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Culvert components

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Culvert components and good design practice

- Culvert barrel
- Inlet structure
- Outlet structure
- Other design considerations

Culvert barrel

- Materials and types
- Constant cross-section and avoid obstructions, bends, etc
- Reasons for selecting single or multiple barrels
- Depress invert below bed level
- Sediment management
- Environmental considerations (fish, wildlife, amenity value)
- Operation and maintenance (access, desilting, etc)

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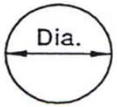
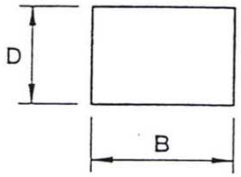
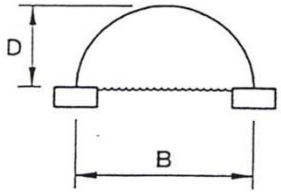
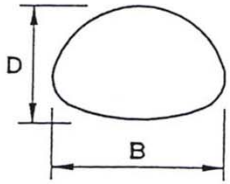
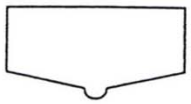
Typical culvert?

TYPE	SHAPE	MATERIALS	SIZE RANGE (dia or B x D) in metres MINIMUM	MAXIMUM
Pipe		Concrete Corrugated Steel Plastic Other	0.45[1]	2.4 8.0 0.6 n/a
Box		Pre-cast concrete In-situ concrete	1.0 x 0.6 See notes [2] and [6]	6.0 x 3.6 B <12.0
Arch		Corrugated steel Brick/Masonry/Concrete	1.8 x 0.9 B>1.5	12.0 x 8.5 B<12.0
Pipe arch		Corrugated Steel [3]	0.8 x 0.6	12.0 x 8.5
Complex		In-situ concrete Pre-cast with in-situ addition[4]	See note [2]	B<12.0 B<6.0

Notes:

(1) Minimum recommended diameter for any culvert.

(2) In-situ concrete minimum sizes limited by construction practicalities.

(3) Corrugated steel structures are available in a wide range of shapes and sizes.

(4) Pre-cast units are often supplied with features, such as low flow channel, incorporated.

(5) All shapes can be used in combination to form a multi-barrelled structure (see section 4.12).

(6) Standard culverts can be tall and narrow as well as short and wide (B<D) although this does not match channel hydraulics well.

Figure 4.3 *Culvert barrel size range*

Criteria \ Culvert Type	Plastic Pipe	Concrete Pipe	Concrete Box		Corrugated Steel
			In-situ	Pre-cast	
Small temporary structures	●	○	X	X	●
Aggressive groundwater conditions	○	●	●	●	○
Low headroom	○	○	●	●	○
Steep streams carrying heavy loads of coarse sediment	X	○	●	●	○(1)
Rapid construction important	●	●	X	●	●
Long term durability paramount	X	●	●	●	○
Multiple barrels required	○	○	●	●	●
Low costs very important (large culvert)	X	○	○	●	●(2)
Low costs very important (small culvert)	●	●	○	○	●
Thrust boring/jacking required	X	●	X	●	X

Legend

- ● Good/appropriate
- ○ May be appropriate
- X Do not use/not applicable

Notes:

(1) Will require additional protection of invert.

(2) Costs will increase if large volumes of material have to be imported to develop soil/pipe interaction.

Figure 4.6 *Culvert selection checklist*

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Steel culvert

Single or multiple barrel

Single barrel generally preferred, but multiple barrels offer the following advantages:

- Low flow channel can be provided
- Lower headroom possible
- Inspection and maintenance easier
- Wildlife migration route
- Better hydraulic performance

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Twin barrels

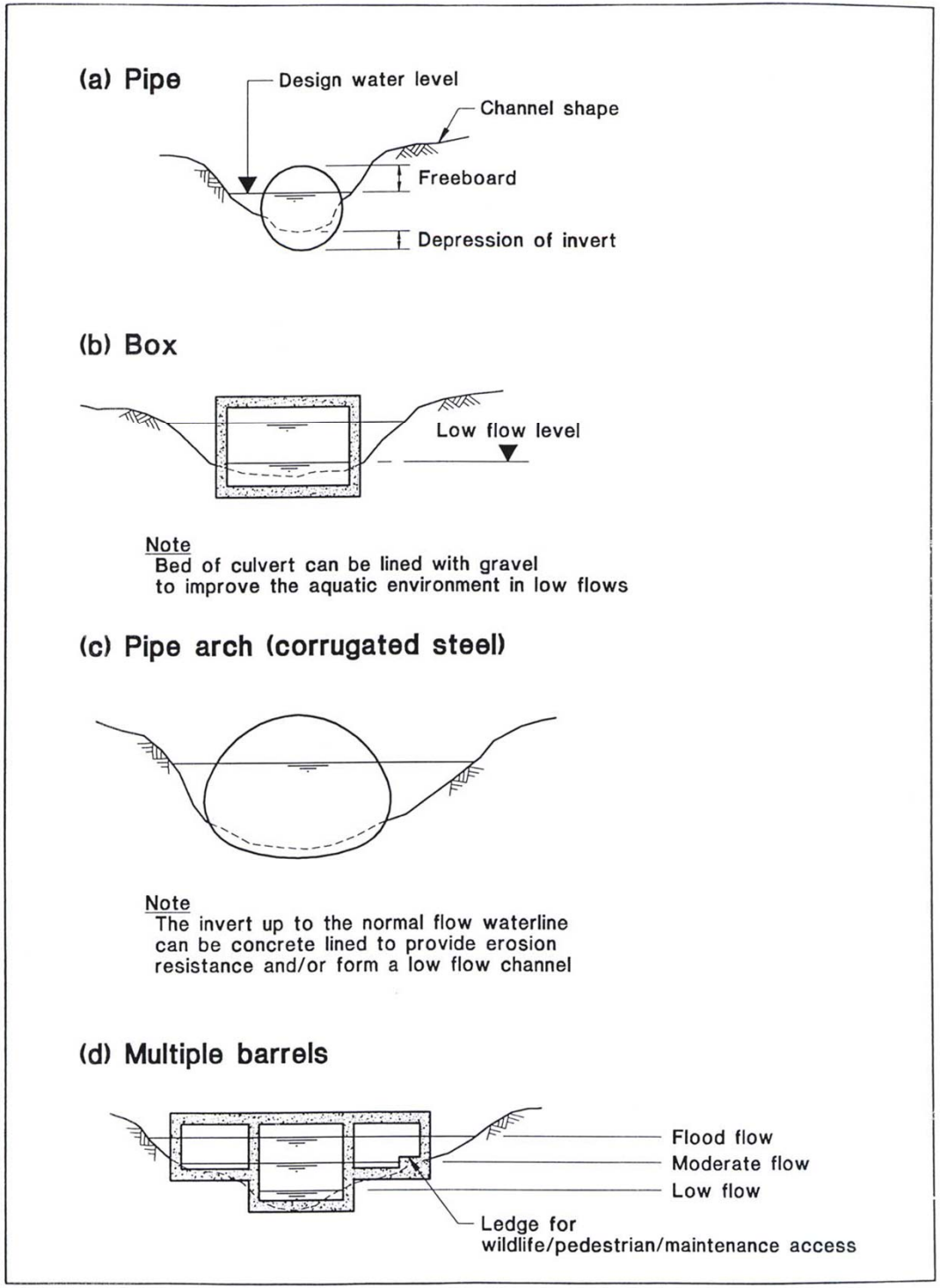

Figure 4.4 *Culvert barrel options (not to scale)*

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Wildlife provision

Why is an inlet structure needed?

- Provide smooth transition into culvert
- Accommodate scour
- Facilitate installation of trash or security screens
- House monitoring devices
- Accommodate bed level drop
- Facilitate maintenance (eg stoplog grooves)
- Maintain upstream water levels
- Possible need for a sediment trap upstream

Why is an inlet structure needed?

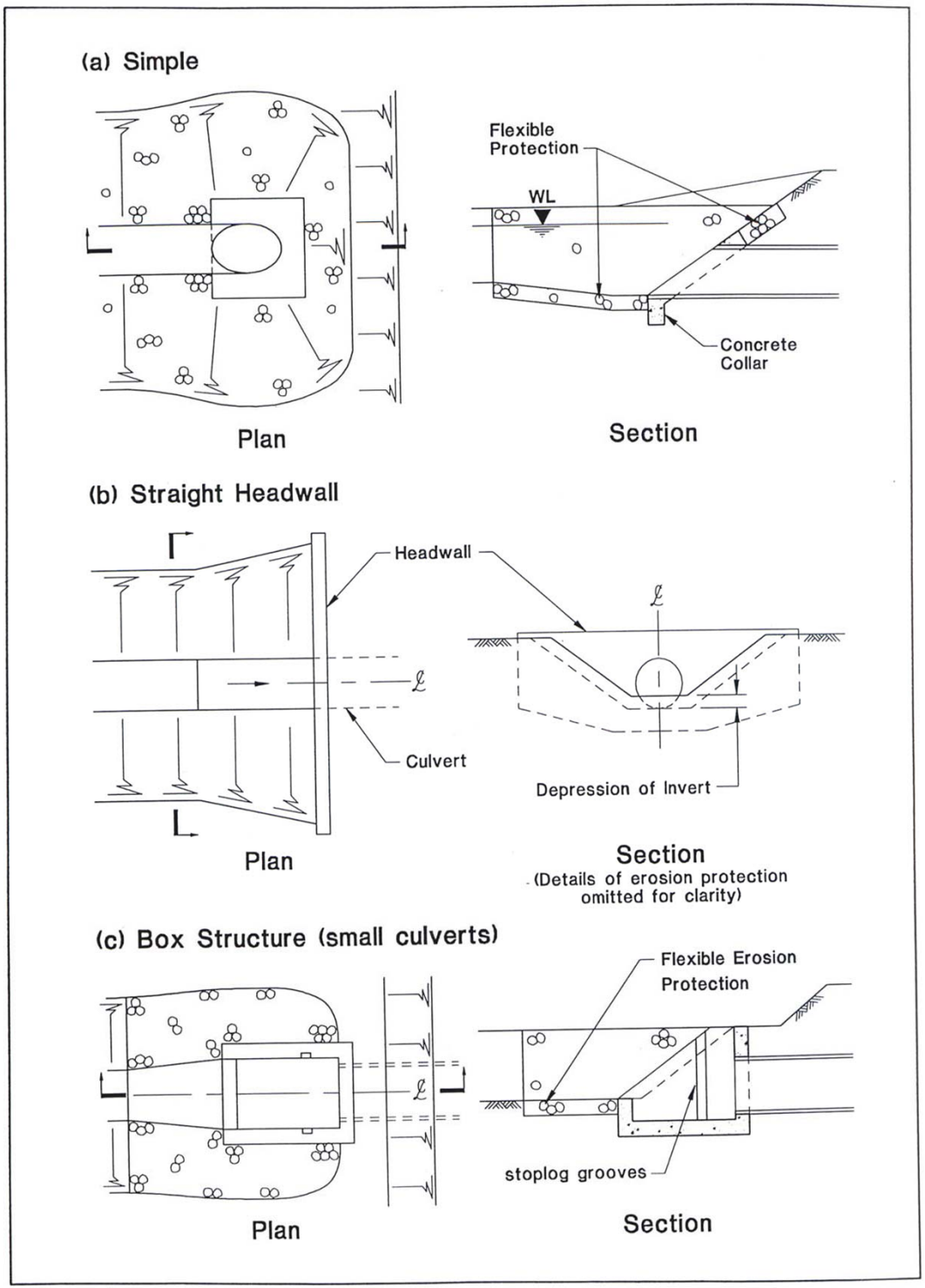

Figure 4.10 *Basic inlet/outlet options (continued over)*

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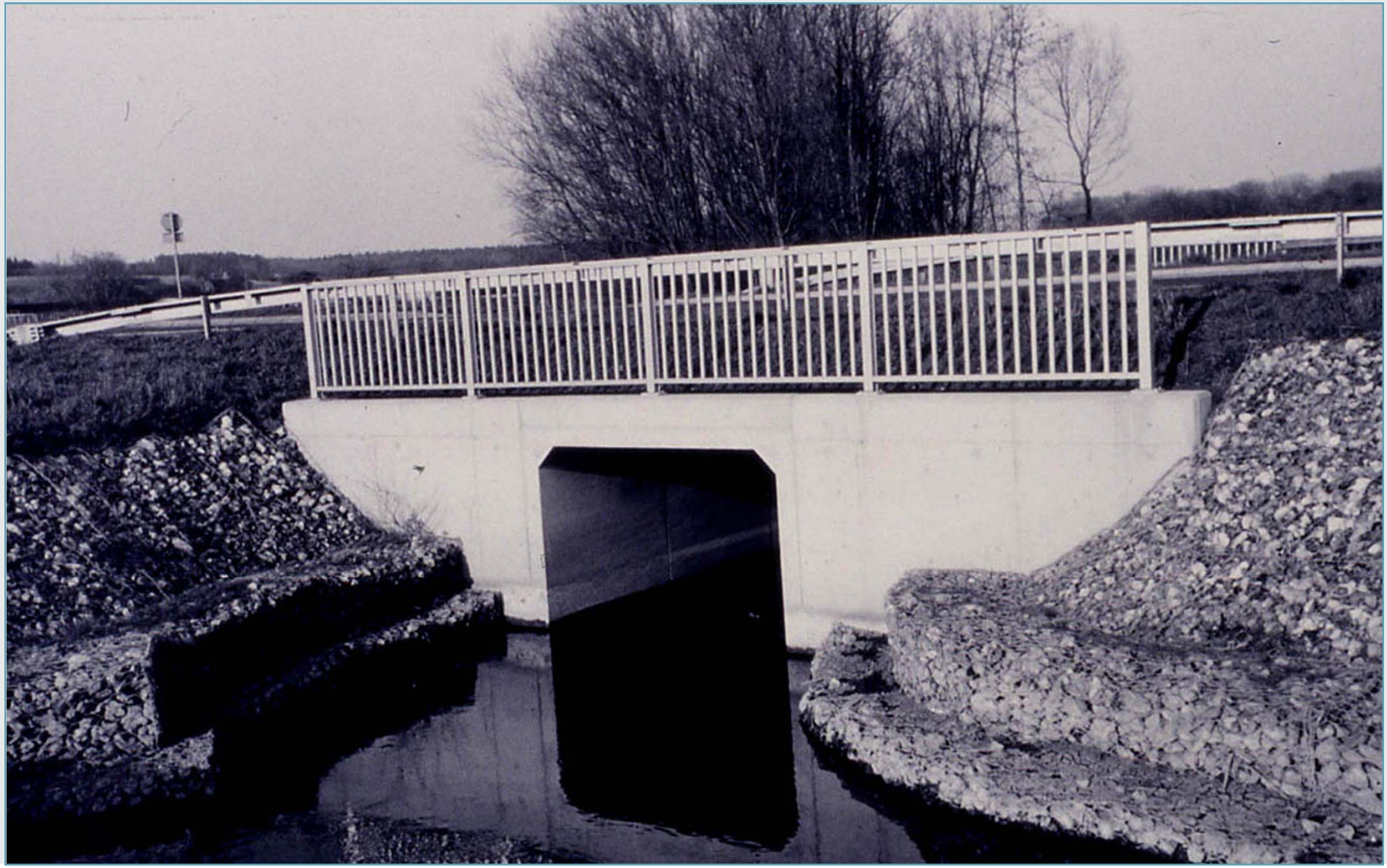
Inlet structure



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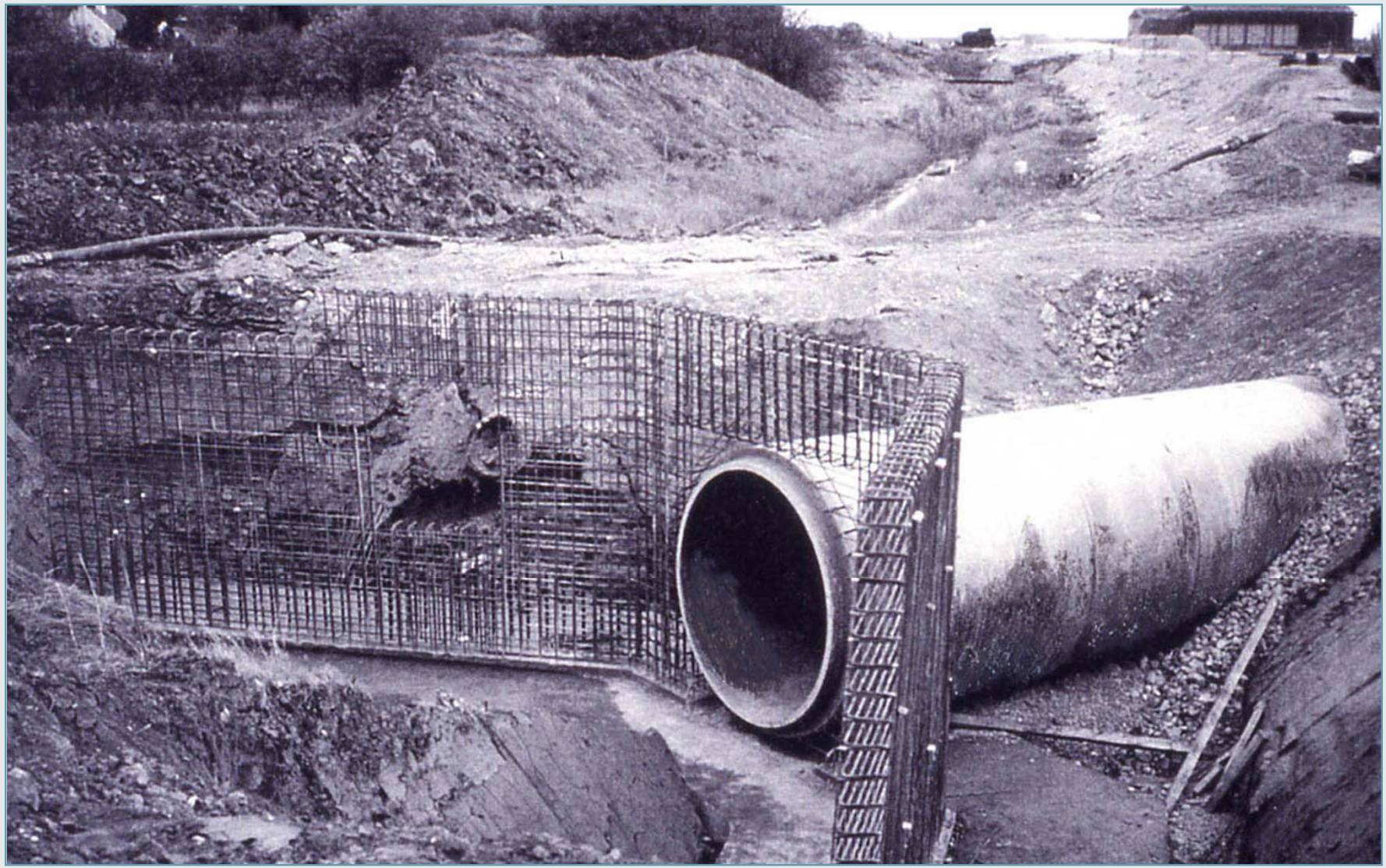
Inlet structure



Inlet screen

- Exclude trash or prevent unauthorised access
- Avoid wherever possible (risk of blockage)
- Large smooth straight culvert preferred
- Recommendations for screen design

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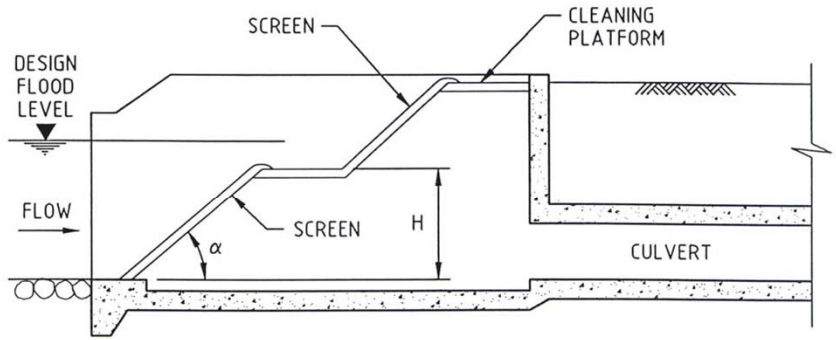
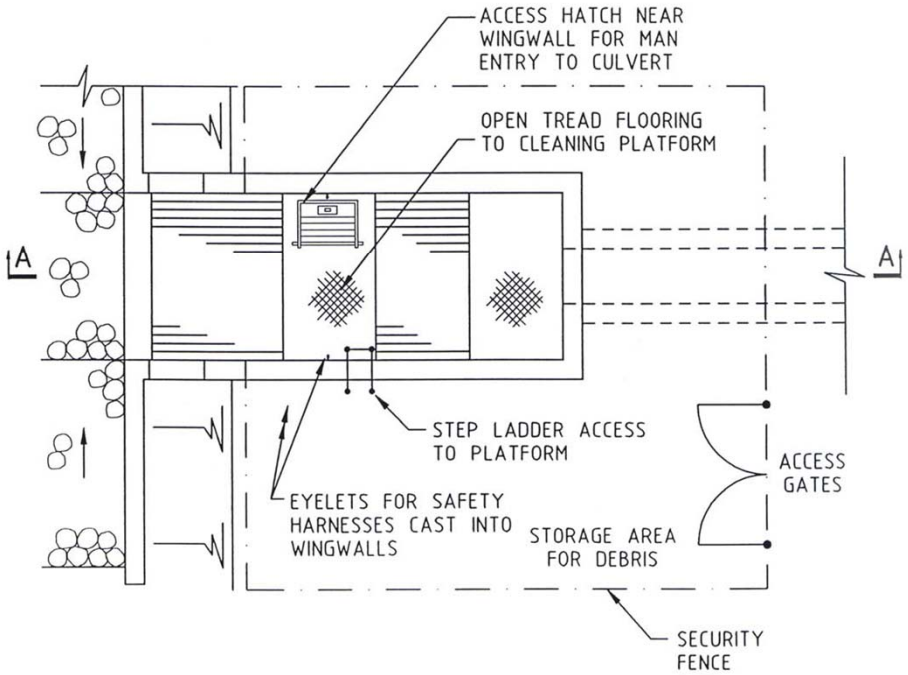
Drawing X.05 | TRASH SCREEN OR SECURITY SCREEN

FOR FURTHER DETAILS REFER TO DRAWING X.06



SECTION A-A
INLET STRUCTURE



PLAN VIEW

NOT TO SCALE

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Trash screens

Trash screens

Trash screens

Why is an outlet structure needed?

- Provide a transition to the channel downstream
- Energy dissipation
- Erosion prevention
- Flap gates
- Security screen

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Any questions?

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