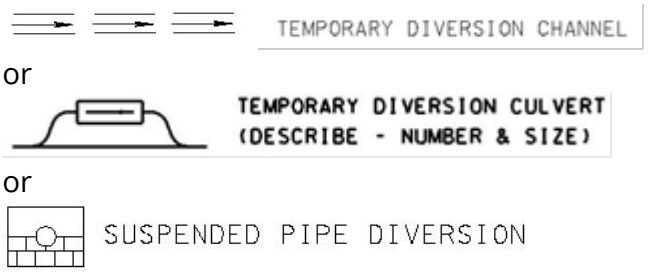
3.3.2.4 Temporary Stream Diversion



Source: TDEC

Definition and Purpose

Temporary stream diversions are implemented to redirect baseflow from active construction areas, such as bridges and culverts, allowing work to proceed in dry conditions. By isolating construction from the active flow of water, these diversions effectively minimize sedimentation and protect water quality, reducing potential environmental impacts associated with in-stream disturbances.

Appropriate Applications

Stream diversions are used where work in the stream is unavoidable and where the diversion will not cross an existing roadway where traffic is maintained (TDOT). This measure is best suited in low flow conditions. Often, a temporary stream diversion is used for smaller channels where baseflow can be entirely contained in a manmade channel, pipe or conveyed through a pipe temporarily.

Limitations and Maintenance

ALSWCC (2022) and TDOT suggest temporary diversions be constructed in drainage basins smaller than one and two square miles, respectively. Instream diversions may be better suited for larger streams where conveying baseflow is more challenging.

Installing instream diversions in jurisdictional waters requires additional permits, such as an ARAP, and therefore, both the conditions of the CGP and ARAP must be followed. A Section 404 permit from USACE may also be required. If the proposed diversion is to be completed

in a TVA reservoir, a TVA 26a permit may also be necessary. Consider the criteria and conditions of the necessary permits during the planning stages of the project and EPSC plans.

Inspect stream diversion channels at the end of each day to ensure flow control measures and construction material are positioned and adequately secured, thereby eliminating material waste downstream. All repairs should be made immediately. Dewatering practices used for the diversion will need to be maintained in order to function as intended (Section 4.4.12.2).

The maintenance for the different temporary stream diversions is type-specific:

Bypass pumps require routine maintenance to remain effective as a stream diversion. Conduct daily inspections to ensure proper pump operation, check temporary piping for leaks, and repair any damage to the impervious dike. The discharge point must be monitored for potential erosion, and flow should be confirmed as adequately diverted through the pipe. Bypass pumping may not be suitable when discharge locations cannot be stabilized, ponding to submerge the suction line is impractical, or the pump cannot handle normal flow within the stream.

Source: NCDOT (2003)

Suspended pipe diversions require regular inspections of the inlet and impervious dike to confirm no damage or leakage and to confirm proper flow diversion. Regularly clear sediment and debris from behind the dike and inlet to prevent blockages. The outlet must also be checked for potential erosion and to ensure the system is functioning effectively. Additionally, the inlet should be securely anchored and sealed to maintain stability.

Piped diversions require frequent inspections for any signs of damage or malfunction. Accumulated sediment and debris must be removed from the berm and inlet to maintain unobstructed flow. Monitor the outlet for erosion potential, and any diverted flow bypassing the temporary pipe must be addressed as soon as possible to prevent surface erosion.

Source: TDOT

Fabric-lined diversion channels require regular inspection for stability under normal flow conditions and following all rainfall events. Signs of displacement or failure must be addressed promptly. It is essential to ensure that earthen material does not come into direct contact with the water body to prevent contamination and maintain water quality.

Planning and Design Considerations

Disturbance within the confines of stream banks is required to be conducted during dry weather or separate from flowing water. Operation of excavation equipment is not to take place in flowing waters. Minimize the duration of the instream work as well as clearance of the stream- bed and banks.

Common temporary stream diversions include bypass pumping, suspended pipe diversions, piped diversions, and fabric-lined diversion channels. Diversions that use impervious dikes or berms require methods for potential stormwater entering the construction area, such as pumping stormwater from the work area to a sediment filter bag (Section 4.4.12.6) that is placed downstream near the top of the bank. Consider placing the EPSC measure outside of the designated buffer zone or at least the minimum buffer distance required in the CGP. Regardless of the type of stream diversion chosen, ensure the dimensions of the diversion can adequately convey the bankfull capacity of the stream (ALSWCC, 2022) or the required design flow, which is specified by either the CGP or local standards.

Use bypass pumping during low flow conditions to minimize land disturbance. This method involves using a bypass pump along with an impervious dike or berm to redirect water from an upstream section to a downstream section through controlled pumping. Since this process transfers water directly from one point to another, it is crucial to discharge at a low flow rate to prevent erosion at the outlet. Bypass pumping is most effective for short-duration construction activities that do not require prolonged water diversion. Construction specifications include:

- Set up bypass pump and hose. Place the hose outlet in such a way to minimize erosion at the discharge site or provide temporary energy dissipation measures. Consider anchoring the pump and hose;
- Construct outlet protection if needed for the diverted water so as not to create erosion;
- Construct an impervious dike or berm upstream of the work area to impound water for the bypass pump intake. Consider using a floating intake for pumps;
- Construct an impervious dike or berm downstream to isolate the work area;
- Check the operation of the pump system. Have an operation plan in place for when the pump will be run and who will manage it if it is not automatic; and

- Upon completion of construction, stabilize the work area in the stream and then remove the impervious dikes or berms, bypass the pumping system.

Use the suspended bypass pipe where an existing pipe or culvert is extended and is large enough to accommodate the bypass pipe. This bypass pipe is constructed inside the existing pipe or culvert to divert the watercourse through the construction area, thereby keeping the work area dry. Construction specifications include:

- Install a temporary pipe through the existing pipe or culvert to be extended. Place outlet of temporary pipe to minimize erosion at discharge site or provide temporary energy dissipation measures;
- Construct an impervious dike or berm upstream of the work area to divert flow through the temporary pipe. Anchor and seal the temporary pipe securely at the inlet;
- Construct an impervious dike or berm at the downstream side of the bypass pipe to isolate the work area; and
- Upon completion of the culvert or pipe extension and once the work area is stabilized, remove the impervious dikes or berms and the temporary pipe.

Temporary pipes are used to divert the small flows around the work area without the use of pumping operations. While the cost is higher for this operation than an open plastic-lined channel, the probability of sediment loss is much lower than with an open diversion channel. Use this practice where adequate slope and space exist between the upstream and downstream ends of the diversion. Construction specifications include:

- Install a temporary pipe adjacent to the work area. Excavation may be required to provide a positive drainage slope from the upstream to the downstream side;
- Connect the downstream temporary pipe to the existing downstream channel. Place outlet of pipe to minimize erosion at the discharge site or provide temporary energy dissipation measures;
- Connect the upstream temporary pipe to the upstream existing channel;
- Construct an impervious dike or berm at the upstream side of the existing channel to divert the existing channel into the temporary pipe;
- Construct an impervious dike or berm at the downstream side of the bypass pipe to isolate the work area; and
- Upon completion of construction, stabilize the disturbed area, then remove the impervious dikes or berms and temporary pipe**.**

A fabric lined temporary diversion channel is used to divert normal stream flow and small storm events around the work area without the use of pumping operations. The temporary diversion channel is typically constructed adjacent to the work area and is stabilized by lining

with a geotextile fabric (Type III) to minimize the potential for erosion within the temporary diversion channel (TDOT). Ensure the selected lining can withstand design velocities per Tables 3.3.2.1-A and 3.3.2.1-B, as well as per manufacturer specifications (ALSWCC, 2022). Geotextile linings alone may not be sufficient to prevent erosion. In cases where design velocities exceed two and a half feet per second, consider the use of conventional riprap or other structural linings in addition to geotextiles (TDOT). Use this practice where adequate space and slopes exist adjacent to the work area. Avoid creating steeper slopes than preexisting natural conditions. Consider alternative methods in summer months, as plastic linings can thermally enrich stream water. Though this is not a CGP requirement, many aquatic species in Tennessee are sensitive to thermal fluctuations. Construction specifications include:

- Excavate the diversion channel without disturbing the existing channel. Ensure the dimensions of the channel can convey the design flow. Refer to Section 3.3.2.3 to adequately size a channel;
- Place poly-fabric liner in the diversion channel with a minimum of 4 feet of material overlapping the channel banks. Secure the overlapped material using at least 1 foot of fill material. Ensure the liner and fill material can withstand the velocity of water during the design flow. Refer to Section 4.2.6.1 to adequately line a channel;
- Connect the downstream diversion channel into the downstream existing channel and secure the poly-fabric liner at the connection;
- Connect the upstream diversion channel into the upstream existing channel and secure the poly fabric liner at the connection;
- Construct an impervious dike or berm in the existing channel at the upstream side to divert the flow into the diversion channel;
- Construct an impervious dike or berm in the existing channel at the downstream side to isolate the work area and capture any construction stormwater;
- Dewater the work area of any construction stormwater through a sediment filter bag or similar, as needed;
- Upon completion of construction and stabilization of the work area, remove the impervious dikes or berms and divert the channel back into the newly constructed reach or culvert;
- Remove the poly-fabric liner and fill in the diversion channel to the previous grade unless new elevations are shown on the plans; and
- Establish vegetation on all disturbed areas.

Example Application

No formal design or quantities are required for most of the temporary stream diversions. For designing a fabric-lined diversion channel, refer to Section 3.3.2.3 for an example regarding the sizing of the channel and Section 4.2.6.1 for lining the channel.

References

ALSWCC. (2022). *Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas.*

NCDOT. (2003). *Best Management Practices for Construction and Maintenance Activities*.

TDOT. *Drainage Manual Ch10*. Retrieved from https://www.tn.gov/tdot/engineering-division/engineering-production-support/design-standards/drainage-manual.html