

Andy: Here is a brief report of the fieldwork that I have carried out this season. Within two or three weeks I will send you the specific locations where I collected hellbenders. I need to get the appropriate 7.5 minute topo maps to mark the locations. As soon as I get them I will send you xeroxed copies.

I have not yet turned in my expenses for this summers field work. If at all possible, I don't want to receive my reimbursement during this tax year. Please let me know if holding off on submission will present any problem.

Best wishes

Art Hulse

SUSQUEHANNA DRAINAGE

OVERALL IMPRESSION

The Susquehanna drainage occupies parts of two major and two minor physiographic provinces in Pennsylvania. The major provinces are the Allegheny Plateau and the Valley and Ridge. The minor provinces are the Triassic Lowlands and the Piedmont. I have spent considerable time in both of the major provinces this summer and they appear to offer extremely different types of potential habitat for hellbenders. Shale is a major geological component of the Allegheny Plateau while sandstone and limestone tend to dominate in most of the Valley and Ridge province. These rocks tend to fracture differently. Shales often form large thin (thickness < 10% of the greatest diameter) slabs of rocky cover, while limestone and sandstone tend to form thicker and more rounded rocks. These more rounded rocks tend to become deeply embedded in the finer sediments of streams. A consequence of this is that the rock has no cavity under it, or opening that would allow animals easy access to the potential cover. Shales on the other hand tend to remain on the surface, with much of the rock free from the substrate. Cavities are present under these rocks and they generally have opening to the interior undersides that allow animals access to these areas.

Streams in the Valley and Ridge province, while often appearing from a distance to support excellent hellbender habitat, don't. The rocks by being deeply embedded provide scant habitat of hellbenders. Streams in the Allegheny Plateau generally have an abundance of thinner shale as cover and as a result provide more suitable habitat for hellbenders.

Relative to the Allegheny/Ohio drainage, the Susquehanna drainage appears to support many fewer populations of hellbenders even though the Susquehanna has a larger drainage area in the state. To this date I have examined 84 streams in the Susquehanna drainage and discovered or reconfirmed the existence of 6 populations of hellbenders. I have examined 75 streams in the Ohio/Allegheny drainage and discovered or reconfirmed the existence of 21 populations of hellbenders.

I believe that three things explain this difference in the occurrence of hellbenders between the drainages:

1. Hellbenders apparently entered the Susquehanna through stream capture. Due to the hellbenders low level of vagility and its tendency to remain for long periods of time in a very small area it is likely that some segments of the drainage have never been colonized by hellbenders.
2. Much of the Valley and Ridge province lacks sufficient suitable habitat to support viable populations of hellbenders.
3. Much of the West Branch of the Susquehanna (the area with the best habitat) has been incredibly impacted by our search for fossil fuels and by agricultural activity.

STREAMS OF THE GREAT BEND AREA OF THE SUSQUEHANNA

1- Starrauca Creek: Worked near the mouth upwards to Stevens Point. Above Stevens Point the stream is too small to possibly support hellbenders. There is some suitable habitat at the mouth and in vicinity of Stevens Point, but didn't find any animals. I would judge the stream to be marginal, based on amount of rock and size.

2- Hemlock Creek: This is a tributary of Starrauca Creek and is of insufficient size to support a viable hellbender population.

3- Canannacta Creek: A small feeder stream entering directly into the Susquehanna River in the Great Bend area. Too small for hellbenders.

4- Drinker Creek: Another direct tributary of the Susquehanna that is too small to support hellbenders.

5- Salt Lick Creek: A third tributary of the Susquehanna that is too small for hellbenders.

NORTHEASTERN SUSQUEHANNA DRAINAGE

1- Tunkhannock Creek: A very troublesome stream, both to work and to figure out. Upstream of South Gibson on SR 92 the stream is decidedly too small to support hellbenders. Below South Gibson the stream is of sufficient width for viable hellbender populations in some places, but not in others. In addition the nature of the substrate varies tremendously from one section to another, as does depth. Most regions from

South Gibson downstream to SR 374 don't appear to have enough rock to support hellbenders. I worked a few spots between South Gibson and SR 374 for hellbenders, but didn't find any and noted little really suitable habitat. Downstream of Nicholson there is more suitable habitat for hellbenders but didn't find any. This section is also very mixed in character. At a point just 2 miles downstream of Nicholson at bridge crossing Tunkhannock on T555 the stream is deep, heavily silted and the few rocks that are present are deeply embedded in the substrate. About another 2.5 miles downstream, near T458 the stream exhibits ideal habitat for hellbenders. Large flat rocks are numerous and there are some large rounded rocks that are deeply embedded in the substrate. I worked about 300m of stream and checked over 120 rocks. Crayfish are abundant and at this time of the year (June 1) females are carrying eggs. *Noturus* sp. Are abundant under the rocks as are a number of darters of undetermined species and genus. Aquatic insects are also abundant in the form of Ephemoptera, Plecoptera and Tricoptera. In all great habitat, but no hellbenders. This section is by far the most suitable habitat from this point upstream. I

I was unable to work further downstream at his time due to high water conditions. Will have to work section later this year or next. A brief perusal of the stream at several bridges suggests that there is suitable habitat. There is an older Carnegie Museum record for hellbenders from near the town of Tunkhannock.

2- East Branch of Tunkhannock Creek: Worked it at SR 407. Some nice rock, but not abundant. Turned about 35 rocks. Very few crayfish. Superficially appears to be viable habitat, but far from optimal. The stream rapidly becomes too small upstream of this point. Little probability that it supports, or supported hellbenders.

3- Martin Creek: From 2.5 to 1 mi S of 167 and SR 11 along SR 11 there is no rock of sufficient size to support a population of hellbenders. By the Village of Hop Bottom at SR 167 the stream is too small to support hellbenders. The stream just above its confluence with Tunkhannock, north of Nicholson needs to be examined.

4- East Branch of Wyalusing Creek: From Montrose downstream 5 miles along SR 706 the stream is far too small to support hellbenders. In addition it runs mostly through farmland, where rocks are unlikely to be large. To Lawton (11.8mi S of Montrose on SR 706) the stream still appears to be too small. Final assessment is that it can't support viable populations of hellbenders.

5- Middle Branch of Wyalusing Creek: Just off of SR 267 at the Village of Lawton the stream is less than 10m wide. There are a few suitable rocks, which I turned. A good population of crayfish exists. I turned 20 rocks, all that were there. No animals. I assume that the stream upstream of this point is too small to support hellbenders.

6- North Branch of Wyalusing Creek: Stream, Even where it enters mainstream of Wyalusing Creek is too small to support hellbenders population.

7- Wyalusing Creek: Potentially good habitat exists along Wyalusing proper between Sr 858 and its mouth where it enters the Susquehanna River. In Bradford County, 1.7m w. Of the junction of 706 and 858 along 706 the area looks very good habitat wise. Just upstream of the bridge at T599 over the creek is an area where large flat rocks are numerous. Area looks really good. I turned about 80 rocks. No hellbenders. I did see many *Noturus*, lots of darters and large numbers of crayfish, often gravid females holding eggs. A few rocks harbored populations of *Spongilla* sp. Doesn't appear to be any biological reason why hellbenders should not be in this area.

At a point 3mi north of the town of Wyalusing I worked the stream. Large number of very large rocks that could not possibly turned, by even a team of workers. I did manage to turn about 20 or 30 smaller rocks. No hellbenders. Crayfish and *Noturus* also present in this. There is still a possibility that this area may harbor hellbenders. I need to return when water is lower and I have my fiber optic scope to check under the immovable rocks.

8- Mehoopany Creek: By the time you get to the road leading to State Gamelands # 57 the stream is too small to support hellbenders. At the first bridge on Route 87 out of the town of Mehoopany there is some very large rock along a cliff face, but I doubt if it supports Hellanders, since it appears to be the only area where rock is present. Found very few crayfish.

9- North Branch of Mehoopany Creek: Too small, even at the mouth.

10- Meshoppen Creek: At the bridge just above the village of Lemon the stream is much too small to support hellbenders. I still need to examine the area downstream from there.

CENTRAL SUSQUEHANNA DRAINAGE

1- Sherman Creek: Parts of this stream support good populations of hellbenders. I took only a brief look at it this summer and want to survey it in greater detail next summer.

JUNIATA DRAINAGE

1- Beaverdam Branch: At SR 36 just below Holidaysburg there are no rocks and stream is of just barely sufficient size.

2- Frankstown Branch of the Juniata: Second rd going east from SR 36 S of Holidaysburg: Area doesn't look good, water very turbid, not much rock, small waste pipe spilling into the stream. Presumably from this point downstream the stream is inadequate due to pollution. **STILL NEED TO LOOK AT UPSTREAM SITES.**

- 3- Yellow Creek: Upstream of Loysville the stream is too small to support hellbenders also has very little rock, runs through farm country. In the vicinity of the Louisville Gap there is a moderate amount of rock, but mostly deeply embedded in substrate, rather silty, looks marginal. Have been told that hellbenders have been caught in this area. The habitat does not suggest that hellbenders would normally be found here. The area below Loysville Gap doesn't provide sufficient cover to support hellbenders. In most areas the stream flows gently over a substrate of sand and silt and attached aquatic vegetation is fairly common.
- 4- Raystown Branch of the Juniata: Water high when I worked (May 24) just downstream of Riddlesburg Bridge the stream looks good. Lots of nice rock etc. Need to work when the water is down. Have received an unsubstantiated report of them having been caught on hook-and-line at the town of Saxton. Worked Raystown Branch in the vicinity of Warriors Path State Park and Saxton. There is some suitable rock, but much of the rock is either too small or too deeply embedded in the substrate, with not opening along the margins. Collected several hundred meters of stream and didn't find any animals. They appear at least to be absent from this region of the stream.
- 5- Shade Creek: Just east of Orbisonia didn't find anything, stream looks rather marginal.. Appeared impacted where I worked it along SR 522.
- 6- Blacklog Creek: Worked near its mouth. Some nice rock (turned about 25 stones). Found lots of crayfish and some darters but not hellbenders. The stream rapidly decreases in size and upstream of the mouth area it is too small to support hellbenders.
- 7- Sideling Hill Creek: In the vicinity of New Grenada there is some suitable habitat, but the stream has been heavily impacted in the past.
- 8- Augwick Creek: At SR 522 bridge about 5 miles N of Orbisonia the water was high enough to make working difficult (May 24). However the stream looks like it may have some potential. There are good populations of mussels. The stream has ready access from SR 522 at several points. Will return in summer when water is lower. I have now worked the entire length of the stream. Above Orbisonia the stream is of insufficient size to support hellbenders. At SR 522 5mi N of Orbisonia there are a few rocks, but not enough in my opinion to support hellbenders. I turned all rocks in a 600m section of stream and found no animals. There does appear to be a fairly decent crayfish population and other fishes are abundant. At the mouth of the creek there is an abundance of rocks. However, no hellbenders were found in this area.
- 9- Standing Stone Creek: Just below Rural Electric Station on SR 26 the stream lacks sufficient stone, the same is true of the section of stream at the first bridge above the Rural Electric Station. The rest of the stream still needs to be looked at.

10- Juniata River: I managed to examine several portions of the Juniata while water levels were low enough to allow for collecting. No hellbenders were found. While there is much rock in the Juniata, the majority of it does not offer good habitat for hellbenders. It tends to be thick, somewhat rounded, and deeply embedded in the substrate so that there are no openings allowing entrance by hellbenders or other aquatic organisms. Crayfish, while present, did not seem overly abundant.

11- Little Trough Creek: Stream is too small to support hellbenders.

12- Great Trough Creek: There is good looking habitat in Trough Creek State Park, but hellbenders are lacking. Numerous large stones were turned along a 3 km section of the stream.

13- Kishacoquillas Creek: Near its mouth the stream appears to be mechanically impacted (lots of large rock in this area, but obviously not of natural origin). Most of the rest of the stream is either too small or lacks suitable habitat for hellbenders.

14- Little Juniata River: Most of this stream lacks suitable habitat. Rocks are of either infrequent occurrence or are too deeply embedded in the stream bed to allow for openings for animals. Above the settlement of Barre there is some large rock where the stream flows through some cliffs, however most of the rock appears to be in the stream due to human activity rather than natural processes and as such I doubt very highly if hellbenders are in this section of stream.

15- Wooden Bridge Creek: This stream is too small to support hellbenders.

16- West Licking Creek: This stream is too small to support a viable population of hellbenders.

17- Little Augwick Creek: This stream is too small to support a variable populations of hellbenders.

18- East Licking Creek: For most of East Licking's length it is too small, but for the last few miles it is of sufficient size, however in this area suitable cover items are absent.

19- Spruce Creek: For most of its length the stream is too small and lacks adequate cover to support hellbenders. Between the town of Spruce Creek and its mouth there are some suitable rocks and the stream is of sufficient size to support hellbenders, however no animals were found in this area.

20- Clover Creek: Lacks suitable habitat for hellbenders.

21- Little Buffalo Creek: Too small to support hellbenders.

22- Buffalo Creek: Too small to support hellbenders upstream of SR 849. Downstream of 849 the creek is large enough but contains little rock, has a generally sandy or silty substrate and slow flow. Overall marginal habitat at best.

23- Cocolamus Creek: The first mile or so of stream is of suitable size to support hellbenders and has some rock, but did not yield hellbenders. Overall I would say that it is marginal habitat. Most of the stream is too small to support hellbenders.

24- Tuscarora Creek: Most of the stream is unsuitable for hellbenders (i.e. slow flow, sandy bottom, little rock) however I was able to find a small population approximately. The entire site was less than 400m in length where the stream flows tightly against a cliff face with shale outcrops. In this area large pieces of shale have become dislodged and have fallen into the stream. Both up stream and downstream of this site the stream is broad, shallow, sandy and has extensive stands of submergent and emergent aquatic vegetation.

GENERAL IMPRESSION OF THE JUNIATA DRAINAGE: After working the Juniata drainage system it is my general impression that hellbenders are absent from most of it. Hellbenders may be present in the mainstream Juniata and its major tributary (Raystown Branch), but at extremely low densities. I have heard of three unsubstantiated reports of hellbenders being caught by anglers in the mainstream and Raystown Branch, but have been unsuccessful in finding animals in either of these streams. The main reason for my belief that they are absent is the lack of suitable habitat in most of the basin. Hellbenders spend most of their time under cover objects and make only occasional forays into the open. Their preferred cover is large flat slabs of shale that rest on the surface, or are only partially embedded in the substrate of the stream. The rocks that they prefer are large with average dimensions of 110cm by 78 cm with a surface area of 9092cm². The flat nature of the rocks assures that most of them rest on the surface rather than being completely embedded in the stream bed. This allows for opening into the interior of the rock that the hellbenders can use as entrances. Rocks without opening invariably lack hellbenders. In the Juniata drainage the rock in streams is mostly sandstone or limestone and tends to be much thicker relative to its surface area than the shales preferred by hellbenders. Because of the shape of the most are deeply embedded in the streambed rather than resting on the surface or being only partially embedded with adequate opening for movement in and out by hellbenders.

STREAMS OF THE WEST BRANCH OF THE SUSQUEHANNA DRAINAGE

For all intents and purposes the West Branch of the Susquehanna River from its source to a point below Lock Haven is devoid of hellbenders and most other aquatic life. The stream in this area has been heavily impacted in times past and present by mine drainage (high iron and reduced pH as well as domestic and agricultural waste). It has not recovered from this impact. Observations along much of this section (from its source to just up stream of Lock Haven) of the stream indicate that suitable habitat would have been present for hellbenders. As

a consequence of this I assume that the West Branch at one time held substantial populations of *Cryptobranchus*. This assumption is further strengthened by the fact that hellbenders still occur in the more pristine streams that feed into the West Branch. Among these are Kettle Creek, Little Pine Creek and Lycoming Creek. Some improvement in water quality occurs in the West Branch between Lock Haven and its confluence with the main stream downstream of Lewisburg, but it still doesn't appear to support hellbenders. However, I still have to work some of the West Branch near Lewisburg when water levels are lower.

1- Kettle Creek. Below the dam at Kettle Creek State Park, the stream has been impacted to the point that hellbender populations are absent. From above Kettle Creek Lake to Ole Bull S.P. hellbenders are present in the stream in virtually every area where there is sufficient suitable rock to afford them adequate shelter. The density of populations, however, does not appear to be very high. This observation is not based on detailed mark-recapture estimates, but rather on animals collected per man-hour of searching. At one time, at least, hellbender populations were fairly abundant, since a Pa Fish Commission survey crew in the 50's collected over 20 hellbenders in one section of the stream during fish survey work (Carnegie Museum records)

2- Young Woman Creek. The stream is too small to support hellbender populations and lacks sufficient rock.

3- Pine Creek. Above the Gorge there is a considerable amount of suitable habitat that looks excellent for hellbenders, however, extensive collecting in some of these areas failed to produce any animals. In questioning local fisherman, I found that none of them had ever heard of hellbenders being caught in the stream. I suspect that some past pollution event has extirpated them from this section of stream. Habitat just upstream of and within the gorge is basically unsuitable for hellbenders. I did manage to find one lone specimen of hellbender in Pine Creek below the gorge. It was located in mid-stream where Slate Run enters Pine Creek. In many areas the habitat looks suitable but no specimens were found.

4- Little Pine Creek. There is a substantial population of hellbenders in Little Pine Creek at the Lower Picnic area of Little Pine State Park. I found 15 animals in approximately 250m of stream bed. Above the impoundment at Little Pine S.P. the stream is too small to support hellbenders. The stream between the Lower Picnic area and its mouth at Pine Creek looks (when viewed from the road) like it contains much suitable habitat, but this entire area is heavily posted and has no access from the road.

5- Bennett's Branch of Sinnemahoning Creek. From the amount of rock in the stream it would appear that Bennett's Branch harbored substantial populations of hellbenders in the past, but extensive pollution has rendered the entire length of the stream unsuitable for hellbenders.

6- Driftwood Branch of Sinnemahonning Creek. I have worked this stream intensively and have not found any hellbenders, although the general habitat looks very good (i.e. lots of rock and an abundance of crayfish). Even though the stream is not of sufficient water quality to support a trout fishery, I suspect that in times past pollution had rendered it lifeless, thus eliminating the hellbenders that in all likelihood were in the stream.

7- Larry's Creek: The first two miles of this stream appear to be quality habitat for hellbenders (i.e. lots of nice rock and an abundance of crayfish) however intensive sampling in this area failed to produce any animals. Shortly above the point where Larry's Creek crosses SR 287 it narrows to a size insufficient to harbor hellbenders. It is possible that in times past this stream, like many others in the West Branch system harbored hellbenders.

8- Lycoming Creek: Above the junction of US 15 and SR 14 Lycoming Creek rapidly narrows to a size that is insufficient to support hellbenders. Downstream of US 15 however the stream is large enough to support hellbenders and contains more than adequate cover objects in the form of large pieces of shale. Just downstream from the village of Powys I collected 5 hellbenders in a 100m section of stream. All animals were small to medium in size.

9- Loyalsock Creek: Worked the stream at a number of locations between Hillsgrove and the mouth of the stream. No hellbenders were found. The stream along this stretch is large and appears clean, but in many areas it is very shallow and few areas appear to have a sufficient amount of rock. In those areas where rocks are present they are generally rounded, thick and deeply embedded in the substrate.

10- Little Loyalsock Creek: Worked along SR 87 between Dushore and Millview. In most areas rock of sufficient size and density was absent from the stream. The few areas where rock was present in sufficient amounts collecting failed to produce animals.

11- Slate Run: Too small to support hellbenders.

12- Cross Fork: Too small to support hellbenders.

13- Babb Creek: A small stream with little in the way of suitable rock. In addition the stream is degraded.

14- Beech Creek: This stream is heavily degraded, but looks like it would have supported substantial populations of hellbenders prior to pollution. There is an abundance of preferred rock in the lower reaches of the stream.

15- Fishing Creek: This stream is too small to support populations of hellbenders and also lack suitable habitat.

16- Little Fishing Creek: This stream is too small to support populations of hellbenders.

17- First Fork: Lots of habitat with sufficient rock to support hellbenders but extensive collecting in the stream has failed to produce any animals and a discussion with the Superintendent of Sinnemahoning S.P. did not provide any evidence of hellbenders being found in the stream. He could not recall ever having heard of anglers catching hellbenders. He further stated that earlier in the century First Fork was heavily impacted by tanneries.

18 Sinnemahoning Creek: This stream is badly impacted by acid drainage and iron, but contains otherwise ideal habitat for hellbenders. Prior to mining it is most likely that this stream contained substantial populations of hellbenders.

19- Bald Eagle Creek: The sections of the stream that I have examined (those in the vicinity of the dam and lake don't provide decent habitat for hellbenders.

20- Clearfield Creek: Prior to pollution this stream probably supported dense populations of hellbenders. There is an abundance of large suitable rock in the stream.

21- Moshannon Creek: As is the case with Clearfield Creek, Moshannon probably supported good populations of hellbenders prior to the events that caused such severe pollution.

22- Chest Creek: The stream near its mouth has ample cover for hellbenders and supports a viable population of crayfish, but I was unable to locate any hellbenders. While water quality in Chest Creek is adequate at present, it is likely that in times past it was impacted by mining, as were most of the streams in the upper reaches of the West Branch of the Susquehanna.

23- Marsh Creek: Stream lacks suitable habitat and has been polluted by organics.

24- West Branch of Pine Creek: Lacks suitable habitat and has been impacted.

25- Mosquito Creek: Lacks suitable habitat and has been impacted.

26- Black Moshannon Creek: This stream has suitable habitat, but like Moshannon Creek has been heavily impacted by mining.

27- Beaverdam Run: Too small

28- White Deer Creek: Too small.

29- Little Clearfield Creek: Has suitable habitat for hellbenders, but has been heavily impacted. Probably supported hellbenders in the past.

30- Trout Run: Too small.

31- Lick Run: Too small.

32- Laurel Run: Animals have been reported from the causeway by the dam. The rocks in this section are huge and it is possible that hellbenders live in this area, but it would be impossible to try to collect them except by setting baited lines. I have worked the stream in several areas downstream from the causeway and have been unsuccessful in locating hellbenders.

33- Mix Run: Too small.

35- Hammersly Fork: Too small

36- Hicks Run: Too small.

37- Hyner Run: Too small.

38- Medix Run: Too Small

39- Dents Run: Too small.

40- Wycoff Run: Too small.

GENERAL IMPRESSIONS OF THE WEST BRANCH. At one time the west branch probably supported many populations of hellbenders, but stream degradation due to mining, drilling, clear-cutting, agriculture and sewage disposal have rendered most of the streams in the region uninhabitable. Even those that have recovered from such degradation (e.g. First Fork and Driftwood Branch of the Sinnemahoning) do not now support hellbenders. This is due to the low vagility of hellbenders and the fact that the mainstream West Branch of the Susquehanna is still so degraded that no corridor exists for their re-entry into recovered streams.

38 1/2 PINE

UNITED STATES
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DEPARTMENT
TOPOGR
MANSFIELD J

77°07'30"
1°22'30"

124

125

5

126



Hoagland

Quiggleville

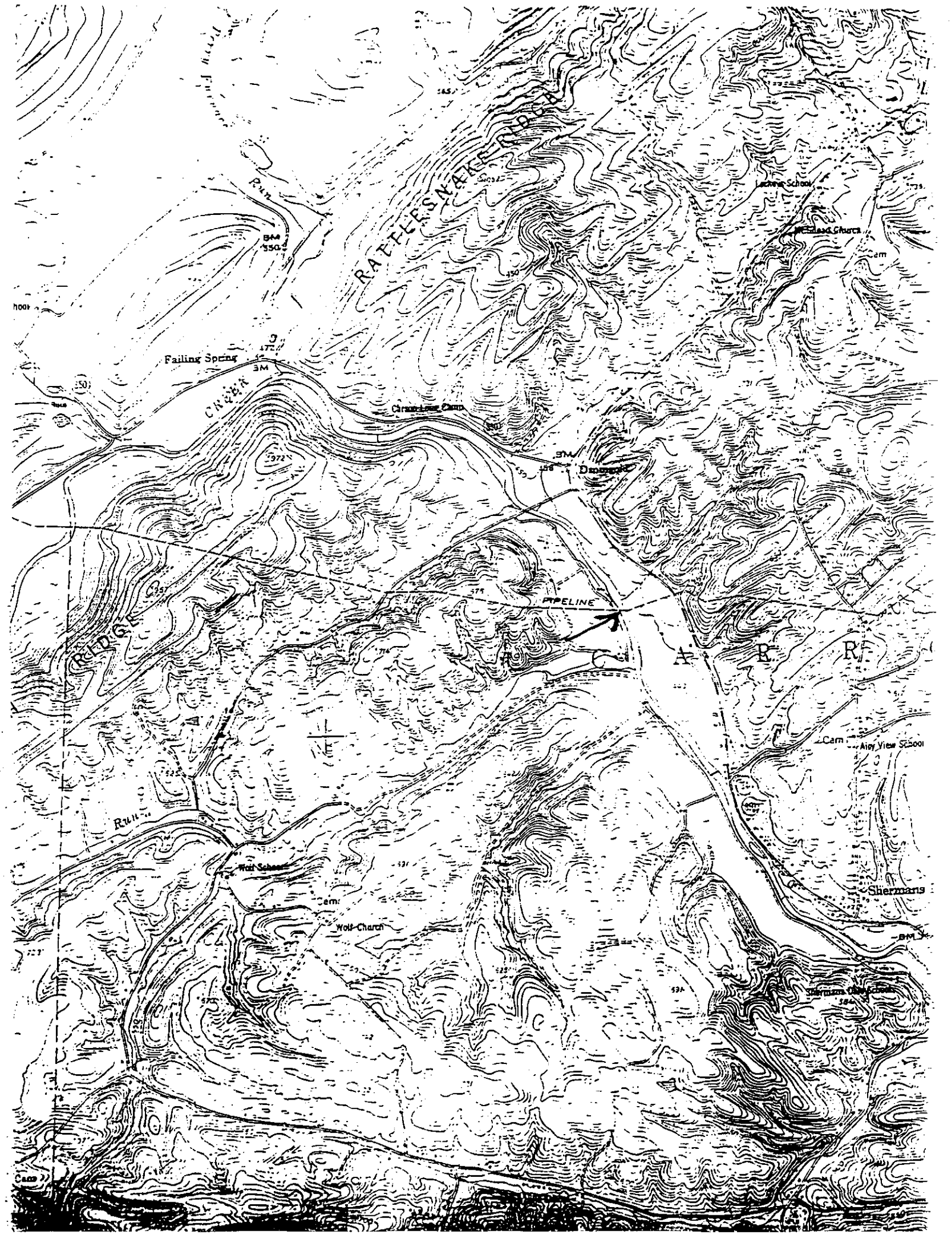
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SALISBURY CAV

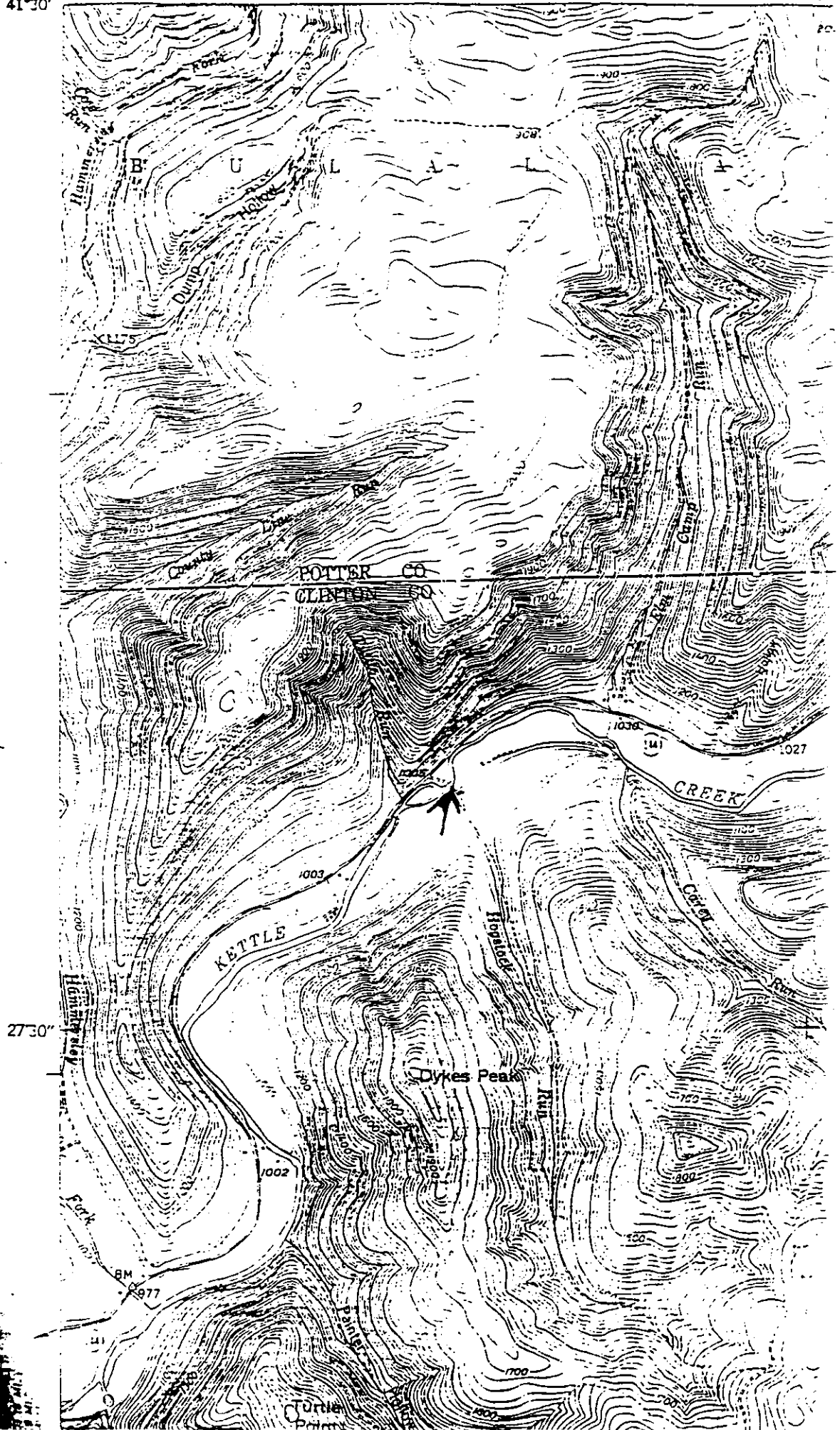
Cowan Station



77°52'30"
41°30'

GEOLOGICAL SURVEY

50'



27°30'

BM
977

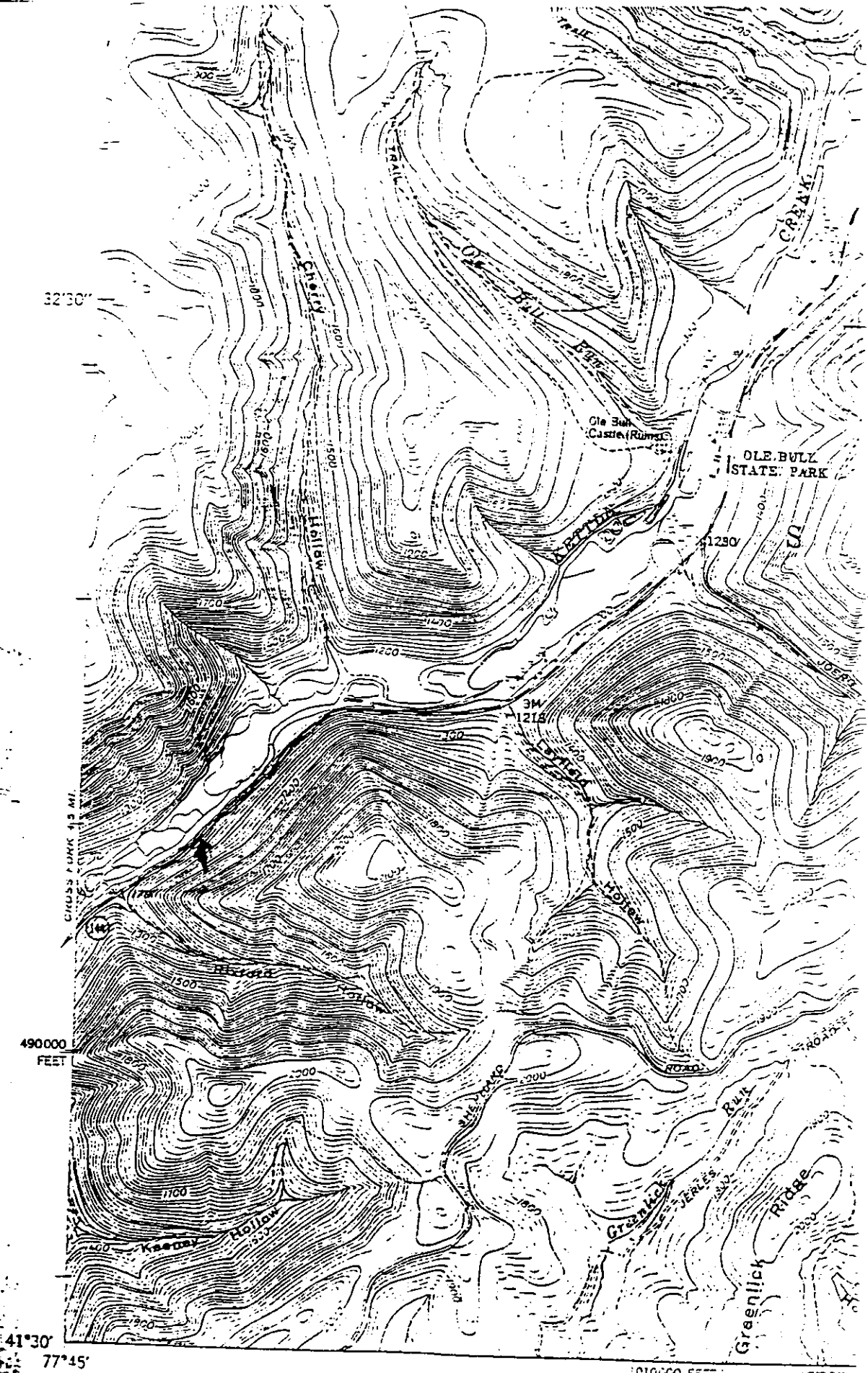
KETTLE

Dykes Peak

POTTER CO
CLINTON CO

CREEK

Curtis



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by multiex methods
 Aerial photographs taken 1945. Field check 1947

Publication 1950



INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1938

ROAD CLASSIFICATION

HARD-SURFACE ALL WEATHER ROADS		DRY WEATHER ROADS	
Heavy-duty	— 4 LANE'S LANE	Improved dirt	— — — — —
Medium-duty	— 4 LANE'S LANE	Unimproved dirt	— — — — —
Loose-surface, graded, or narrow hard-surface — — — —			
○ U. S. Route		○ State Route	

SHORT RUN PA.
N4130-W7745/7.5

1947

D. EQUEST

(YOUNG WOMAN'S CREEK)

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77° 22' 30"
41° 22' 30"

72000m E.

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71

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TY AND A G H T O N . S T A

ROAD

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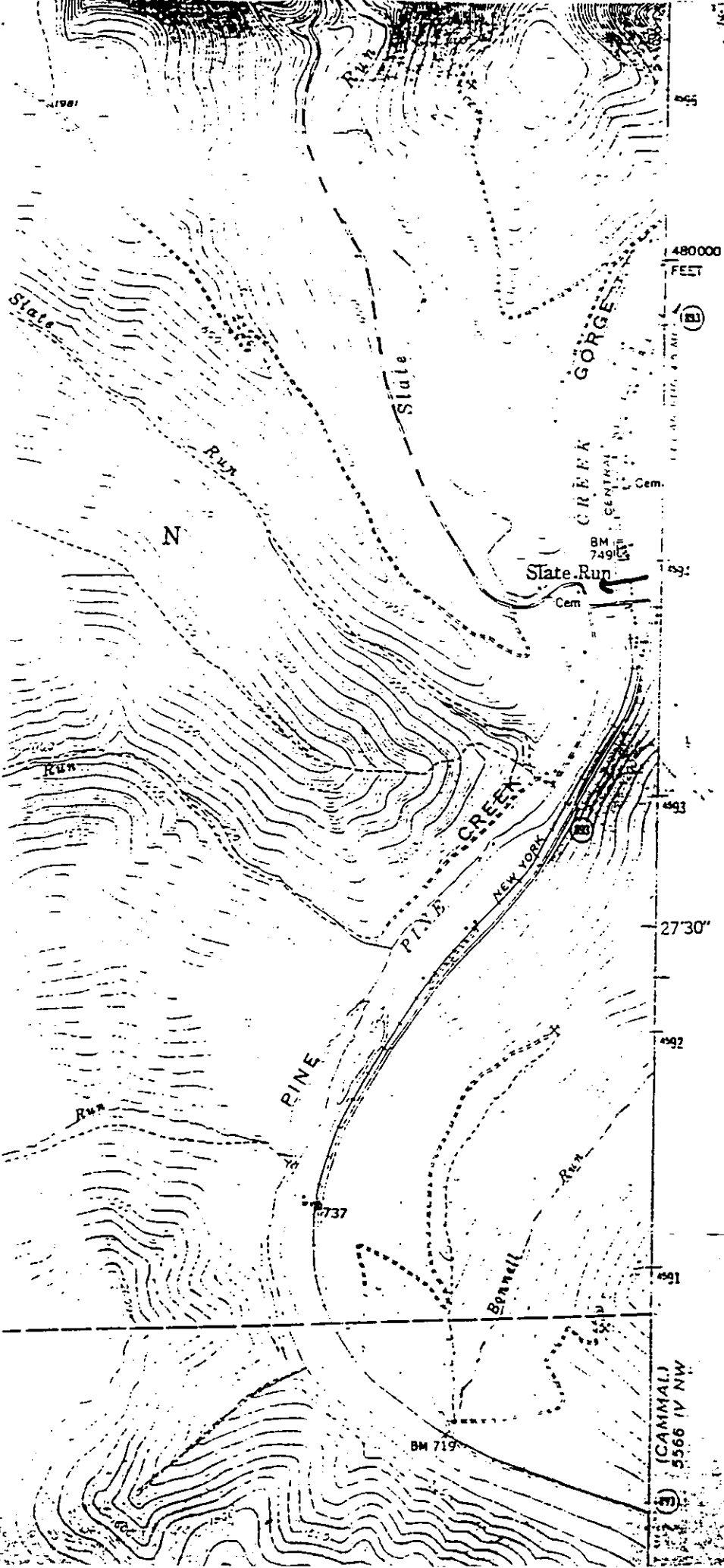
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Slate Run
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27°30'

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5566 IV NW

(E)

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253 (155)
(LEWISTOWN)



*Spruce Hill
Quad.*

*Tuscarora
Creek
77° 28' 38"
40° 28' 39"*

INTENSIFIED BY
MAY 1958
MAY 1958

Wate Run Quad

77° 30'

41° 28' 18"

Lycoming Co., Pine Creek at mouth of
Wate Run.

reek at mouth of

River.

Waterville Quad

77° 21' 26"

41° 21' 10"

Lycorning Co., Little Pine Creek at
lower picnic area of Little Pine State
Park.

Short Run Quad

77° 45' 46" 32"

41° 30'

Potter Co., Kettle Creek at bridge crossing
SR 144, 3 mi N. of Cross Forks

Oberon Quad

77° 44' 20"

41° 31' 15"

Potter County, Kettle Creek along SR 144
approximately 5 mi upstream from Cross Fork.

Cogan Station Quad

$77^{\circ} 5' 06''$

$41^{\circ} 26' 40''$

Lycoming Co., Lycoming Creek, road to

Poups ca 0.4 mi N₂ intersection with

US 15

FIELD WORK FOR 1995

- 1- **Fishing Creek just north of Harrisburg:** Most of this stream is too small. I worked a section where there was a little rock, but not a whole lot. That that was there was mostly deeply embedded in the substrate. Most rock was folded so that the strata were vertical rather than horizontal.

- 2- **Stony Creek:** At the mouth it is wide and very muddy with lots of *Nympha* growing along the margins. About 2 miles up at a powerline cut the stream is much smaller. There is plenty of rock in this section, but all of it is too small to harbor hellbenders. Much of the rock showed heavy staining from previous pollution. Stains yellow. Worked about 5 mi of stream (up to Ellenberg Rd). No decent rock. I talked to two anglers. Neither had seen or heard of any hellbenders being caught in the stream.

- 3- **Clarks Creek:** Worked about 5 miles of stream. No decent rock. Talked to an angler who said he had never heard of any being caught here. Also said that the stream didn't have any large rock. Along state game lands, 4.5 miles E of SR 225 and 325 I found a nice marshy area with *Hyla crucifer* calling, amplexed pairs of *Bufo americanus* along with plenty of eggs and small tadpoles, and about 80+ masses of *Ambystoma* eggs. Egg masses had either just recently hatched or still (in most cases) contained the embryos. Habitat looked great for *Clemmys guttata*, but I didn't find any.

- 4- **Powells Creek at SR 225.** Not enough rock of appropriate size. Lots of small rock, but nothing larger.

- 5- **Armstrong Creek.** Checked in a section where the creek runs right up against a hillside. Even here had only about 15 rocks in a section of stream greater than 150m in length. None of these rocks were more than 75cm long. Didn't see any crayfish. Indeed, crayfish appear to be rather scarce in all of the streams that I have checked today (i.e. Powells, Fishing, Stony and Clarks).

- 6- **Wiconisic Creek.** Nada. Didn't look at all good.

7- Mahantanga Creek. Just east of Pillow. Some habitat, but didn't see any animal. Should maybe work a little more. Talked to some anglers none(3) had ever caught or heard of hellbenders being caught in the creek. Two knew of them being caught in the mainstream Susquehanna and two had caught, or seen them caught in Penns Creek. One said he had never seen an individual over 20 inches long. Area just below Pillow looks fairly good with lots of rock and plenty of crayfish but I didn't find any animals. Did see a painted turtle, a bundle of Bufo larvae and an adult green frog.

8- Fishing Creek. Must have checked this stream at about twenty different places. In all but one of them there was not sufficient habitat to support hellbenders. At Colc's Mill there was some nice rock, but didn't find any hellbenders, nor did I see many crayfish.

9- Huntingdon Creek. At Twin Bridge Road (near the mouth of the stream. There was some nice rock, turned about 50 [pieces and worked about 150m of stream but didn't see any hellbenders and only saw a very few crayfish.

10 Little Fishing Creek. No decent rock at the mouth of the stream, nor is there any decent rock further upstream.

11- Little Muncy creek, no rock of appropriate size.

12- Muncy Creek. Very little rock of appropriate size. Talked to a fisherman.

13- Wysox Creek. At first road off of SR 187, N of US 6 there is very little rock of any size and even the largest rock was smaller than what I usually find hellbenders under. At 187 and 467 there were a few rocks, but I think that they may be the result of construction along 187 since it runs within a few meters of the creek at this point.

14- Wapassing Creek. No rock of suitable size to support hellbenders.

15- Little Wapassing Creek is not of sufficient size to support hellbenders.

16- Sugar run Creek too small for hellbenders

17- Tuscarora Creek is too small for hellbenders.

18- Bowman's Creek. Only a few sections had any rock. In these sections the rock was sporadic in occurrence and too large to lift. Doubt if hellbenders occur in this stream.

19- Harveys Creek is too small to support hellbenders.

20- Schwaben Creek too small to support hellbenders.

21- Mahanoy Creek badly polluted. Some areas have rock.

22- Little Shamokin Creek is too small to support hellbenders.

23- Shamokin Creek is heavily polluted and unable to support hellbenders.

24- Catawissa Creek polluted.

25- Little Juniata River. Worked this in several areas from near its headwaters to close to the mouth. Very little in the way of suitable habitat. In most areas the substrate is either composed of cobble and rock too small to harbor hellbenders or if large rock is present it is in the form of limestone chunks that are very thick and become deeply embedded in the substrate with no way for hellbender to gain entry.

26- Shaver Creek lack suitable habitat.

27- Standing stone creek doesn't live up to its name. Very little in the way of suitable rocks. Much of the stream has a muddy bottom and where the substrate is rocky they are too small for hellbenders. In addition a long time native of the area (Dr. Bill Brennerman, an Ichthyologist) says that he has never heard of hellbenders being taken in the stream.

28- Buffalo Run is too small.

- 29- **Bald Eagle Creek.** Lacks suitable habitat.
- 30- **Spring Creek** marginal in habitat, didn't find any animals.
- 31- **Sinking Creek.** Too small.
- 32- **Little Clearfield Creek.** Worked several sections of the stream in the vicinity of Odanal. In most areas there was not sufficient large rock to support a population of hellbenders, however, one area was perfect habitat. I failed to find hellbenders in any of these areas. There is a very good population of crayfish, aquatic insects are abundant and fish are common.
- 33- **Sinnemahoning Portage Creek.** Some good habitat at the beginning of the stream (first couple of miles) and then too small. At the beginning plenty of crayfish etc. Looks like nice habitat. No hellbenders
- 34- **Freeman Run.** Basically too small along its entire course.
- 35- **East Fork of Sinnemahoning Creek.** First couple of miles supports decent habitat and crayfish, but no hellbenders.
- 36- **West Branch of Pine Creek.** Too small for hellbenders. Where it enters Pine Creek it is all fucked up due to flood control activities.
- 37- **Hyner Run** is too small.
- 38- **Tangacosta Creek:** Too small
- 39- **Big Run:** Too small
- 40- **Antes Creek.** Even at the mouth it is basically too small and there is insufficient rock to support hellbenders.
- 41- **White Deer Hole Creek.** Some rock, but doesn't appear to be sufficient in amount to support a decent population of hellbenders. As one nears the mouth the creek becomes progressively more and more sluggish with a mud bottom. Definitely not hellbender habitat.

42- **Lycoming Creek.** Some habitat above SR 15 appears to be good. Collected some of these areas and didn't find any animals. Looks like much of the rock was dislodged during the course of road building and as a consequence has not been there long enough to attract hellbenders.

43- **Rock Run** is too small.

44- **Roaring Run** is too small.

45- **Seeley Creek** is too small to support hellbenders.

46- **South Creek** is too small to support hellbenders.

47- **Snake Creek** lacks sufficient habitat to support hellbenders.

48- **Cedar Run** is too small to support hellbenders.

49- **Texas Creek** is too small to support hellbenders.

50- **Stony Fork** is too small to support hellbenders.

51- **Mill Creek** is too small to support hellbenders.

52- **Bentley Creek** is too small to support hellbenders.

53- **Pleasant Run** is too small to support hellbenders.

54- **Nescopeck Creek.** Stream carries an incredible load of a black suspended material that settles out along the shore line at the high water mark. Looks like it might be coal dust. I can't believe that the damn thing is listed as Approved trout Water. It looks like it might have been able to support hellbenders in the past based on the size and the amount of rock present in the stream.

55- **Chilisquaque Creek.** Stream is too slow moving and muddy to support hellbenders

- 56- **South Branch of Codorus Creek.** No suitable habitat, flows primarily through a wide floodplain.
- 57- **Codorus Creek.** Generally flows through a broad floodplain, little to no suitable habitat.
- 58- **Little Conewago Creek.** No hellbenders, some rock, but not very much.
- 59- **Conewago Creek.** In that section of the stream large enough to support hellbenders the habitat is unsuitable. There is some rock in sections, but the stream is heavily silted
60. **Yellow Breeches Creek.** Checked this stream in several places. Generally it flows through a rather wide floodplain and the substrate is mostly gravel or mud. I didn't find any suitable habitat.
61. **Fishing Creek.** I returned to this stream when the water was low and worked the area in the vicinity of Rupert's Covered Bridge near the mouth. Found hellbenders.
62. **Roaring Creek.** Lots of habitat for the first few miles, after that stream becomes inaccessible (posted, etc.) so I can't vouch for habitat above. I didn't find any hellbenders, but the habitat looks good. Many of the rocks are exceedingly large and thick and would take several people to move. Hellbenders have been reported to me from the lower reaches of this stream and I have every reason to believe they occur here even though I didn't find any. The size of the rocks makes it unlikely to collect animals if the population is small in number.
- 63- **Conodoquinet Creek.** For most of the length of the stream where it is large enough to support hellbenders the stream lacks suitable habitat.
- 64- **Little Chickes Creek.** Too small.
- 65- **Chickes Creek.** Flows through a broad floodplain with virtually no suitable habitat for hellbenders.

66- Pequea Creek. No suitable habitat over most of its length. Very deep at the mouth.

SUSQUEHANNA DRAINAGE OVERALL IMPRESSION

The overall impression that I developed by the end of the 1994 field season has not been changed by subsequent field work in 1995. The Susquehanna is the largest drainage in the state and occupies parts of two major (Allegheny Plateau and Valley And Ridge provinces) and two minor (Triassic Lowlands and Piedmont) physiographic provinces that occur in the state. I have spent considerable time in all of these, with of course, major emphasis on the two major provinces. All four of these offer very different potential habitat for hellbenders. Shale is a major geological component of the Allegheny Plateau, while sandstone and limestone tend to dominate in most of the Valley and Ridge province. Both the Triassic Lowlands and Piedmont are regions of relatively little topographic relief, except in the immediate vicinity of the mainstream Susquehanna where a relatively deep channel has often been cut. In both of these regions the soil tends to be very well developed and most streams tend to meander through fairly broad floodplains with little exposed rock. Hellbenders absolutely require abundant cover objects in the streams that they inhabit in order to support viable populations.

Sandstone and limestone tend to fracture differently. Shales often form large thin (thickness <10% of the diameter) slabs of rocky cover, while limestone and sandstone tend to form thicker and more rounded rocks. These more rounded rocks tend to be come deeply embedded in the substrate of the streams. As a consequence of this the rocks have no cavity under them, or opening that would allow hellbenders access to potential cover. Shale, on the other hand, tends to remain resting on the surface, with much of the slab free for the substrate. As a result shale usually have cavities under them and entrances leading to the cavities. This makes them highly suitable cover rocks for hellbenders.

By and large the streams feeding into the Susquehanna River from the Piedmont and Triassic Lowlands lack suitable rock to support populations of hellbenders. As mentioned above most of these streams flow through regions of relatively low relief with well-developed soils. Generally substrate in streams in these provinces are either muddy or composed of fine sands and gravel and have a minimum of rocky cover.

This renders then unsuitable for hellbender populations. The best chance for hellbenders in these regions would be near the mouth of the streams in those cases where the streams cut steep channels to reach the mainstream Susquehanna. These areas of increased relief however are usually very steep and of relatively short distance.

Streams in the Valley and Ridge Province, while often appearing, from a distance, to support excellent hellbender habitat, don't. The rocks, by being deeply embedded provide scant habitat for hellbenders. Two notable exceptions to this are Sherman Creek and the lower reaches of Tuscarora Creek.

Streams in the Allegheny Plateau generally have an abundance of thinner shale as cover and as a result provide suitable habitat for hellbenders. The West Branch of the Susquehanna and its tributaries occupy most of the Allegheny Plateau in the Susquehanna drainage. Unfortunately the entire West Branch has been severely impacted by anthropogenic activity as have most of the tributaries entering into the West Branch. Adverse anthropogenic events include, but are not limited to strip mining, deep mining, drilling for fossil fuels, clear cutting, agricultural activities, and the dumping of domestic and industrial waste into the watershed. Some streams, however, have not been severely impacted and these, if large enough, tend to support populations of hellbenders. Examples of these are Little Pine Creek, Pine Creek, Kettle Creek, and Lycoming Creek.

Relative to the Allegheny/Ohio drainage (all of which occurs in the Allegheny Plateau physiographic province), the Susquehanna drainage supports far fewer populations of hellbenders, even though the Susquehanna has a larger drainage area within the state. I have examined 150 streams in the Susquehanna drainage and have discovered or reconfirmed the existence of hellbenders in only 7 of those streams. In two of those streams (Fishing Creek and Tuscarora Creek) hellbenders appear to be restricted to short distances near the mouth. While they are more widely distributed in the other 5. In sharp contrast I have examined 75 streams in the Ohio/Allegheny drainage and discovered or reconfirmed the existence of hellbenders in 21 of the streams. This in spite of the fact that the Allegheny /Ohio drainage has also been heavily impacted by anthropogenic activities.

I believe that three things explain the difference in the occurrence of hellbenders between the drainages:

1. Hellbenders apparently entered the Susquehanna drainage through stream capture. Due to the hellbenders low level of vagility and its tendency to remain for long periods of time in a very small area it is likely that some segments of the drainage (tributaries) have never been colonized by hellbenders.
2. Much of the Valley and Ridge Province lacks sufficient suitable habitat to support viable populations of hellbenders.
3. The area with the best habitat (West Branch and its tributaries) is also the area most dramatically impacted by past and present human activities

OVERALL STATUS OF THE HELLBENDER IN PENNSYLVANIA

I feel that there are sufficient populations of hellbenders within the state to preclude it from being listed as either endangered or threatened within Pennsylvania. This, however, is not an endorsement that the species is secure within Pennsylvania. Hellbenders have been dramatically impacted within Pennsylvania and have been extirpated from better than 60% of their former range. Upwards to 40 percent of the populations that I have located are marginal and may not be in existence by the year 2020.

Particular attention should be paid to the streams that still harbor hellbender populations and any projected activities involving those streams should take into consideration the possible impact of the activity on the hellbenders. For example, the Game Commission has engaged in the reintroduction of the otter (*Lutra lutra*) into several streams in northern Pennsylvania. Several of these streams harbor large viable populations of hellbenders (e.g. Tionesta Creek, Oil Creek, Pine Creek, and Kettle Creek). No one knows what impact the otters may have on existing hellbender populations and I am sure that hellbenders were not taken into consideration when deciding to reintroduce the otter, even though the otter is a species far more widely distributed and ecologically secure than the hellbender.

Pennsylvania is one of the last bastions for the hellbender and the Fish and Boat Commission should make every attempt to manage streams with hellbenders in such a way that hellbender populations are not harmed. For example, Trout Unlimited (a generally laudable organization) often engages in "stream improvement". Often this takes

the form of partially impeding stream flow to generate larger and more extensive pools for trout. It is highly unlikely that this practice improves habitat for hellbenders. This type of "stream improvement" should be kept to a minimum in streams with hellbenders until the effects of pool formation on hellbender distribution can be determined.

An effort should be made to educate anglers to the unique nature of the hellbender. Many anglers believe that hellbenders compete with trout or prey upon trout and kill them when they are caught. I would suggest that it be made illegal to intentionally harm hellbenders.

WHERE DO WE GO FROM HERE?

While this project has, I believe, been a success it most certainly is not the end point in determining the actual status of hellbenders in Pennsylvania. It is rather the starting point. Much work needs to be done.

First, this project was designed exclusively to determine the presence of hellbenders within streams in the Susquehanna drainage. It was never intended to determine the status of populations once discovered. I have located a total of 28 streams (21 in the Ohio/Allegheny drainage and 7 in the Susquehanna drainage) that harbor populations of hellbenders. The next logical step is to determine the status of hellbender populations in those streams. Just because hellbenders are present in a stream does not mean that the stream contains a secure or even ecologically viable population. By virtue of being long-lived animals populations may appear to be substantial and secure when in actuality they may be in decline. An "ecologically dead" population could persist for decades before extirpation finally occurs. Mark-recapture studies need to be conducted on as many populations as possible to determine the status of hellbenders in each stream. I have to this point intensively worked on populations in 4 streams. The results of these studies reflect the range of population status available. In Little Yellow Creek intensive collecting has revealed the presence of but a single very large female. cursory collection of a single animal would suggest that hellbenders are present, however more detailed, repeated collection in this case shows a stream in which for all intent and purpose hellbenders have been extirpated. At the other extreme is the upper region of Tionesta Creek where hellbenders show much evidence of reproductive activity and have densities of 1 animals per 1.1 linear meter

of stream. Little Mahonning Creek and Tubmill Creek are intermediate between the two extremes.

Even if good populations are present at one site along the stream this doesn't give us any idea of the extent of suitable habitat within the stream. It could be that most of the stream is suitable, or that only a small portion possess habitat able to support hellbenders. For example in Tubmill Creek there is only a total of about 10% of the length of the stream contains habitat that is suitable for hellbenders. On the other hand in Tionesta Creek better than 50% of the length of the stream contains suitable habitat for hellbenders.

While I have been able to survey virtually all of the tributaries of the Susquehanna, Juniata, Allegheny, and Ohio rivers I have not been able to survey any of the main streams due to the fact that they are generally too deep for wading. I have numerous reports of hellbenders being taken by anglers in the Allegheny and Susquehanna rivers as well as the Juniata. If possible these rivers should be surveyed for the presence of hellbenders. This coming summer (although I have no grant support) I intend to try two methods of sampling the Allegheny River for hellbenders. One technique is to set wire-mesh hoopnet style traps baited with sardines and chicken entrails. To determine if this is an effective way to capture hellbenders I will first set these traps in streams where I know substantial populations of hellbenders exist (i.e. Little Mahonning Creek and Tionesta Creek). If they "fish" I will then set them in the mainstream Allegheny. I also intend to use SCUBA this summer to work some of the deeper sections of the Allegheny from East Brady to Warren.