Practice Title

Gravel Management

Photo(s)

Photos of channel aggredation in the East Kill (left) West Kill (center), and upstream of an undersized bridge in the East Kill (right).

Summary of Practice

Gravel excavation has been a routine practice in attempts to alleviate flooding and property damage. The immediate results of flood water diversion or increased conveyance capacity (the amount of water a stream channel can handle) makes this practice a popular strategy. The factor that is often overlooked when using this method is stream channel stability.

Stream channel stability is a function of a number of physical parameters, one of the most important being the consistent transport of sediment through the system. All streams have a capacity to move the amount of sediment that the energy of water flowing downhill under the force of gravity can transport. Other factors excluded, it can be stated that a stream will remain stable as long as the volume of sediment entering a given reach of stream is in balance with the volume of sediment that is being transported through the reach. Otherwise, the stream bed will build up (aggrade) or scour down (degrade) and, in either case, result in increased rates of bank erosion and/or overbank flooding.

Impact on Stream and Floodplain Processes and Functions

The removal of gravel from stream channels has many effects on the morphology of the entire stream system. Deepening of the active channel causes incision by increasing the stream's energy and cutting down into the bed. The active channel often becomes disconnected from its floodplain, which leads to further erosion within the channel due to the higher concentration of

flow. During high flow events, gravel removal may result in less stream energy as a result of a larger channel and more conveyance capacity. Rarer flood events however will result in higher stream energy as the active channel no longer has access to its floodplain to disperse this energy. This could lead to catastrophic failure of the banks and possible avulsion of the stream.

Sediment transport plays an important role in the stability of a stream system. A balance must be present between the forces exerted on the boundaries and the resistance of the boundaries. This relationship is easily thrown off by gravel management and will likely result in problems upstream and downstream from the reach, and even further failure of the managed reach itself.

Further complicating the issue is the possible destruction of riparian and aquatic vegetation. Vegetation plays a very important role in the stability of a stream channels bed and banks. Manipulation of gravel within the stream often leads to destruction of this stabilizing vegetation. Disconnecting the stream from its floodplain also negatively impacts the plant and animal communities.

Impact on Your Property

The removal of gravel from a stream channel often results in incision of the channel. Once a reach has become incised and disconnected from its floodplain its flow energy and conveyance capacity increases and it is more susceptible to bank erosion. This could lead to property damage or loss during high flow events. A healthy functional stream channel must have ready access to its floodplain during high flow events or else the resulting increase in conveyance capacity will result in catastrophic failure during rare flood flow events.

Impact on Neighbor's Property

Changes in sediment transport and stream energy occur as a result of gravel management. When gravel is removed from a channel, further deepening of the channel as well as bank erosion often occurs. A similar process occurs upstream from the management reach as well, as waters feeding the newly deepened stream bed gain energy and cut into the bed. This often happens in an irregular pattern, creating alternating points of high erosion forces along the stream bed. As the stream bed erodes irregularly, erosion and flooding problems can spread even further upstream. Hence, the gravel management practices at your reach could lead to bank

failure and property loss for upstream neighbors as well. Downstream of the management reach all the eroded sediment collects. This restricts the channel flow, often causing extreme widening of the channel. This sediment deposition can result in property damage or loss during flood events for downstream neighbors.

Recommended Use

Gravel extraction may be most appropriate when performed to restore a natural stable pattern to a disturbed reach. An instance where gravel extraction would not be appropriate is where stream bed degradation is the primary cause of the instability, as gravel extraction would only exacerbate the problem. Gravel extraction in small channels is not recommended (due to their sensitivity) and management in large systems is only to be conducted if a well defined management plan is followed, which involves addressing issues of channel form and particle roughness, bed material gradation and structure, and the preservation of riparian vegetation and floodplain connectivity. Please contact info@catskillstreams.org to schedule a site visit from a local resource professional that can advise on the best options for your streamside.

Permits Needed

In-stream work will require a DEC Article 15 Stream Disturbance Permit. An ACOE permit is required when more than 25 cubic yards of fill material will be used below the "ordinary high water mark" (the approximate yearly flood level); the DEC can advise you about determining these limits.

Resources (Links, Articles, etc.)

http://www.mdc.mo.gov/conmag/2001/10/50.htm

http://mdc.mo.gov/fish/streams/gravel/

Photo Sources

New York City Department of Environmental Protection

Greene County Soil and Water Conservation District

Text Sources

The Center for Watershed Protection Aquafor Beech Limited & Step by Step. 1999. *Impact Assessment of Instream Management Practices on Channel Morphology.* Vermont Geological Survey Agency of Natural Resources Department of Environmental Conservation. Available on Web: http://www.anr.state.vt.us/DEC/GEO/watheda.htm.

Vermont Department of Environmental Conservation Water Quality Division, 1999. River Gravel Excavation: When, Where, and Why it Should or Should Not Be Done. Available on web: http://www.vtwaterquality.org/rivers/htm/rv_management.htm#analyzing.