

ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF ENFORCEMENT

REPORT ON

REMOTE SENSING MAJOR WATERWAYS
MEMPHIS, TENNESSEE VICINITY

NATIONAL FIELD INVESTIGATIONS CENTER-DENVER
DENVER, COLORADO

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REMOTE SENSING REPORT
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Prepared By
National Field Investigations Center - Denver
Denver, Colorado

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FEBRUARY 1972

INTRODUCTION

In accordance with the Memphis study plan, an aerial reconnaissance mission was carried out over selected waterways in the Memphis, Tennessee vicinity on the 7th of January, 1972. A Remote Sensing Report was issued covering this mission.

On 17 February 1972, a second reconnaissance mission was flown over Memphis. The timing of this second mission coincided with the field operations of a ground survey team studying the five waterways constituting the target area. These waterways were as follows:

- (a) Nonconnah Creek - From a point approximately four miles east of the intersection of Mt. Moniah Road and Interstate 240 downstream of its outflow into McKellar Lake.
- (b) Wolf River - From a point approximately true north of Collierville, Tennessee, to its confluence with the Mississippi River.
- (c) Loosahatchie River - From a point approximately due south of Millington, Tennessee, to its confluence with the Mississippi River.
- (d) McKellar Lake - In its entirety.
- (e) Mississippi River - From a point adjacent to Beef Island downstream approximately to the Tennessee/Mississippi State Line.

MISSION PURPOSE

The expressed purpose of this reconnaissance mission was to provide the following capabilities:

- (a) Appraise the ground survey team of the current status of the suspected outfalls detected in the imagery from the first reconnaissance mission.
- (b) Locate any industrial or public outfalls that were not detected in the imagery from the previous mission.

CHRONOLOGICAL DATA

The flight parameters of this mission are as follows:

- (a) Time over target - 1100-1300 hours CST in which the entire reconnaissance task was fulfilled.
- (b) Flight Altitude
 - 1. Photographic imagery was recorded at 3,000 AGL (above ground level) providing a scale of 1:6,000.
 - 2. Infrared Line Scanner (explained in the Aircraft Sensor Section) imagery was recorded at 1,000 feet AGL at a scale of 1:10,500.

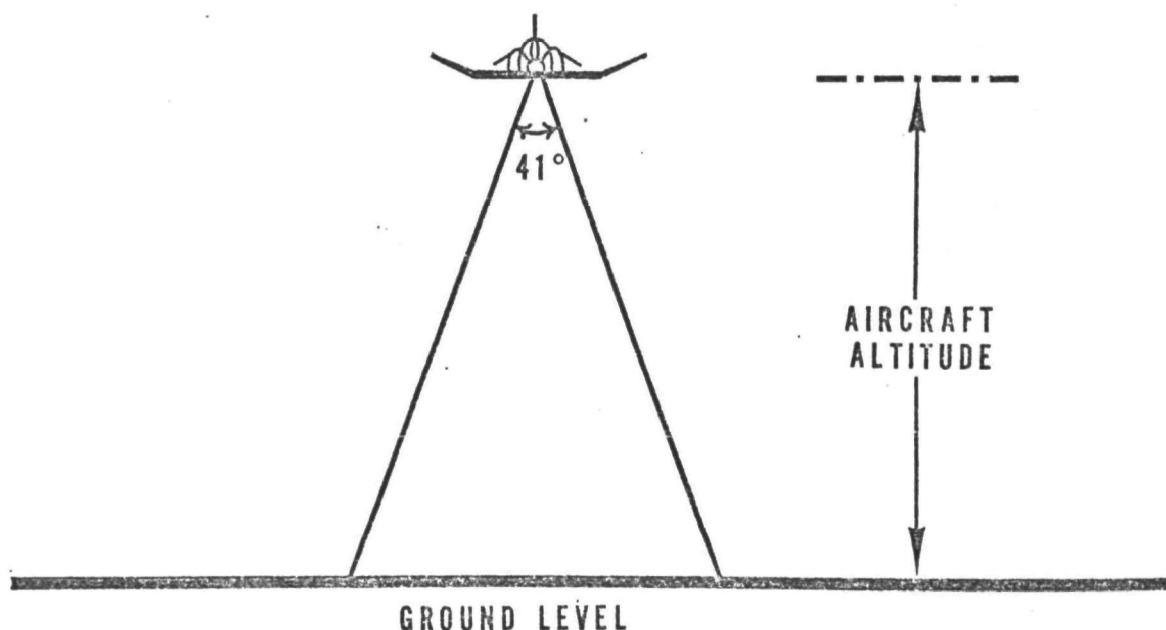
AIRCRAFT SENSOR DATA

The reconnaissance data were recorded aboard two high performance aircraft. These aircraft contained three framing cameras and an Infrared Line Scanner (IRLS). All cameras were mounted in the tri-vertical array, i.e., mounted in their respective vertical positions coincident with the nadir of the aircraft. Each of the cameras was uploaded with different

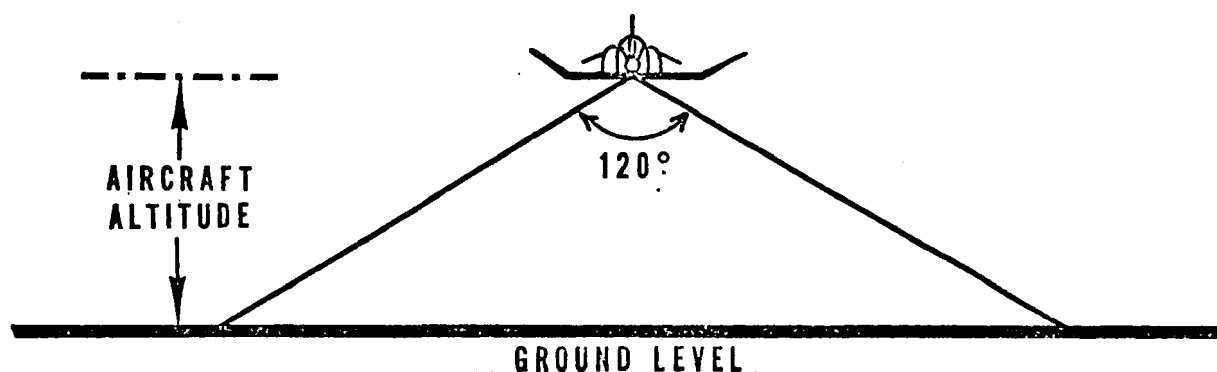
film/optical filter combinations. They were capable of recording the presence of optical energy within the following bands of the optical spectrum:

- (a) Near ultraviolet, resulting in a 4.5" X 4.5" negative-Kodak 2475 recording film with a Wratten 47A gelatin optical filter.
- (b) Visible region of the optical spectrum, resulting in a true color 4.5" X 4.5" positive aerographic ektachrome transparency-Kodak S0-397 aerographic ektachrome film with a Wratten HF-3/HF-5 optical filter combination.
- (c) Near Infrared region of the optical spectrum which was overlapped with a portion of the visible spectrum (red, orange), resulting in an aerographic ektachrome 4.5" X 4.5" false color (rendition) transparency - Kodak 2443 aerographic film with a Wratten 16 gelatin optical filter.

The viewing angle of each camera was 41° about the aircraft's nadir as shown below:



The IRLS is a cryogenic device (optical and electronic) capable of detecting passive electromagnetic energy resulting from target thermal emissions in the infrared band from 8 to 14 microns (1 micron= 10^{-6} meters). It has a cross-track scan angle of 120° about the aircraft's nadir, as shown below:



The true color photographic technique served as a real-world color basis for the photo interpretation of the imagery obtained during this mission.

The ultraviolet near infrared photographic media and the IRLS provided further refinements in the positive detection, location and identification of all outfalls and dispersion patterns detected in the respective target areas. The ultraviolet photography has been used extensively in the detection of oil present on fresh and salt water. The false color infrared film was used for the isolation of shrouded or masked (due to color likeness or foliage) waterways and provided detailed information on outfall dispersion patterns (due to wider color separation in the false

color rendition). It provided information regarding relative turbidity/DO levels in addition to biological growth detection and identification.

DESCRIPTION OF DATA REDUCTION

An immediate interpretation report from the airborne reconnaissance data was transmitted by telecon to the Chief of the Ground Survey party on 22 February 1972. A more detailed interpretation report is presented in the following paragraphs as identified by the specific waterways. Only those outfalls and drainage ditches which were apparent discharge media, are listed. Each location is identified, by its specific number, on the maps given in Appendix A.

NONCONNAH CREEK

The water volume in Nonconnah Creek was considerably lower than when the previous mission (7 January 1972) was flown.

1. A small stream enters Nonconnah Creek on the southern bank approximately 400 yards upstream of the first railroad bridge above McKellar Lake. The dark green plume from this stream maintained its identity for at least 70 feet downstream as it followed the southern bank of the creek.
2. A large storm drain outlet was located on the northern shore of Nonconnah Creek approximately 360 feet downstream from the Third Street bridge. The discharge from this drain was dark green in color. It followed the northern shore of Nonconnah Creek downstream for approximately 350 feet. The volume of the discharge was not large.

3. There was a drainage ditch located on Nonconnah Creek's southern bank approximately 440 feet upstream of the second railroad bridge. There was no discharge from this creek at the time of flight.
4. Cane Creek flows into Nonconnah Creek, from the north, approximately 1,000 yards upstream from the third railroad bridge that crosses the latter creek above McKellar Lake. The water flowing from Cane Creek into Nonconnah Creek displayed a greenish-gray color at the time of flight. This color usually indicates the presence of untreated sewage. The discharges from Cane Creek could be traced about 300 feet downstream along the northern bank of Nonconnah Creek before complete dispersal had been achieved.
5. On the northern bank of Nonconnah Creek approximately 1,200 feet downstream from the Highway 55 bridge was a drainage ditch exit. There was very little water, which appeared dark brown in color, in this ditch. There were traces of discoloration in the Nonconnah Creek waters adjacent to the ditch exit.
6. Another drainage ditch was located on the southern bank of Nonconnah Creek and 70 feet downstream from the Highway 55 bridge. The flow of water from this ditch into Nonconnah Creek at the time of flight was small, exhibiting no apparent discoloration.
7. It is noteworthy to mention that a drainage ditch, located immediately below a diking weir on the northern bank of Nonconnah

Creek approximately 1,700 yards upstream of the Belleview Boulevard bridge, would most possibly serve as a drainage conduit for the storm sewers in this area during high-water conditions. There was no outfall present at the time of flight.

8. A storm drainage outlet, positioned 1,200 yards downstream from the Holly Ford Road bridge, was connected to a feeder drainage ditch from a small industrial area that contained open storage of dump truck loads of material or refuse. At the time of flight, no discharge from this area was detected.
9. Approximately 1,400 feet upstream of the Airways Road bridge a drainage ditch cuts the northern bank of Nonconnah Creek. This drainage ditch serviced the area north of Highway 240. At the time of imaging, the flow of water in this ditch was minimal and no discoloration was noted in Nonconnah Creek.
10. Another open drainage ditch cuts the northern bank of Nonconnah Creek 350 feet downstream from the Lamar Avenue bridge. The flow of water was negligible and no discoloration was noted.
11. An open drainage ditch, located 250 feet upstream of the Lamar Avenue bridge on the northern bank of Nonconnah Creek, contained water whose turbidity was greater than that of the Creek. There was a small discharge of this water, which dispersed quickly, into the creek.
12. On the northern bank, midway between the Lamar Bridge and the Get Well bridge, was another open drainage ditch with the discharge having a greater turbidity than that of Nonconnah Creek.

There were numerous drainage ditches and storm drains that were not listed in this section of the report because there was no water present in them at the time of flight, and as a result, no constructive evaluations could be made regarding their functional use.

WOLF RIVER

Only those discharge media that appeared to be introducing foreign substances into the Wolf River waters are listed herein.

13. Tree shadows mask an area downstream from the river's southern bank from the single track Illinois Central railroad bridge, that was immediately upstream of the Thomas Street bridge. Approximately 130 feet downstream from the R.R. bridge, along the southern bank of the river, a greenish colored substance of considerable volume was readily seen. As this substance follows the current downstream, it tends to maintain its surface identity with little dispersion. For the most part, the furthest point downstream that this substance could be seen was 1,300 feet from the confluence of the Mississippi and Wolf Rivers. Traces of the substance were found at the confluence of the two rivers but in no significant concentrations. The imagery also indicated that this discharge contained significant amounts of chlorophyll.
14. Cypress Creek enters the south bank of Wolf River 2,200 feet downstream from the Watkins Street bridge. The water in Cypress Creek was more turbid than that in Wolf River. The outflow from Cypress Creek appeared to be small and dissipated rapidly into the river.

15. A small stream 45 feet wide on the southern bank and approximately 930 yards upstream of the Illinois Central double track railroad bridge contained very turbid water. The discharge into Wolf River was minimal.
16. The discharge from Harrison Creek was a lighter green color than the water of Wolf River and was completely dispersed within 35 feet after entering the River.
17. Fletcher Creek entered the northern bank of Wolf River approximately 650 yards downstream from Highways 70/79 bridge. The water from Fletcher Creek appeared slightly lighter in color than the yellowish-brown waters of Wolf River. The waters were mixing rapidly and there was no plume of any significance.

LOOSAHATCHIE RIVER

Only that portion of the river immediately downstream of Todd Creek was photographed. In this area, the river is very turbid exhibiting a yellowish-brown color nearly identical to that of Wolf River. The color hue was constant over the section of the river covered.

MISSISSIPPI RIVER (MEMPHIS, TENNESSEE)

In this section of the report, only the eastern or Tennessee bank of the Mississippi River will be discussed.

18. The volume of yellowish-brown turbid water from the Loosahatchie River was considerably less than that seen in previous aerial coverage of this area. The dispersal pattern of the Loosahatchie water appeared to drift out and upstream in the Mississippi River for a distance of approximately 1,200 feet where it achieved nearly complete dispersal (see Figure 1).

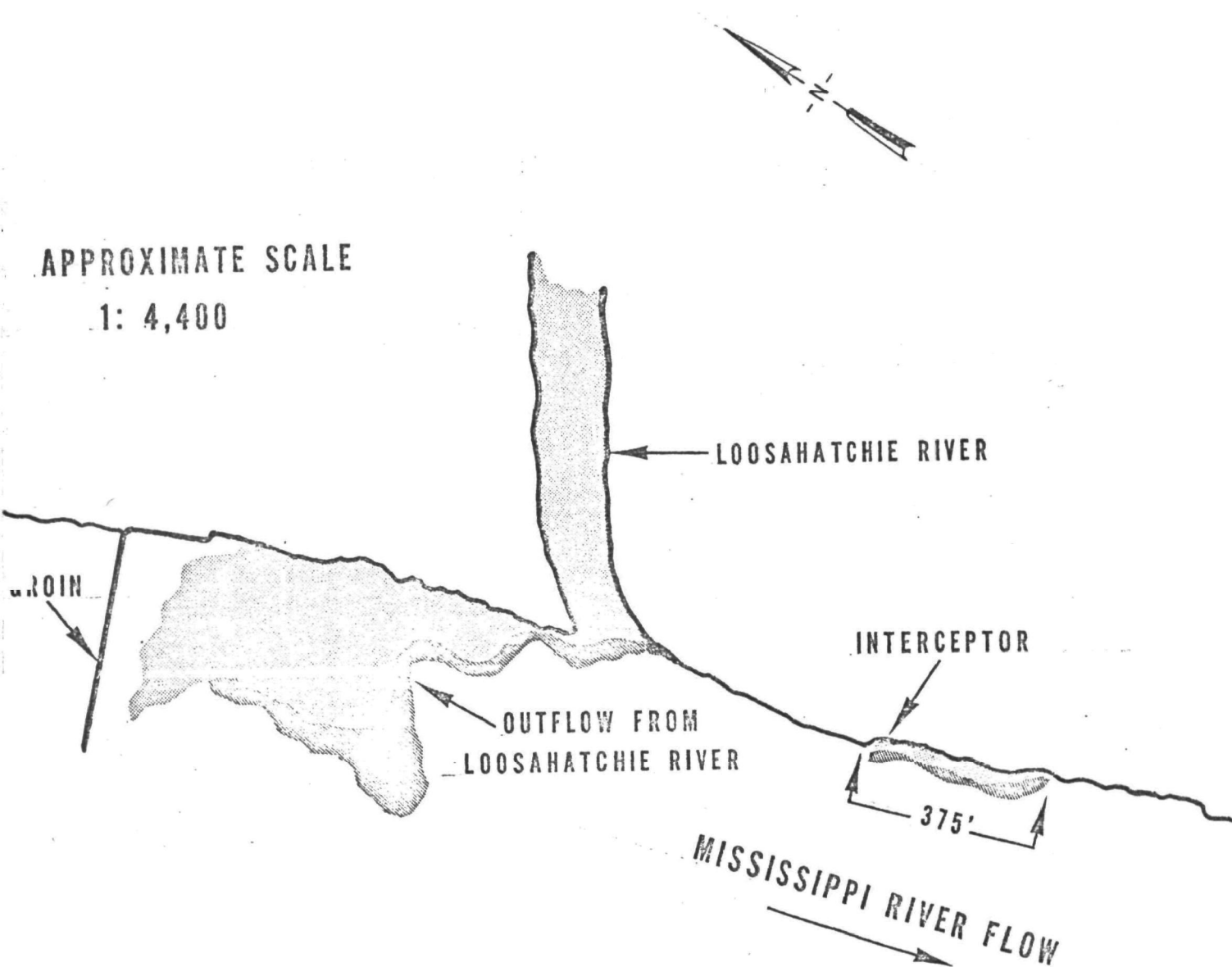


Figure 1 Loosahatchie River and Interceptor

19. The Loosahatchie Interceptor discharge plume penetrated into the Mississippi River 80 feet from the eastern bank. It had completely dispersed within 125 feet from the outfall.
20. Approximately 1,450 feet downstream from the Loosahatchie River was a ditch carrying a very dark, almost black, liquid which was discharging into the Mississippi River. The plume from this outflow extended 30 feet out into the River from the eastern bank and paralleled the east bank of the Mississippi for at least 1,000 feet before dispersing completely.
21. The Wolf (sewage) Interceptor was observed 5,300 feet upstream from the mouth of Wolf River. The substance, being discharged into the Mississippi River, was a very dark brown color. The outfall plume followed the River's eastern bank downstream approximately 3,000 feet before complete dispersion was achieved (Figure 2). The outfall's deepest penetration into the River was 100 feet from the eastern bank. The thermal imagery indicated that this outfall was somewhat warmer than the ambient temperature of the Mississippi River.
22. The yellowish-brown outflow from Wolf River was not as pronounced as that displayed in the previous flight's coverage. The water from Wolf River penetrated into the Mississippi River for approximately 100 feet from the eastern bank and paralleled the eastern bank of the Mississippi River finally dispersing within approximately 800 feet.

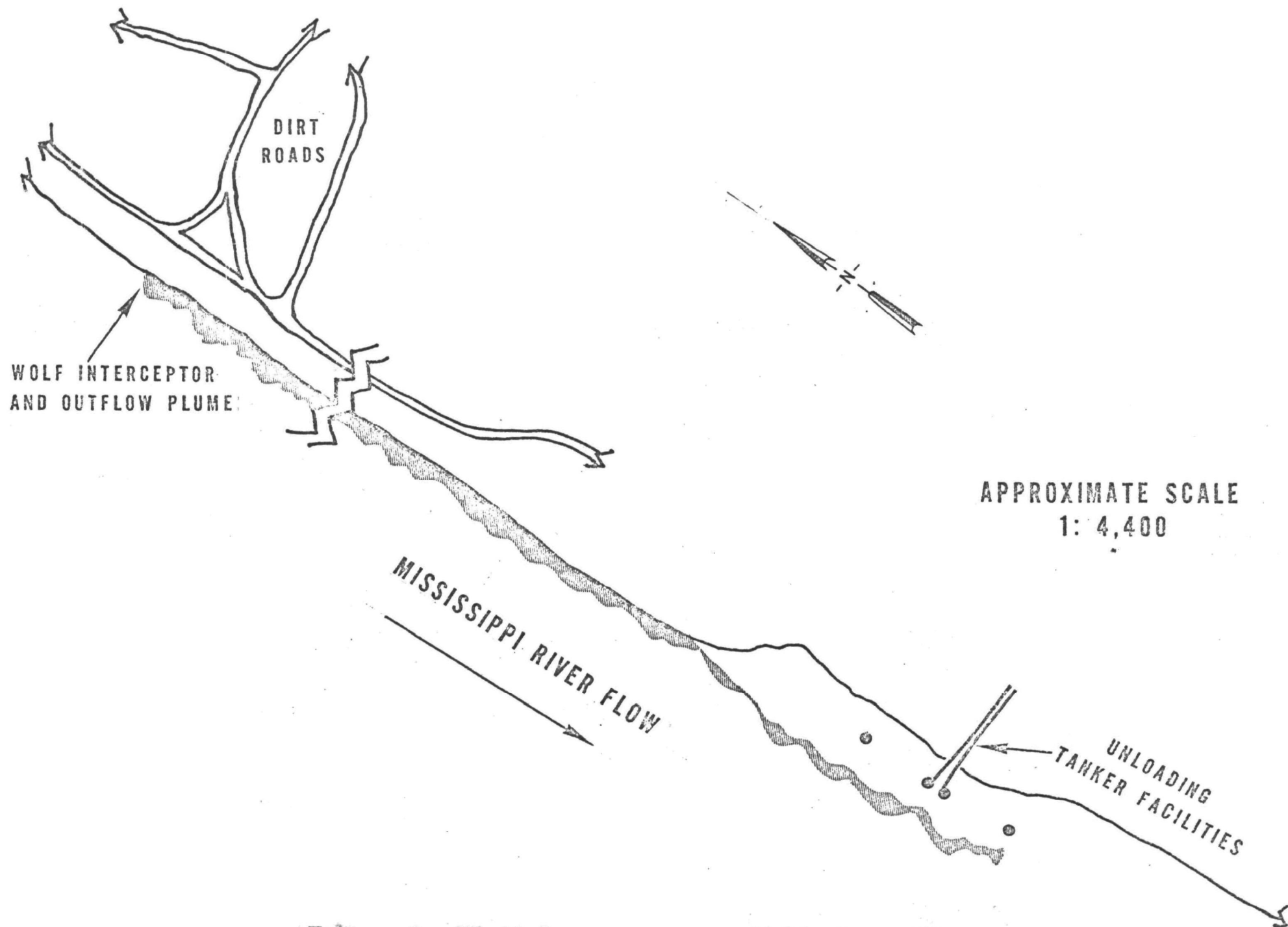


Figure2 Wolf Interceptor and Outflow Plume

23. The outflow, from the pumping station between Front Street and Wolf River lagoon, was lighter in color than the water in the lagoon. The thermal imagery indicated that this outflow was warmer than the lagoon's water. The outfall plume maintained its identity for approximately 400 feet as it traveled northward in the lagoon.
24. A drainage ditch, located 3,300 feet downstream from the Crump Boulevard bridge, was discharging a very dark brown (most dominant color) substance. This substance was entering the River very slowly. This ditch was 36 feet wide and positioned immediately below a tank farm with unloading dock facilities. A line of barges 25 feet from shore contained the outflow from this ditch to the river bank area.
25. Approximately 100 feet downstream from the drainage ditch mentioned in 24, was a small cove. Floating on the surface of this cove was a white viscous substance covering an area 90 feet x 25 feet. The row of barges, tied up approximately 25 feet from the eastern bank of the Mississippi River, was containing this white substance along the Mississippi River bank and not allowing it to disperse.
26. The Nonconnah interceptor, located on the Mississippi River's eastern bank 3,500 feet downstream from the mouth of Tennessee Chute (from McKellar Lake), was discharging a greenish-gray substance at the time of flight. This discharge was penetrating the Mississippi River waters approximately 80 yards from the

eastern bank and flowed downstream achieving nearly complete dispersion within 3,000 feet from the mouth of the interceptor conduit. The thermal imagery indicated that this outfall was significantly warmer than the ambient temperature of the receiving water. Approximately 1,350 feet upstream from the Mississippi River and on the southern bank of the Nonconnah interceptor conduit was a discharge pipe at least six feet in diameter that was discharging the greenish-gray substance into the interceptor chute (Figure 3). The substance appeared to be untreated domestic sewage.

MCKELLAR LAKE (TENNESSEE CHUTE)

27. There was a small drainage ditch at the northern end of McKellar Lake that had a small outflow into the Lake. No discoloration was apparent.
28. On the eastern shore of the Harbor Channel, an outfall was seen on the waterfront of an area containing some petroleum storage tanks. At the time of imaging the outfall was above the water level in the Harbor Channel. This outfall appeared to be a pipe, approximately three feet in diameter, discharging a fluid into the Harbor Channel. The thermal imagery indicated that the contents of this outfall were warmer than the ambient temperature of the Channel. In the photographic imagery the plume from this outfall could be seen for approximately 400 feet as it flowed in a generally northeast direction. The deepest penetration of this plume into the Channel was 300 feet from shore (see Figure 4)

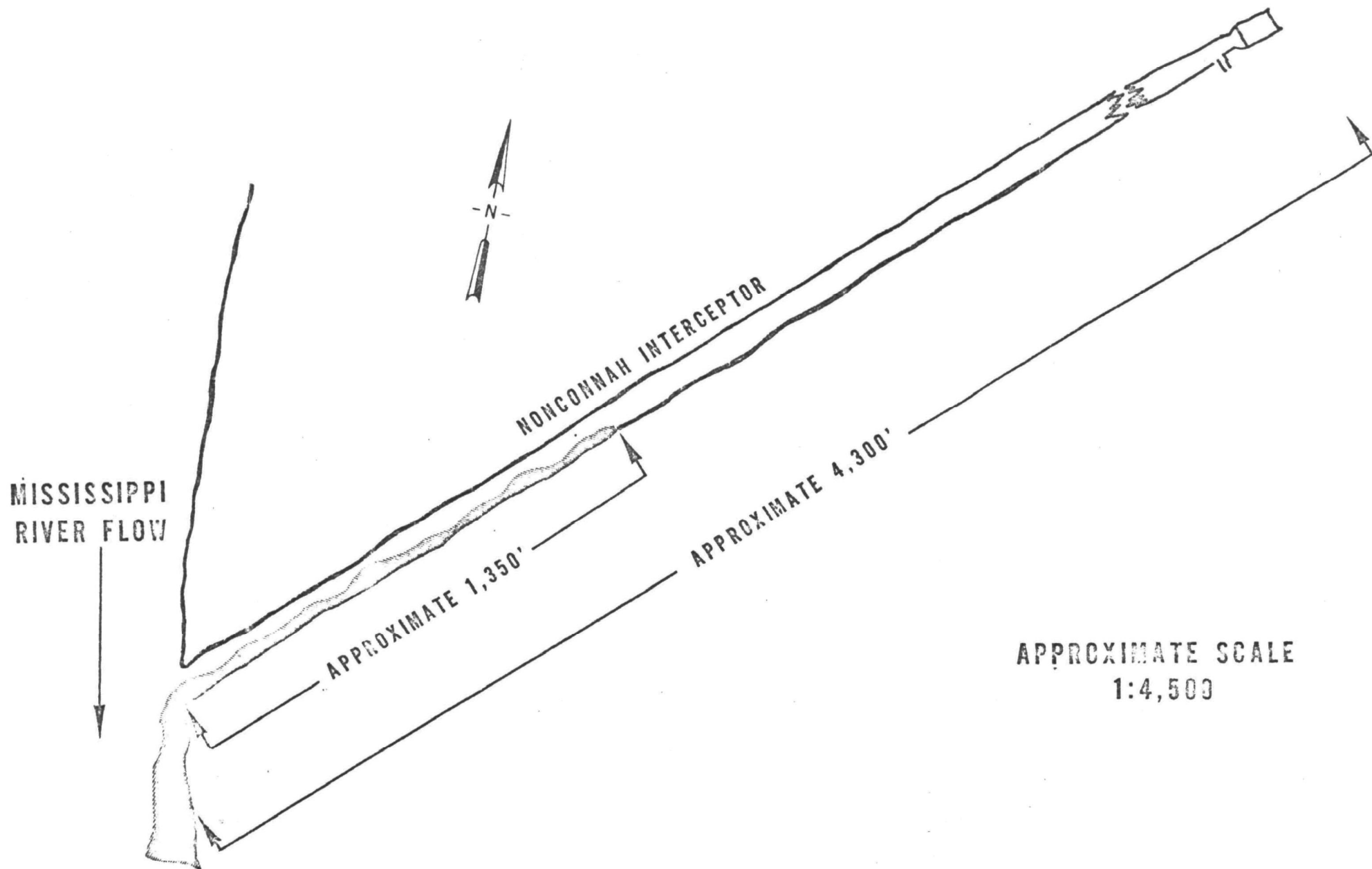
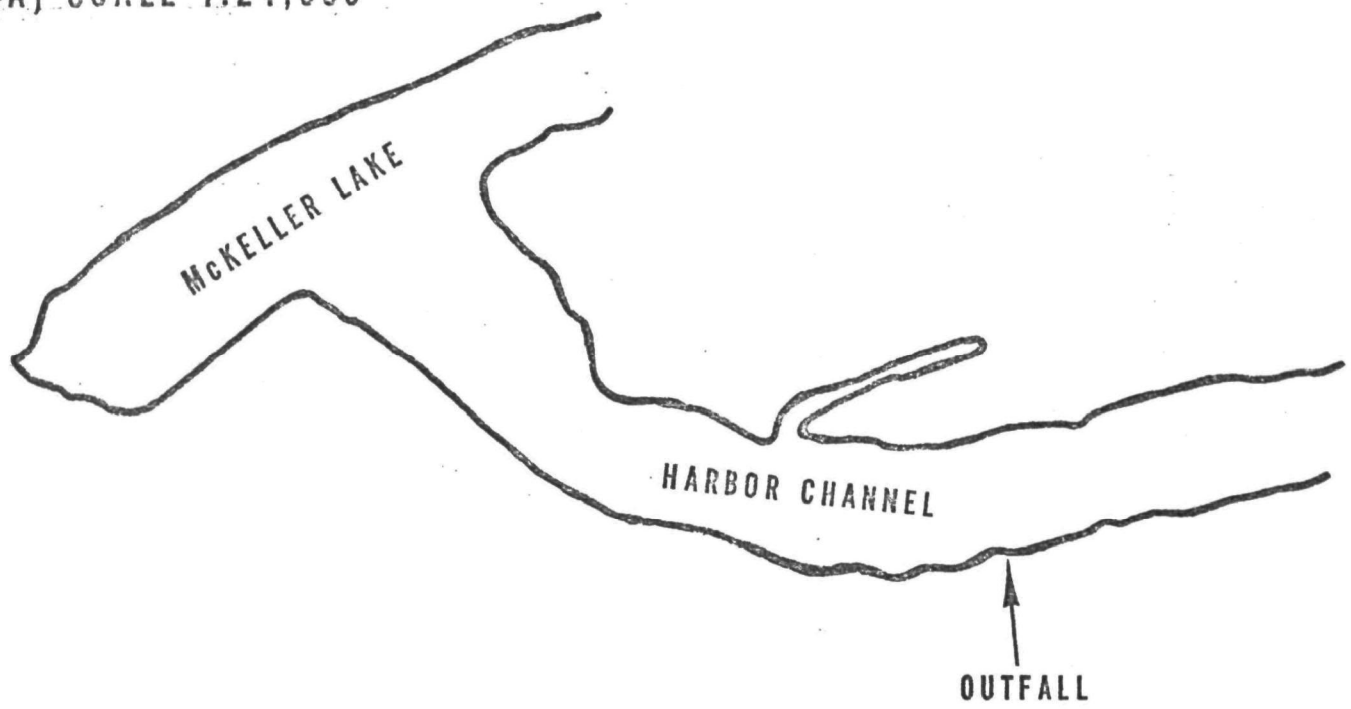


Figure 3. Nonconnah Interceptor

4A) SCALE 1:24,000



4B) SCALE 1:4,500

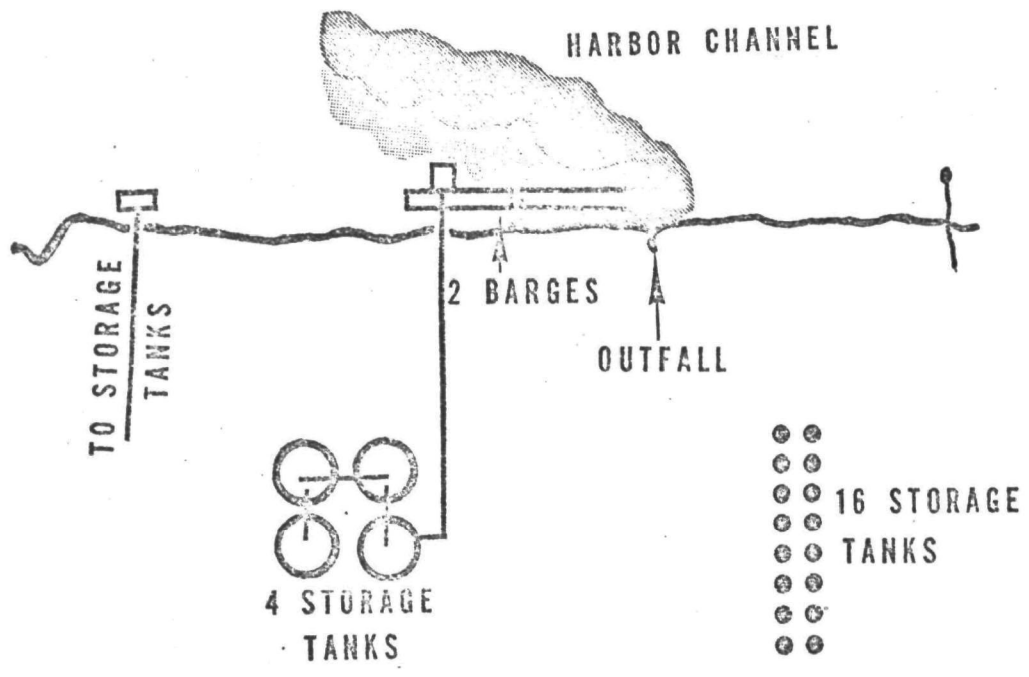


Figure 4 Outfall on Harbor Channel

SUMMARY:

The 28 outfalls and drainage ditches, listed in this report, were identified in the airborne imagery recorded on 17 February 1972. At the time of imaging, these 28 sites showed sufficient indications that they were or had the potential of introducing polluted effluence into the five waterways covered in this report. The most significant effluent in the area appeared to be that of nearly raw sewage. Numerous ditches through out the target area appeared to serve only as natural drainage.

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