*	kNm/m	16.0
Ultimate moment	kNm/m	32.1

* Safety factor = 2



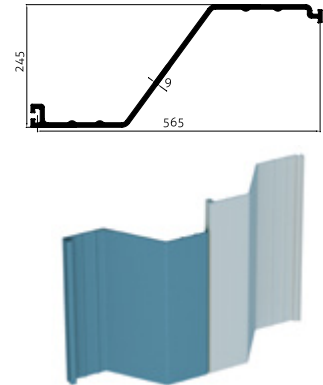
GW-610/9.0	unit	value
Section width	mm	606
Section depth	mm	230
Thickness	mm	9
Section modulus	cm ³ /m	1076.8
Moment of inertia	cm ⁴ /m	12766
Allowable moment*	kNm/m	23.7
Ultimate moment	kNm/m	47.4

* Safety factor = 2



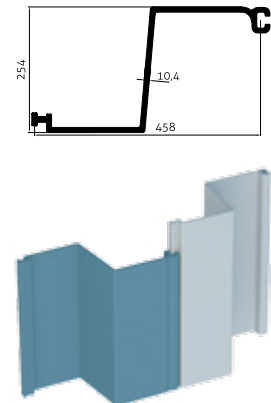
GW-565 / 9.0	unit	value
Section width	mm	565
Section depth	mm	245
Thickness	mm	9.0
Section modulus	cm ³ /m	1042
Moment of inertia	cm ⁴ /m	12768
Allowable moment*	kNm/m	22.9
Ultimate moment	kNm/m	45.8

* Safety factor = 2



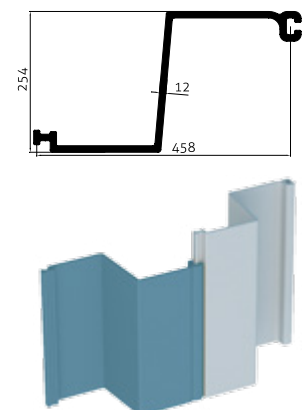
GW-458 / 10.4	unit	value
Section width	mm	458
Section depth	mm	254
Thickness	mm	10.4
Section modulus	cm ³ /m	1541.5
Moment of inertia	cm ⁴ /m	20718
Allowable moment*	kNm/m	33.9
Ultimate moment	kNm/m	67.8

* Safety factor = 2



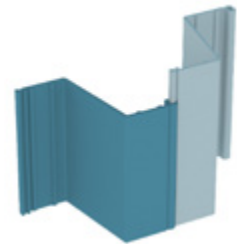
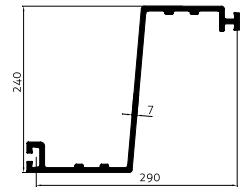
GW-458 / 12.0	unit	value
Section width	mm	458
Section depth	mm	254
Thickness	mm	12
Section modulus	cm ³ /m	1717
Moment of inertia	cm ⁴ /m	22937
Allowable moment*	kNm/m	37.8
Ultimate moment	kNm/m	75.5

* Safety factor = 2



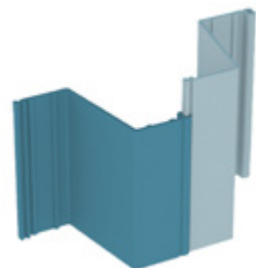
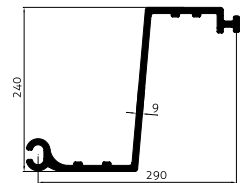
GW-580 / 7.0	unit	value
Section width	mm	290
Section depth	mm	240
Thickness	mm	7.0
Section modulus	cm ³ /m	1228.3
Moment of inertia	cm ⁴ /m	15429
Allowable moment*	kNm/m	27.0
Ultimate moment	kNm/m	54.0

* Safety factor = 2



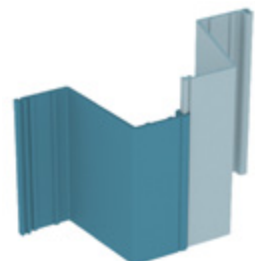
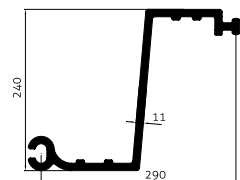
GW-580 / 9.0	unit	value
Section width	mm	290
Section depth	mm	240
Thickness	mm	9.0
Section modulus	cm ³ /m	1461.6
Moment of inertia	cm ⁴ /m	18739
Allowable moment*	kNm/m	32.2
Ultimate moment	kNm/m	64.3

* Safety factor = 2



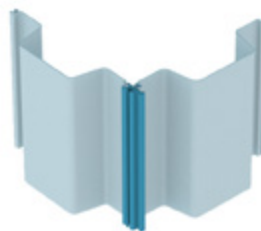
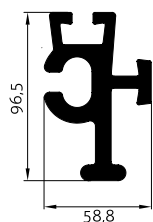
GW-580 / 11.0	unit	value
Section width	mm	290
Section depth	mm	240
Thickness	mm	11
Section modulus	cm ³ /m	1711
Moment of inertia	cm ⁴ /m	21851
Allowable moment*	kNm/m	37.6
Ultimate moment	kNm/m	75.3

* Safety factor = 2



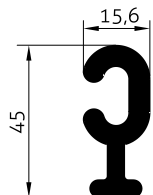
Corner 610/580

	unit	value
Section width	mm	96.50
Section depth	mm	58.80



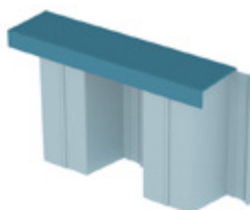
Corner 300

	unit	value
Section width	mm	45.00
Section depth	mm	15.60



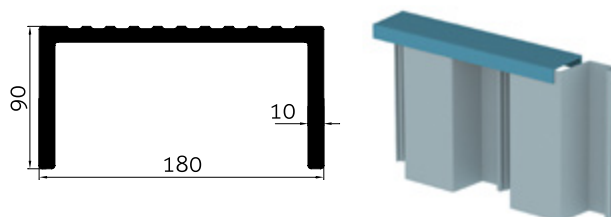
Cap 290

	unit	value
Section width exterior	mm	290
Section depth exterior	mm	90
Thickness	mm	10



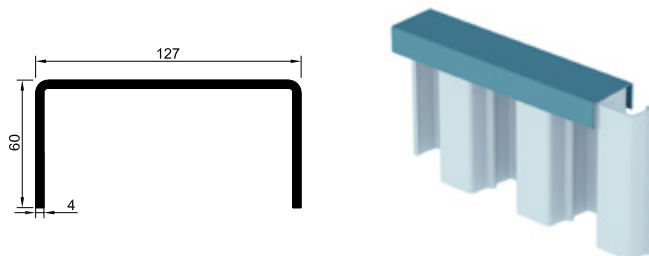
Cap 180

	unit	value
Section width exterior	mm	180
Section depth exterior	mm	90
Thickness	mm	10



Cap 120

	unit	value
Section width interior	mm	127
Section depth interior	mm	60
Thickness	mm	4



Bumper

	unit	value
Section width	mm	46
Section depth	mm	90



The EcoLock System Installation

Hammering

The most commonly used method, in which sheet piles are mechanically embedded into the soil along the pre-installed templates with the use of vibratory hammers, i.e. light equipment with small impact energy. The type of the equipment used depends on the soil type, the depth of the cavity and the durability of the sheet pile. In the case of hard, dense surfaces, or when long elements need to be hammered, steel mandrels are used. Mandrels are special guide bars of a shape and length reflecting the used PVC elements.



Pneumatic hammer



Hammering of a vinyl sheet pile
using a steel mandrel

Advantages of using mandrels

- hammering sheet piles in very difficult soil environments (compact silt, clay, gravel)
- installation of long profiles, even up to 12m
- removing obstacles found in soil (roots, stones)
- maintaining straight lines
- ensuring pre-loosening of soil
- significant acceleration of installation work

Jetting



This method is used in cases of very compact or cohesive soil where the force of vibration hammers is not sufficient to embed the vinyl sheet piling to the required depth. Jetting consists in exerting pressure directly under the sheet piles which are being installed, which helps loosen and remove the soil or the obstacles. Special water or air ejectors are used in this technology.

Digging



This method is used when the constructed walls are not embedded too deeply into the ground and it consists in the PVC piling being installed in a ditch which is subsequently filled in with a bedding layer selected individually to best meet the requirements of a given project.

We offer for rent the necessary embedding equipment including light hammers and vibrohammers mounted on diggers.

The Pietrucha Group offers a full service at all stages of the project, from technical advice and design support through transport services, general contracting, and construction works supervision.

For our contractors, we offer the necessary embedding equipment (vibrohammers, pneumatic hammers, mandrels) along with training courses and consultancy services.

Support to designers

Our engineers offer support to designers, engineers and contractors dealing with the project using the products manufactured by the Pietrucha Group. For their convenience, we have created a specially designed computer program which may be used for:

- construction calculation and modeling.
- creation of charts including various physical and mechanical parameters.
- calculation and modeling of earth anchors.

Case study: Europe's largest investment using vinyl sheet piles

One of the most important functions of the vinyl sheet piling is to prevent the flood-protection systems against water corrosion caused by ground water.

The project:

Delivery of approximately 72 400 m² (15690 m length, which is almost 16 kilometers) of vinyl sheet piling used to construct the anti-filtration barrier in the project „Flood Protection of the polder Gardna V-VI“.

The objective:

- Protection against water corrosion of the embankment of polder Gardna.
- Extension of the filtration route of groundwater.
- Increase of the stability of the embankment structure
- Partial reconstruction of the existing embankments, as well as the creation of new ones

The challenge:

Weak subsoil of the embankment, mostly consisting of peat and high probability of uncontrolled earth settlement of the embankment structure.

Solution:

- To apply the EcoLock GW 270/5.5 profiles made of hard PVC. They serve a dual role in the structure: an anti-filtration barrier to prevent leakage and undercutting of the embankment by groundwater and, thanks to a proper length (2.0 - 9.0 m), they reach the top layer of fine sands, forming a support to the soil embankment body, improving its stability.
- In the construction of the embankment body a mix of peat and sand was used, in such a way as to achieve an elevation of the crown of embankments equal to 0.5 m above the water level.

Conclusions:

- The installation of EcoLock vinyl sheet piling will prevent the erosion by groundwater and protect the area of 918 hectares against flooding.
- The number of GW-270 / 5.5 sheet piles used in the project, amounting to as much as 72000 m², may be compared to the area of 11 football fields, making it the biggest investment of its kind in Europe.




To illustrate the number of GW-270 / 5.5 sheet piles, amounting to as much as 72000 m², this value can be compared to the area of 11 football fields, making it the biggest investment of its kind in Europe!



Completed projects



-  Pokój, Poland
-  **Regulation of the bed of water canal**
-  GW-300/5.5
-  2007



-  Sieradz, Poland
-  **Sealing of the flood embankment**
-  GW-300/5.5
-  2013



-  Kowal, Poland
-  **Retention tank by the A1 motorway**
-  GW-580/7.0
-  2012



- Warsaw, Poland
- Water culvert**
- GW-300/5.5
- 2008



- Blans, Denmark
- Yacht harbour**
- GW-580/11.0
- 2009



- Żagań, Poland
- Construction of a fish ladder at the Bóbr river**
- GW-610/6.4 + cap
- 2016



📍 Padang, Indonesia

📄 **Anti-erosion protection of the river-bed**

🏗️ GW-610/9.0

📅 2012-2013



📍 Łunawy Wielkie, Poland

📄 **Securing foudation of a hydroelectric power plant**

🏗️ GW-300/5.5

📅 2007



📍 Warta, Poland
Jeziorsko Reservoir

📄 **Kayak marina**

🏗️ GW-580/7.0

📅 2012

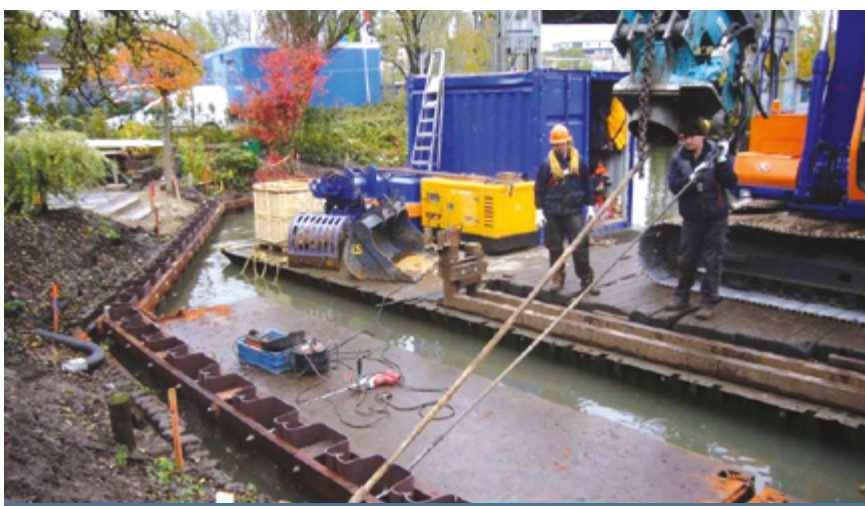


📍 Jelcz-Laskowice, Poland

📄 **Modernization of embankments**

🏗️ GW-610/9.0

📅 2013



📍 Utrecht, Holland

📄 **Regulation of the bed of river**

🏗️ GW-610/9.0

📅 2013



📍 Pruszków, Poland

📄 **Modernization of the railroad**

🏗️ GW-610/9.0

📅 2014



- 📍 Scott's Point, Australia
- 📄 **Protection of the seawall**
- 🏗️ GW-610/9.0
- 📅 2013







- 📍 Ryga, Latvia
- 📄 **Reinforcement of river embankments and modernization of the flood-protection system**
- 🏗️ GW-610/9.0
- 📅 2015







- 📍 The Carribean Curacau
- 📄 **Yacht marina**
- 🏗️ GW-610/9.0
- 📅 2014







-  Odessa, Ukraine
-  **Protection of the coastline**
-  GW-580/7.0
-  2015



-  Schapenput Marina, Holland
-  **Marina**
-  GW-610/9.0
-  2015



-  Terwolde, Holland
-  **Protection of the canal bank**
-  GW-460/5.5
-  2014



📍 Neusiedl am See,
Austria

📄 **Protection of the
canal bank**

📐 GW-580/9.0

📅 2014



📍 South Korea

📄 **Reinforcement of
flood-walls**

📐 GW-580/7.0

📅 2011



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