AGENTURA OCHRANY PŘÍRODY A KRAJINY ČESKÉ REPUBLIKY

ČVUT v Praze KHMKI

STANDARDS FOR NATURE AND LANDSCAPE MANAGEMENT

WATER IN LANDSCAPE **SERIES B**	**CREATION AND RESTORATION OF POOLS**	**SPPK B02 001: 2014**

Vytváření a obnova tůní
Die Bildung und Erneuerung der Tümpel

This standard contains principles of optimal design, creation and restoration of pools. Pools formed naturally or without any antropogenous intervention are not included in this standard.

References:

ČSN 75 1400 (2014). *Hydrological data on surface water*.
ČSN 75 2101 (2009). *Ekologisation of watercourse regulation*.
ČSN 75 2410 (2011). *Small water reservoirs*. Praha: Český normalizační institut, duben 2011

Act No. 17/1992 of the Coll.,on Environment, as amended
Act No. 114/1992 of the Coll., on Protection of Nature and the Landscape, as amended
Act No. 334/1992 of the Coll., on the conservation of agricultural land resources, as amended
Act No. 185/2001 of the Coll., on Waste and the Amendment of Some Other Acts, as amended
Act No. 254/2001 of the Coll., on Water and Amendments to Some Acts (The Water Act), as amended
Act No. 183/2006 of the Coll., on town and country planning and building code (Building Act), as amended
Decree No. 395/1992 of the Coll. implementing selected provisions of Czech National Council Act No. 114/1992 Coll. on the protection of the environment and the natural landscape, as amended
Decree No. 590/2002 Coll., on the technical requirements for water management structures, as amended
Decree No. 294/2005 Coll., on the conditions of depositing waste in landfills and its use on the surface of the ground and amendments to Decree No. 383/2001 Coll., on details of waste management
Decree No. 257/2009 of the Coll., on the usage of sediments on the field, as amended

Recommended literature:

Mikátová, B., Vlašín, M. (2002): Ochrana obojživelníků. EkoCentrum.Brno, 137 s. ISBN 80-902203-9-8.
Zavadil V., Sádlo J., Vojar J. (eds.): Biotopy našich obojživelníků a jejich management : Metodika AOPK ČR (2011). Vydání 1. Praha, 178 s., ISBN 978-80-87457-18-4.
Vojar J. (2007): Ochrana obojživelníků: ohrožení, biologické principy, metody studia, legislativní a praktická ochrana. Doplněk k metodice č. 1 Českého svazu ochránců přírody, 1. Vydání, Louny : Český svaz ochránců přírody, ZO Hasina Louny. 156 s. ISBN 978-80-254-0811-7.

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Table of contents

1. Standard purpose and content

1.1 Standard definition

Standard "Creation and restoration of pools" contains principles of optimal design, creation and restoration of pools. Pools formed naturally or without any antropogenous intervention are not included in this standard.
Pools are primarily designed for aquatic plants, amphibians and aquatic invertebrates. Not as water bodies for fish rearing.

1.2 Pool definition

Pools are field depressions permanently or periodically filled with water. It can be formed naturally (e. g. old channels in river alluvium) or artificially (by antropogenous intervention). Water sources for pools are mainly precipitation, surface and subsurface water flow (non-point outflow or centred outflow), groundwater, surface streams or water outlet from drainage systems. Pools are usually fully embedded above the surface level. There are no dykes or other technical equipment (water outlet, safety spillway overflow) and the maximal water level is set by the level of surroundings. The water outlet is built in natural way.

Pool bodies (wetlands) are meant only for the nature conservation purposes, mainly for the biodiversity support and increasement. Fish farming or poultry farming is strictly forbidden. Only specific fish stocks for ecological stabilisation are allowed (mainly for the invasive species suppression).

The area with water level reaching groundlevel or above, without water body creation is called wetland. Wetlands in Czech Republic are mainly peatbogs, spring habitats, reeds, waterlogged grasslands and forests, borders of water bodies and floodplains.

Small water reservoir (fishpond) is a hydraulic structure with dyke and technical objects (water outlet, safety spillway overflow). Water level in reservoir can be manipulated or drained completely.

1.3 Standard objective

This standard is intended primarily for applicants for support from landscape funding programs, secondly to planners, suppliers, agents of national and autonomy administration.

2. Legislative framework

Act No. 254/2001 of the Coll., on Water and Amendments to Some Acts (The Water Act), as amended, eg. provides what the hydraulic structure is (according to Provision Sec. 55 of this Act, the pool should not be counted as a hydraulic structure due to the absence of the dyke and technical objects - water outlet, safety spillway overflow etc.), further there are provided the cases of "Permission for water use" necessity.

Act No. 183/2006 of the Coll., on town and country planning and building code (Building Act), as amended, eg. determines the permissons necessary for building the pool (pools up to 300 m^2 size and maximal depth 1,5 m need neither "Decision on alteration of the use of the area" nor "Planning approval" nor "Building permit" nor "Building notification").

Act No. 185/2001 of the Coll., on Waste and the Amendment of Some Other Acts, as amended and Annex to Decree No. 257/2009 of the Coll., on the usage of sediments on farmland, determine the procedure of pool sediment deposition (excavated material).

Act No. 114/1992 of the Coll., on the Conservation of Nature and Landscape, as amended, regulates the water management with the objective to maintain natural conditions for life of aquatic and wetland ecosystems. And which preserves a natural character and semi-natural appearance of streams, water bodies and wetlands in landscape, mainly in specially protected areas.

3. Pool classification

3.1 Classification by creation techniques

Pools are classified as:

- manually excavated,
- mechanically excavated,
- made in alternative ways of excavation,
- non-excavated.

3.1.1 **Manually excavated pools –** This type of excavation is used mainly when very specific conditions for target species are needed, or if there are threats of damaging the present suitable conditions in the site. Secondly in cases when technique cannot be used (complicated access, damages to valuable surroundings, low bearing capacity of terrain).

3.1.2 **Mechanically excavated pools –** Standard methods. Various excavators with clamshell or loader buckets are used. The most suitable in general are crawler machines. In terrain with high bearing capacity it is suitable to use wheeled machines as well. In the case of large pools, pool systems or in slope terrain, exceptionally bulldozers can be used. These are not suitable for bottom modelling.

3.1.3 **Pools made in alternative ways of excavation –** Mainly blasting the soil belongs to the alternative methods. It cannot be used in heavily wet areas (due to drowning the blast). This method is considered as demanding in terms of legislation and can be realized by specialists only. Suitable are sites with areal blasting permission (near mines, quarries etc.). To prevent people entering the area, high staffing is necessary. Shape and indentedness of the pool can be modelled if the powderman is skilled. The advantage of pool creating by blasting is an absence of rutted tracks and that the soil is spread all around the area. The disadvantage is in faster renaturation of the pool and in the wash off of the blown banks.

3.1.4 **Non-excavated pools –** Includes mainly hollows, depressions, gullies, mined quarries or sandpits which are only shaped or artificially flooded.

3.2 Classification by flowing and suitability for particular animals

Pools are classified as:

- non-flow,
- bypassed flow,
- intermittently flow,
- flow-through.

3.2.1 **Non-flow pools –** This type is dependent only on precipitation or infiltration as water source. Water level in pool corresponds to groundwater level in surroundings. During the long droughts, pools can be dried up.

Temporary ponds are suitable for fairy shrimps (*Branchipus schaefferi*) or tadpole shrimps (*Triops cancriformis)*. More suitable are small and shallow pools in early stage of succession (puddles usually) without vegetation and frequently dried (more than 8 months per year).

Non-flow pools are suitable for animals stated in chap. 1.1. This type of pool is also suitable for Odonates. Due to their overwintering larvae, it is important to build deeper pools that do not freeze to the bottom. Larvae of some Odonates species are developping under the water for more than 3 years, so the pool must be deep enough and the presence of water must be secured for the whole year. The most suitable is to build more pools in various size and depth to support various animals with various biological demands.

3.2.2 **Bypassed flow pools** – This is a type of usually non-flow pools situated in locations not usually flooded. Bypass flow secures water supply due to the seepage. Bottom of the pool should be beneath the water level of bypassing watercourse. This type of pool is more suitable option for amphibians and Odonates than flow pools.

3.2.3 **Intermittently flow pools -** These pools are flow-through periodically or in some occasions during the year (after casual precipitations, snow melting or e.g. overflow). Due to this, water level and outflow in this type of pool must be stabilazed.

3.2.4 **Flow-through pools –** Source of the water for this type of pool is permanent. They are flooded by surface inflow, concentrated outflow from wellsprings or drainages, by inflow from water stream (naturally or artificially – this needs construction of weir for damming the source stream) or by subsurface source (drainage, streams). In this type of pool water level must by stabilized due to the permanent water outflow. This stabilization ought to be by suitable natural way.

Flow-through pools are suitable for e.g. crayfish. To fire salamander (*Salamandra salamandra*) suit for laying eggs and subsequent larvae development both flow-through pools and non-flow pools. It is suitable to build flow-through pools directly in small water courses with low water flow or in damaged drainage systems.

4. Technical bases for pool designing

In technical bases for pool designing following characteristics should be respected:

- Pool size,
- Pool shape,
- Indentidness of shores and bottoms,
- Water depth,
- Slope of the shores and bottom,
- Pool reinforcing,
- Litoral and epilitoral zone,
- Associated vegetation and pool solar access,
- Excavated soil deposition,
- Technical objects,
- Realisation date.

4.1 Pool size

Size of the pool depends on ecological requirements of target species. In general, the most suitable is the system of pools in various size and depths. Optimally, there should be pools in size from 1 m^2, to tens of m^2, to hundreds of m^2.

If the available area is large enough, it is suitable to build one large pool (over 100 m^2) and smaller pools (10 – 50 m^2) and some small ones (up to 10 m^2) on each site. A large and deep pool provides a non-freezing biotope for overwintering species and sufficient water supply during the long dry periods. Smaller pools correspond to specific requirements of target species.

When the area is limited, it is more purposeful to build more smaller pools even with limited depth from 0,5 to 0,6 m than one large pool. The presence of micropools is important on each site. Size of these micropools can be only several m^2 or smaller with the depth from 0,1 to 0,2 m. These micropools are suitable for shrimps and tadpole shrimps.

Size of the pool can be affected by ownership reations, as well as available financial means or size of the site.

4.2 Pool shape

Natural shape of pool should be always preffered. Despite the unnatural view, also some geometrical shapes as rectangles, trapezoids or circles can sometimes do the work (if there are e.g. enough shallow areas included). The most important is always diversity, indentedness of shores and bottom, length and character of diversified shore line.

In larger pools there is a possibility to build an island covered with vegetation for protected bird nesting.

4.3 Indentidness of shores and bottom

4.3.1 Pools should be spatial and depth indented (irregular shape) with natural character.

4.3.2 It is suitable to diversify the area of the pool as well as to create places with different depths. The pool must include shallow parts with quickly and easily warming water and deeper parts too. Shallow parts (with the depth up to 0,5 m) are essential in all pools and should create half of the pool area at least.

4.3.3 Gradually sloping bottom in 1:3 inclination or slower are suggested. This should provide gradiently changing conditions (temperature, insolation, dissolved oxygen etc.). But more suitable is to substitute the slopping bottom by stepped profile with step changes of depths in 10 to 20 cm. Gradients among the steps must not be vertical (sloping in 1:3 inclination or slower). Particular grades must slope into deeper parts to prevent amphibian larvae from getting stucked.

4.3.4 The bottom and shore area should not be regulated. Eventual irregularities are suitable environment with shelters for small animals. This can be reached by using a rock buckets when excavating.

4.3.5 Diversified character of the bottom can be reached by covering (at least one third) with bigger rocks, tree branches or stumps from close surroundings. Also bunches of local aquatic plants are suitable (beware concerning protected species). These elements increase a supply of shelter possibilities especially in newly created pools with lack of vegetation.

4.4 Water depth

4.4.1 Depth in pools depends on demands of target species variation for which the pool is created. Suggested are depths from 0,8 to 1m. Maximal practical depth is 1,5m. This provides non-freezing area at the bottom. Deeper pools have no biological reason.

Small shallow non-flow pools with removed sod in the surroundings and consequent maintaining pools in early succession stages are suitable for natterjack toad (*Buffon calamita*), green toad (*B. viridis*) and yellow-bellied toad (*Bombina variegata*).

Shallow pools with depth up to 0,4m and pools on the paths or near the roads with removed sod around are suitable for carpathian newt (*Lissotriton montandoni*), alpine newt (*Ichthyosaura alpestris*) and yellow-bellied toad. Maintaining the pools in early stages of succession is optimal as well.

4.4.2 It is suitable to create variously deep steps along the shore when excavating the pool to provide shallows even when the water level sinks. These steps should slope down to the deepest point of the pool to prevent the larvae to get stucked. Most of the pool area should be shallow.

4.4.3 Some pools on the site should be prepared for gradual drying during the year. This secure flow-through or intermittently flow pools. Permament maximal water level is considered as undesirable.

4.4.4 Maximal water level in pool is naturaly fixed by shore edge or by a low earth bank. Water level in flow-through pools can be fixed in many ways, but mainly as spilaway using natural materials (wood, stones).

4.5 Slope of the shore

Moderate slope of shores is required in most of the pools larger than 300 m^2. Minimal sloping area is one quarter of the pool in range from 1:10 to 1:20. Smaller pools do not allow such moderate sloping but it is suitable to create it at least on some parts (cca 20%) of the shore line. In general, the slope of shores should not be steeper then 1:3, otherwise it creates traps for animals with no possibility to escape from the pool. In any case, it is suitable to keep maximal heterogenity of slope gradients.

4.6 Pool reinforcing

Reinforcement of the pool is undesirable. In justified cases (e.g. in place of water outlet) local reinforcing is optional. In general, the areal overflowing of the pool is useful for increasing a groundwater level on adjacent sites. Bank reinforcing is in justified cases even necessary (e. g. path or building protection). But not all of the banks should be reinforced and the reinforcement should be in a natural way – e.g. ripraps, bulk stones, pickets etc.

4.7 Litoral and epilitoral zone

4.7.1 It is suitable to create moderate slope to the terrestrial surroundings at least on 20% of the shore line in each pool.

4.7.2 The most important in pools is litoral zone with depth from 0,4 to 0,5m. Each pool should have as much of these shallow zones as possible. Recommended range is one third of the pool area at least.

4.7.3 Very important is the presence of adjacent flooded and waterlogged zones, abb. epilitoral zones. This requirement can be sometimes supported by removal of sod connected to the shallow parts of the pool in the certain range.

4.8 Associated vegetation and pool solar access

4.8.1 Associated vegetation aroud the newly created pool and in its close surroundings should be modified according to shading or insolation requirements of major species. Disadvantage of pools with excessive vegetation is thea leaf fall which causes progressive dimming of water column.

4.8.2 To support aquatic animal biodiversity it is necessary to create and to maintain pools under full or major insolation. Such pools are preffered by most of the species.

4.9 Excavated soil deposition

4.9.1 The way of removing the soil from pool excavation depends mainly on the amount of excavated soil and on the terrain bearing capacity (soil removal issue). Around small pools it is possible to flatten the soil in small thickness (up to 10 to 15 cm). This must be realized with regard to conservation of specially protected

species of animals and plants and their habitats. An exception from prohibitions on specially protected species of animals and plants as referred to in paragraph 56 of Act No. 114/1992 of the Coll. is sometimes necessary to obtain. The area for soil flattening can be maximally of ten times the area of pool from which is the material excavated.

4.9.2 Low earth dyke creation is possible mainly in slope terrain as a protection measure against flooding from close streams. These waters can introduce unwanted fish in the pool. Earth dyke must be built in a natural way, maximally 0,5m high with gentle sloping both waterward and landward slope.

4.9.3 Higher amount of excavated earth must be transported out of the site. Leaving the excavated soil in the site (even flatten in layers – see 4.9.1) decreases a water holding capacity of alluvial plain. This has negative influences on flood protection of lower areas.

4.9.4 Transporting the excavated soil from the site is urgently required in case of its contamination (by toxic substances, mine drenaige water, water from industrial zones, housings and invasive plants or by their seeds). Recommended is to transport soil away in case of high eutrophication or degradation.

4.10 Technical objects

4.10.1 Technical objects in pools can include low earth bank, inflow device and device for water level holding. Safety spillaway overflow and outlet device are not usually planned in pools.

4.10.2 Using technical objects (dyke, outlet device and safety spillaway overflow) in pools is very rare and requires sufficient justification by interests of nature conservation.

4.11 Realization term

Creating a pool, maintaining it or restoring it should be based on a biological assessment of the locality or on results of a biological survey. The most suitable period for pool creating is from the end of August to the end of October, as it is out of the breeding season of amphibians. Alternatively, it is necessary to set the term with respect to presence of animal and plant species on the site. If there is no risk of damaging the site (including the wintering cycles), construction work can be realized in winter as well.

5. Maintenance and restoration of pools

5.1 Pool maintenance

Pool maintenance consists in:

5.1.1 partial removal of sediment for maximal technical and biological extension of pool,

5.1.2 natural seeding of shrubs removal and sensitive pulling out of plants from pool area. The aim is to increase the insolation of water surface which should provide warming of the water column and subsequent faster development of amphibian larvae. The other aim is to reduce a leaf fall and extend the lifetime of the pool. Recommended maintenance interval is once per 5 to 10 years.

5.1.3 repairing the device for water level stabilisation if needed,

5.1.4 creating, restoring or grass strips cutting along the shore line to prevent water debris sedimentation,

5.1.5 elimination of unwanted fish stock. Presence of fish stock is nearly always unwanted due to the priority purpose of pools. Potential presence of fish should be reduced by fishing, periodical drying up of the pool or freezing to the bottom. The presence of fish in newly created or restored pools should be regularly controlled (at least once a year),

5.1.6 It is necessary to respect the already stable biotope present on the site in all of the ways of maintenance, it must not be damaged.

5.2 Pool restoration

Creating a new pool should be always preferred to restoring an existing one, including the cases when the pool is almost filled with sediment (such pools serve as a biotope for many organisms e.g. amphibians in terrestrial stage). If there is no possibility to create a new pool in the surroundings, the original one can be restored. At least one fifth of the pool should stay in original state to keep process of succession of the biotope.

Restoration of pools is based on removing sediment and lightening the pools surroundings up. Also reducing reed or cattails vegetation is often necessary. Sediment can be removed in two ways:

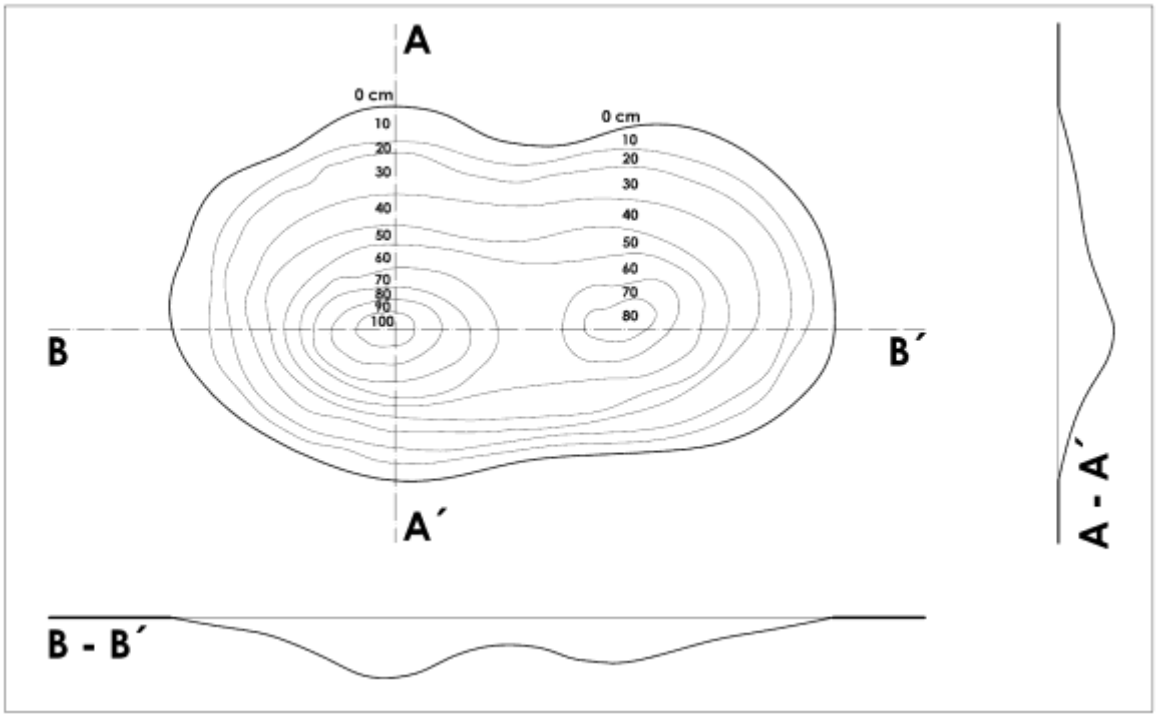
- dry method – complete drying the pool off is possible only by pumping the water out; but there are threats of filling back by water from the surroundings. Should be done during a period without necessity of animal transfer.
- wet method – without possibility to extrapolate the original bottom and shores. It makes the work more difficult and expensive. This method is applied when there is no possibility to pump off the water from the pool or when the water inflow is too heavy.

Lightening the pool surroundings up is realized by clearing the natural seeding away including its root system. The pool should be always carefully checked due to the amphibians and its larvae presence. These must be captured and tranferred on suitable place and released back when the pool restoration is over. This activity is subject to authorisation scheme according to Act No. 114/1992 of the Coll.. Reed vegetation

reducing will be realized by periodic cutting or mechanicaly by tearing 30 to 40 cm of sediment layer off. Chemical method of its elimination is definitely inappropriate.

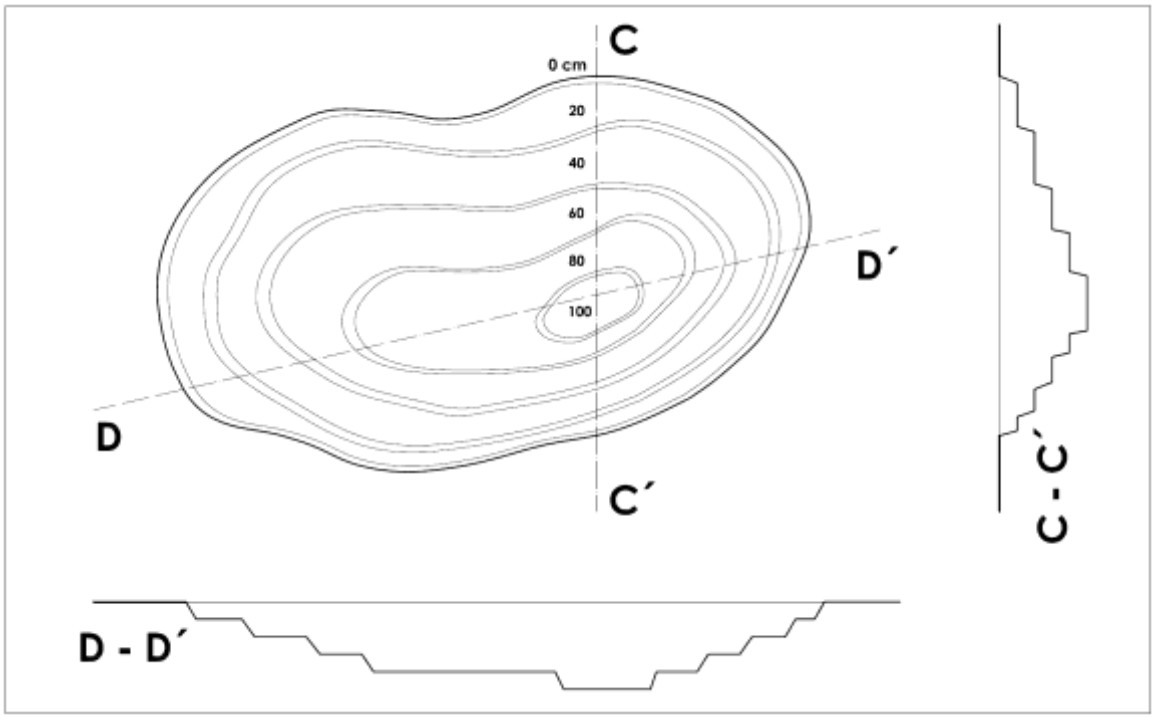
Appendix 1 Fig. – Pool with gradually sloping bottom

Pools require modified depth and modelling of the bottom. Gradually sloping bottom guarantees continuous connection between the close environment and the litoral zone of the pool. Fluent changing of conditions in pool is guaranteed as well.



Appendix 2 Fig. – Pool with stepped sloping bottom

Pools require modified depth and modelling of the bottom. Stepped sloping bottom guarantees differentiation from the close environment and also differentiation of conditions in pools themselves.



Appendix 3 List of processed Standards For Nature And Landscape Management (Water in landscape)

00	**General**
00 001	Terminology
01	**Controls, evaluation, planning**
01 001	Controls, evaluation, planning
02	**Technological processes**
02 001	Creation and restoration of pools
02 002	Obnova vodního režimu rašelinišť a pramenišť
02 003	Revitalizace drobných vodních toků a jejich niv
02 004	Péče o vodní toky včetně břehových porostů
02 005	Extenzivní hospodaření na rybnících
02 006	Fishpasses
03	**Occupational safety and health protection**

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