

9-5-2004

## Ex. 281-US-418

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Stream: Wood River  
Tributary to: Agency Lake  
Survey Type: Spawning Gravel  
Access: Canoe  
Reach: 1  
Start Reach: T34S-R7E-S31SW  
Quad: Agency Lake  
Date: 5 September 04  
Surveyors: R. Nawa, K. Hartzell  
Report: R. Nawa, C. Huntington  
Distance Surveyed:

*1.9 Km*

Reach 1 is from the mouth to the confluence of Crooked Creek. No spawning gravel was found because the streambed was 100 percent sand/organics. Below Crooked Creek the bankful channel increased from 10m to 18 m due to increased flows. The channel was a continuous glide with depths ranging from 1.2 m to 2.3 m. A distributary channel about 500 m above the mouth of the river was dammed with large boulders and blocks fish migration (Photo 297). The recently excavated main channel is free of obstructions. Stream temperature was 13.3°C at the mouth of the river at 1500 PDT.

Photo 297 Reach 1  
A boulder dam blocks fish migration at an outlet or distributary channel. This is the "old" outlet channel to Agency Lake.

Stream: Wood River  
Tributary to: Agency Lake  
Survey Type: Spawning Gravel  
Access: Canoe  
Reach: 2  
Start: T34S-R71/2E-S3NW  
Quad: Fort Klamath, Agency Lake  
Date: 5 September 04  
Surveyors: R. Nawa, K. Hartzell  
Distance Surveyed:

*10.1 Km*

Reach 2 is Crooked Creek to the upper end of levees and diversion dam north of Weed Road (map). The river was surveyed downstream. No spawning gravel was found because the channel was 100 percent sand/organics. Several meander cutoffs have reduced channel length by over 600 m (map), but the channel does not appear to be incising or downcutting due to meander cutoffs. Meander cutoffs are probably a result of levee construction. About 5 percent of streambanks are eroding, mostly at meander bends. Marsh grasses and sedges are colonizing lateral accretions or depositional areas of sand/organics. Erosion and deposition appear to be in balance. The channel was 3.6 m deep at UTM 10 E:0582742; N:4721452 and 2.8 m deep at UTM 10 E:58361; N:4720899 (map). At the Thomas Ranch the channel was 1-1.8 m deep (UTM 10 E:0584349 N:4719754) and willows were found on both banks at UTM 10 E:585609; N:4717723.

At the upper end of the reach the west bank had a levee below a diversion dam (UTM 10 E: 0582949; N: 4722776). The diversion dam may be a fish migration barrier when irrigation boards are in place. A beaver dam was located on the right bank (not main channel) about 200 m below diversion dam. Willows were thick below the diversion dam and islands protected from grazing also have abundant willow reproduction and extensive new growth (map). Heavy grazing on willows resumed 200 m north of Weed road and continued south of Weed road. South of Weed Road the channel meandered between two levees. At the lower end of the reach, but above the confluence with Crooked Creek, the east levee provides a 500 m wide area for floodplain development. A marsh with dense willows developed at this location. Stream temperature was 11.7°C at 1340 PDT.

Stream: Wood River  
Tributary to: Agency Lake  
Survey Type: Spawning Gravel  
Access: Canoe  
Reach: 3  
Start: T33S-R71/2E-S34NE  
Quad: Fort Klamath  
Date: 5 September 04  
Surveyors: R. Nawa, K. Hartzell  
Report: R. Nawa  
Distance Surveyed

3.5 km

Reach 3 is from the diversion dam/levees above Weed Road to Fort Creek. The river meandered in an agricultural valley with high sinuosity. The channel was primarily a glide with scour holes. Maximum depth was 2.1 m below Loosely Road. Willows were old and decadent. Streambed was about 97 percent sand/organics, 2 percent gravel and 1 percent cobble. Glides have sporadic patches of fine gravel less than 13 mm diameter. Some pumice gravel was found below Fort Creek but none was judged suitable for spawning. Deposition at point bars and riffles was sand/organics (no gravel). Livestock grazing appeared heavy. Streambanks are eroding at meander bends. In some locations dikes up to 250 m long have been placed on the outside of meander bends. Towards the beginning of the reach an oxbow side channel has been created by a meander cutoff. About 300 m of channel was bypassed by the meander cutoff. At the end of the reach a diversion dam blocks the channel with a drop of 0.6 m ( UTM 10 E:0582949; N:4722776). The dam is a possible migration barrier when boards are in place in the center of the dam.

Photo 283 Reach 3  
Upstream view of  
diversion dam at  
beginning of reach 3.  
Dam, is possible fish  
migration barrier when  
boards are in place.

stream had ponderosa pines. The stream had an average of 98 hardwoods (mostly willow) and 12 mature pines for each 1000 ft of stream. Shade averaged 9 percent. About 7 percent of streambanks were eroding. Erosion was primarily at sharp meander bends in contact with high terraces (Photo 273). Grass and willows were adequate to stabilize streambanks where the channel was straight or only gently meandering.

#### Wood

Infrequent wood debris (0.7 piece/100m) was causing some deepening of the channel along margins of the stream. Very few conifers and hardwoods are located close enough to the stream to contribute future wood debris. A channel spanning debris jam at unit 4 was not storing sediment (map). In general, the stream lacks the amount of wood and stream power needed to move wood into debris jams that can modify channel geometry (e.g., cause meander cutoffs)

#### Rearing and Adult Holding Habitat

About 82 percent of the river was glide habitat and 13 percent pools. Pools were distinguished from glides by maximum depths usually greater than 1.5 m, otherwise the two habitat types were similar. Pools were often associated with meander bends (U73,U76). An estimated 29 percent of the streambanks were undercut. Undercut streambanks and deep pools provide ample cover for juvenile and adult fish.

#### Stream Temperature

Maximum spot stream temperature at unit 3 was 13.0° at 1835 PDT.

Photo 273 Unit16  
Wing deflectors were placed at this eroding streambank. Heavy grazing reduced grass and willow growth needed to stabilize streambanks.

Stream: Wood River  
Survey Type: ODFW Stream Habitat  
Tributary To: Agency Lake  
Access: Canoe  
Reach: 4 (Units 1- 52)  
Begin: T33S-R71/2E-S22NW  
Quad: Fort Klamath  
Date: 4 September 04  
Surveyors: R. Nawa, K. Hartzell  
Report: R. Nawa, C. Huntington  
Distance Surveyed: 8.6 km

Reach Description

Reach 4 is Fort Creek to southern Forest Service boundary at day use picnic area.

Land Use

Land use is heavy grazing for cattle and rural residential east of Fort Klamath. About 5 homes have been constructed along streambanks in the first km south of Highway 62 (map).

Valley and Stream Channel Geometry

The river meanders in an agricultural valley about 8 km wide. Extremely low stream gradient (0.06%) was accompanied by high sinuosity (2.4). Narrow floodplains and low terraces bordered the 15 m wide stream. A meander cutoff at unit 13 with 80 percent of the flow has created an oxbow shaped side channel (map). Potential for additional meander cutoffs is high. Meander cutoffs will generally result in significant channel and streambank erosion. Home construction as close as 5 ft to the stream has been accompanied by 30-100 m sections of riprap which prevents natural meandering of stream (Photo 265). Similarly, dikes or levees at 5 meander bends also reduced the ability of the stream to meander and reduce local channel gradient (see comments for unit locations).

Substrate

The streambed was fine textured. An estimated 66 percent of the streambed was sand/organics and 34 percent gravel.

Spawning Gravel

Surveyors visually estimated 1,505 m<sup>2</sup> (176 m<sup>2</sup> /km) of fine textured gravel were suitable for steelhead spawning at existing low flows (Photo 272). The median gravel size (D50) for spawning gravel was 4-8mm measured at unit 20 (see Wolman Pebble count). Spawning gravel was in shallow riffles that covered 5 percent of stream. Substrate composition in riffles was 68 percent gravel and 32 percent sand/organics. High sand and fine sediment content decreases the quality of spawning gravel.

Riparian Vegetation

Grass dominates riparian zones due to conversion of riparian forest to pasture. Sparse patches of willows and hardwoods border the river in low lying areas. Some very old willows had a tree-like growth form with diameters up to 40 cm. High terraces along the

Stream: Williamson River  
Survey Type: Spawning Gravel  
Tributary To: Agency Lake  
Access: Foot and Canoe  
Reach: 5  
Start: T33S-R07.5E-S22NW  
Quad: Fort Klamath  
Date Surveyed: 4 September 04  
Surveyors: R. Nawa K. Hartzell  
Report: R. Nawa  
Distance Surveyed: 0.9 km

Reach 5 is a Forest Service day use area. Stream gradient is low and sinuosity is high. Surveyors visually estimated that 153 m<sup>2</sup> (176 m<sup>2</sup>/km) of fine textured gravel was suitable for steelhead spawning at existing low flows (Photo 272). Anglers indicated that rainbow trout did not spawn in this reach.

Photo 261 Reach 5  
Gravel was fine textured and  
stream velocities high.

Stream: Wood River  
Tributary To: Agency Lake  
Survey Type: ODFW Stream Habitat  
Access: Canoe  
Reach: 6 (53-57)  
Start: T33S-R71/2E-S10SW  
Quad: Fort Klamath  
Date Surveyed: 21 August 04  
Surveyors: R. Nawa, K. Hartzell  
Report: R. Nawa, C. Huntington  
Distance Surveyed: 3.6 km

#### Reach Description

Northern Forest Service boundary at day use area north to confluence with Annie Creek.

#### Land Use

Land use is heavy cattle grazing.

#### Valley and stream channel geometry

The river meanders in an agricultural valley over 2 km wide. Extremely low stream gradient (0.1%) was accompanied by high sinuosity (2.4). Narrow floodplains and low terraces bordered the 14 m wide stream. A secondary channel at unit 72 is a developing meander cutoff (map). The developing meander cutoff currently diverts about 15 percent of the flow and is slowly downcutting with migrating nickpoints. Significant channel and streambank erosion would occur if the meander cutoff captures the majority of the flow from the Wood River.

#### Substrate

The streambed was fine textured. An estimated 54 percent of the streambed was sand/organics and 46 percent gravel.

#### Spawning Gravel

Surveyors visually estimated that 1,758 m<sup>2</sup> (492 m<sup>2</sup> /km) of fine textured gravel were suitable for steelhead spawning at existing low flows (Photo). Approximately 1600 m<sup>2</sup> of spawning gravel was concentrated in the 2 km below Annie Creek (map). The median gravel size (D50) for spawning gravel was 8-16mm measured at unit 74 (see Wolman Pebble count). Spawning gravel was found in riffles and pool tailouts. ~~Substrate~~ (Note 151). composition in riffles was 61 percent gravel and 39 percent sand/organics. High sand and fine sediment content decreases the quality of spawning gravel.

#### Riparian Vegetation

Grass dominates riparian zones due to intensive conversion of riparian forest to pasture. Sparse patches of willows and hardwoods border the river in low lying areas. Shade averaged 5 percent. About 6 percent of streambanks were eroding. Erosion was primarily at sharp meander bends in contact with high terraces. Grass and willows were adequate to stabilize streambanks where the channel was straight or only gently meandering.



#### Wood

Sparse wood debris (0.7 piece/100m) was causing some deepening of the channel along margins of the stream. Very few conifers and hardwoods are located close enough to the stream to contribute future wood debris.

#### Rearing and Adult Holding Habitat

About 5 percent of the river was pool habitat and 37 percent glides. Pools were distinguished from glides by maximum depths usually greater than 1.5 m, otherwise the two habitat types were similar. An estimated 44 percent of the streambanks were undercut. Undercut streambanks would provide ample cover for juvenile and adult fish, irrespective of wood densities and pool depths.

#### Stream Temperature

Stream temperature at unit 63 was 9.5° C at 1650 PDT.

#### Photo 151 Unit ??

Pools scoured at meander bends (upper right) while gravel deposited in pool tailouts and long shallow riffles (foreground).

Stream: Wood River  
Tributary To: Agency Lake  
Survey Type: ODFW Stream Habitat  
Access: Canoe, Foot  
Reach: 7  
Start: T33S-R07E-S03SE  
Quad: Fort Klamath  
Survey Dates: 9, 21 August 04  
Surveyors: R. Nawa, K. Hartzell  
Report: R. Nawa, C. Huntington  
Distance Surveyed: 4.7 km

#### Reach Description

Annie Creek to source springs in Kimball State Park

#### Land Use

Cattle pasture and rural residential

#### Valley and stream channel geometry

The river meanders in an agricultural valley over 2 km wide. Extremely low stream gradient (0.05%) was accompanied by high sinuosity (2.3). Narrow floodplains and terraces bordered the 17 m wide stream.

#### Substrate

The streambed was very fine textured. An estimated 71 percent of the streambed was sand/organics, 27 percent gravel, and one percent cobble.

#### Spawning Gravel

Surveyors visually estimated that 1,260 m<sup>2</sup> (270 m<sup>2</sup> /km) of medium textured gravel were suitable for steelhead spawning at existing low flows. Spawning gravel was primarily concentrated in the upper portions of the reach. Two riffles above Dixon Bridge had an estimated 900 m<sup>2</sup> of spawning gravel (Photo 140, U101, U96, map). The median gravel size (D50) for spawning gravel in this area was 8-16 mm (Photo 139, Wolman Pebble count). Numerous old redds indicated that adult rainbow trout use this medium textured spawning gravel for spawning. Substrate composition in riffles was 59 percent gravel and 41 percent sand. High sand and fine sediment content decreases the quality of spawning gravel.

#### Riparian Vegetation

Grass (75-88 percent cover) is the dominate vegetation due to intensive conversion of riparian forest to pasture. Patches of willows and hardwoods border the river in low lying areas providing canopy closure that ranged from 10-24 percent. The highest density of tree cover was in Kimball State Park. Shade averaged 22 percent. About 3 percent of streambanks were eroding. Erosion was primarily at sharp meander bends in contact with high terraces. Grass and willows were adequate to stabilize streambanks where the channel was straight or only gently meandering.

### Wood

Wood debris (3 piece/100m) was causing some deepening of the channel along margins of the stream. Very few conifers and hardwoods are located close enough to the stream to contribute future wood debris.

### Rearing and Adult Holding Habitat

About 42 percent of the river was pool habitat and 44 percent glides. Pools were distinguished from glides by maximum depths greater than 1.5 m, otherwise the two types were similar. An estimated 29 percent of the streambanks were undercut. Undercut streambanks provide ample cover for juvenile and adult fish, irrespective of wood densities and pool depths.

### Stream Temperature

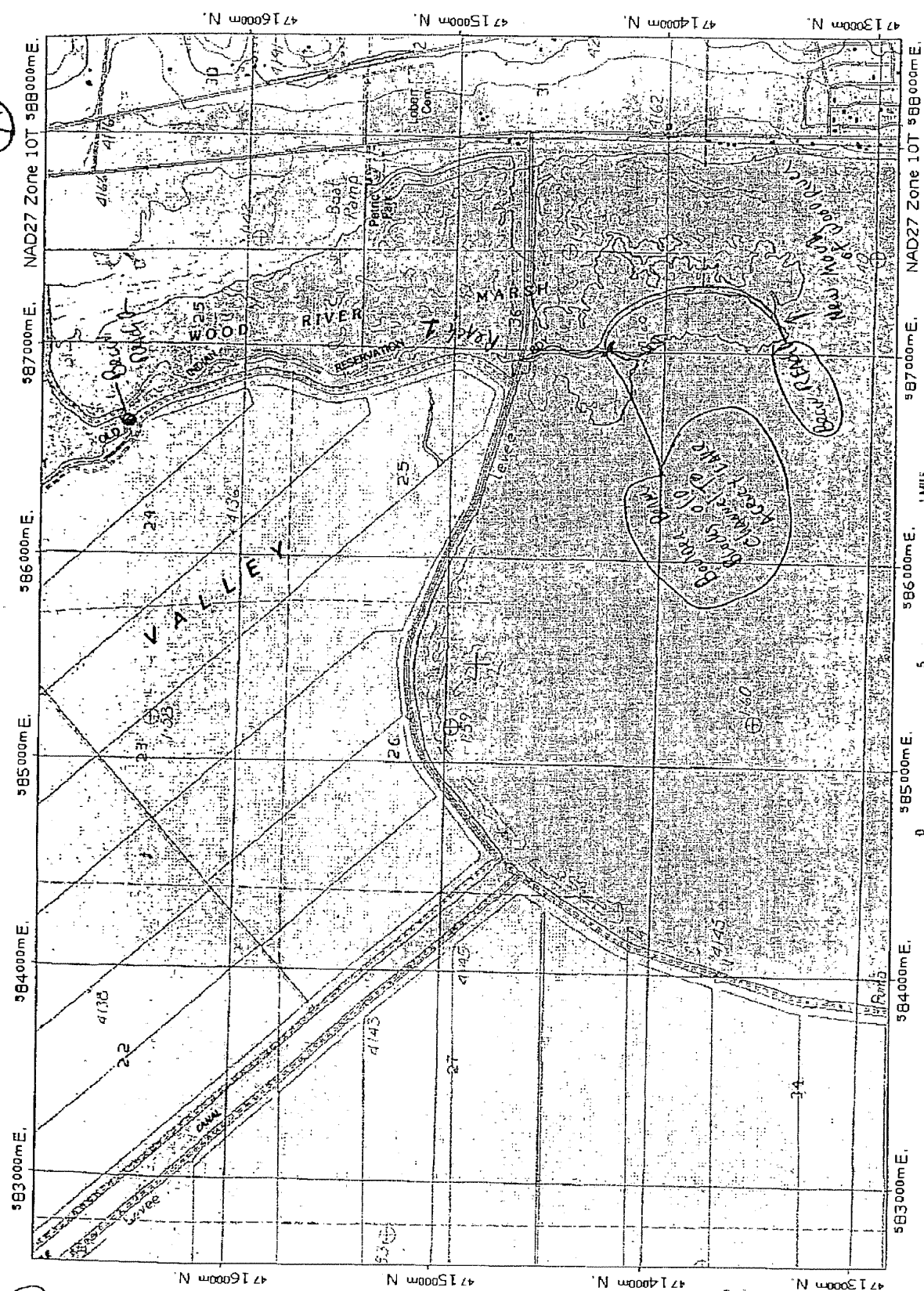
Wood River springs and other spring sources in Kimball State Park were 7°C at all times. Further downstream at unit 89 the stream was 7.5°C at 0950.

### Migration Barriers

A diversion dam with a 0.3 m drop did not appear to be a barrier to adult migration (U79, see map; Photo 147). A large portion of the flow can be diverted at this diversion dam.

Photo 147 Unit 79  
A 0.30 high irrigation dam spans the Wood River.

119



1

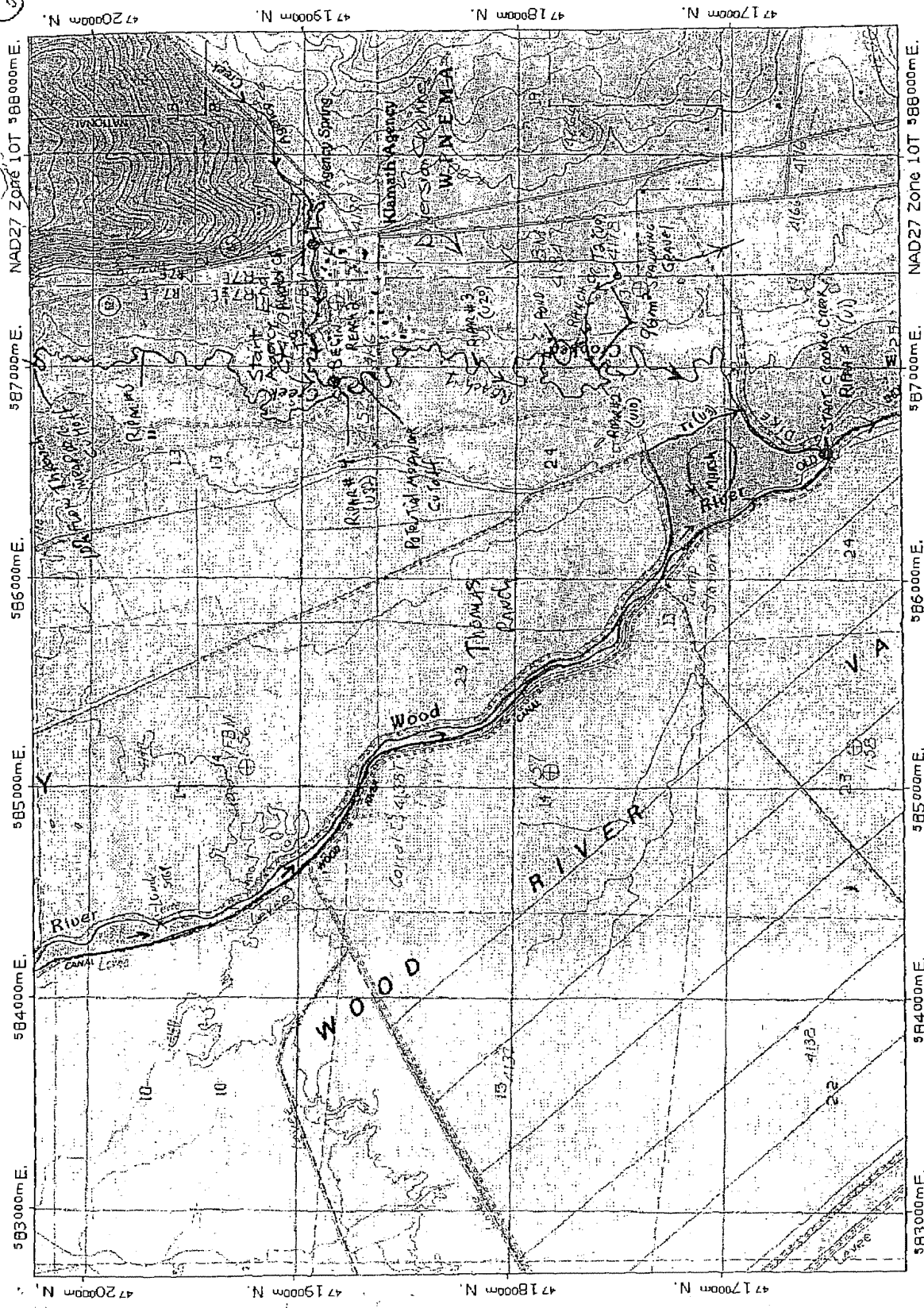
Wood River

Wood River + tributaries



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2



Crooked Creek Reach 1+2  
 Wood River + Tributaries  
 Agency Creeks - Reach 1

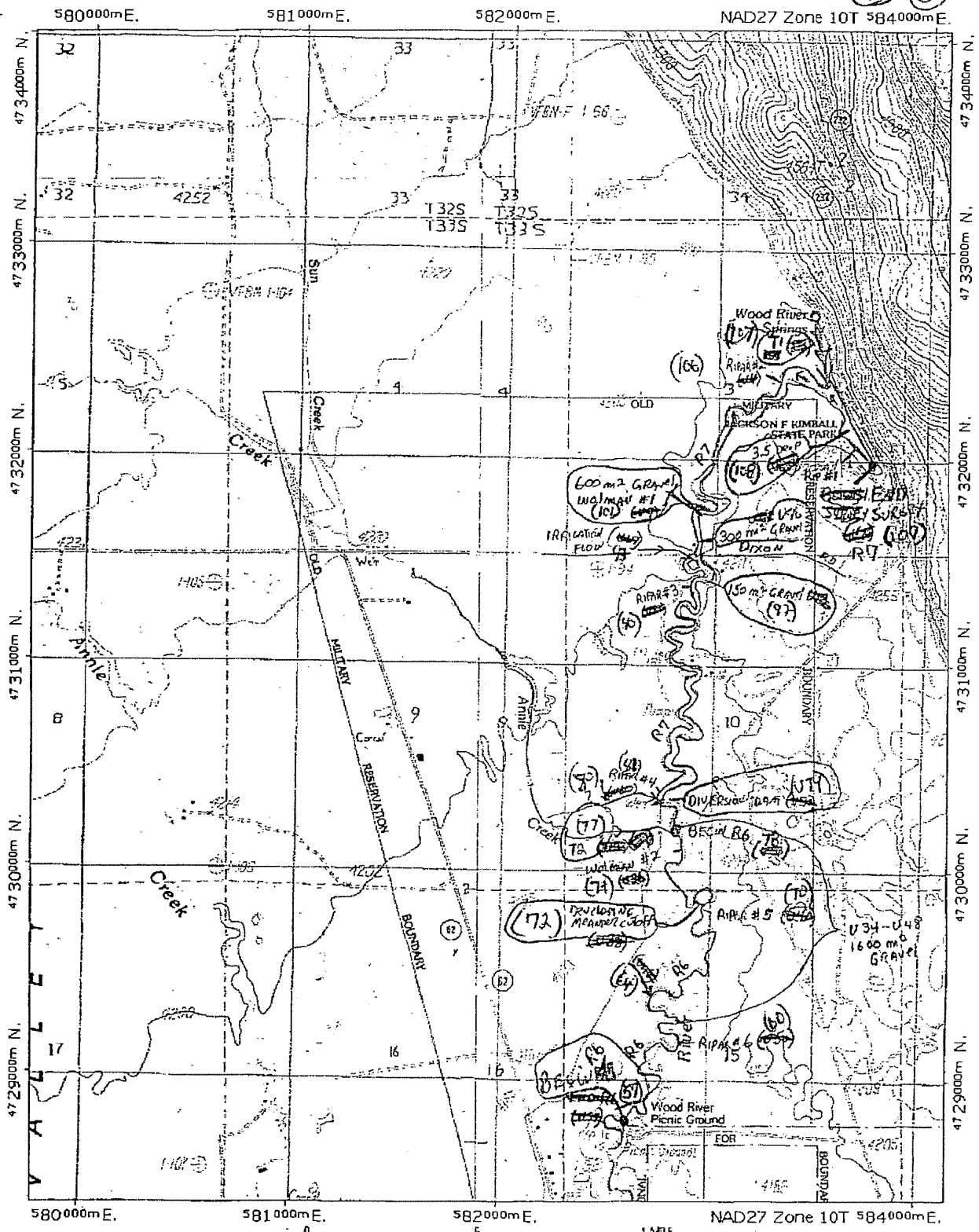
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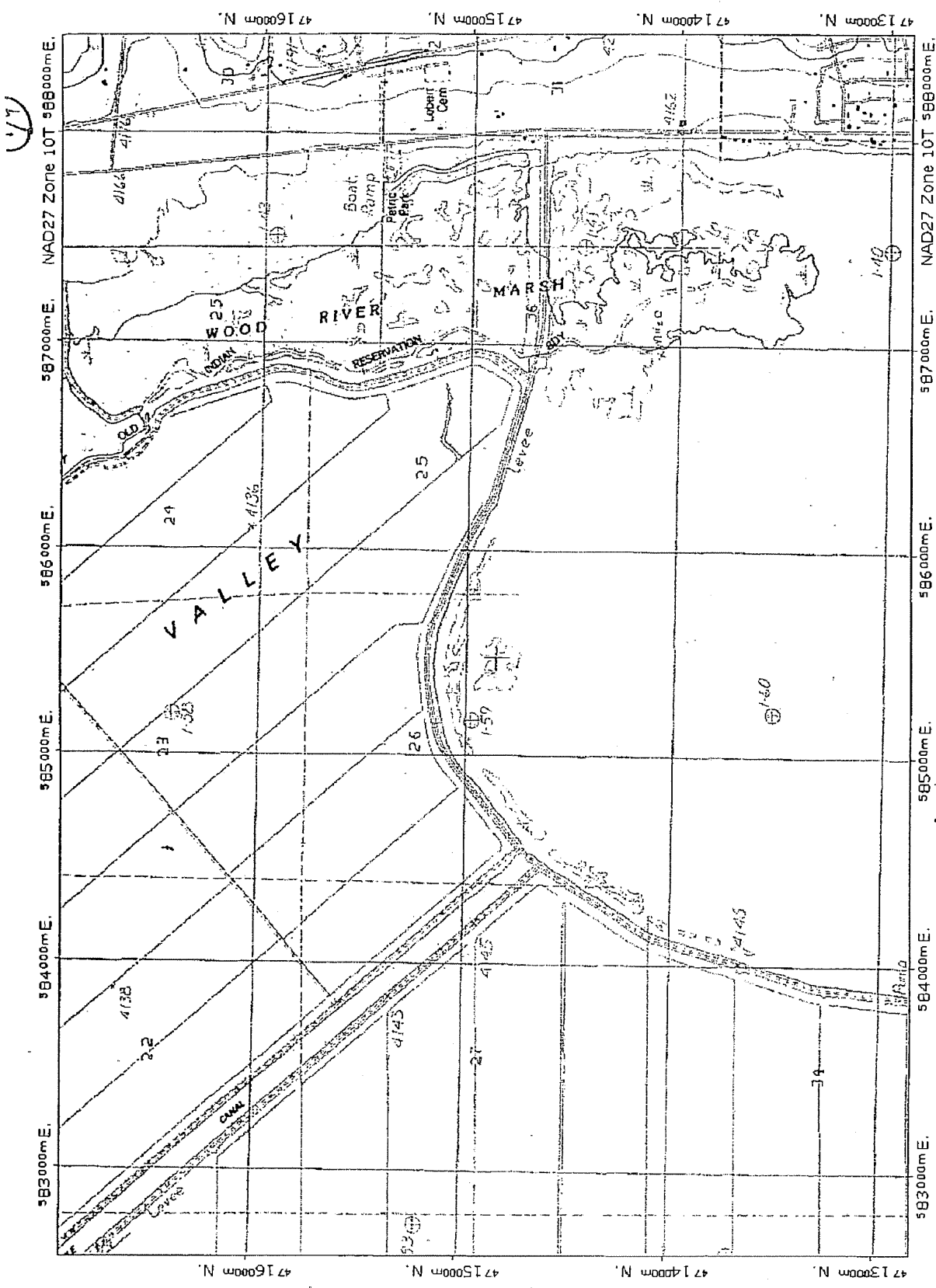
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Wood River + tributaries



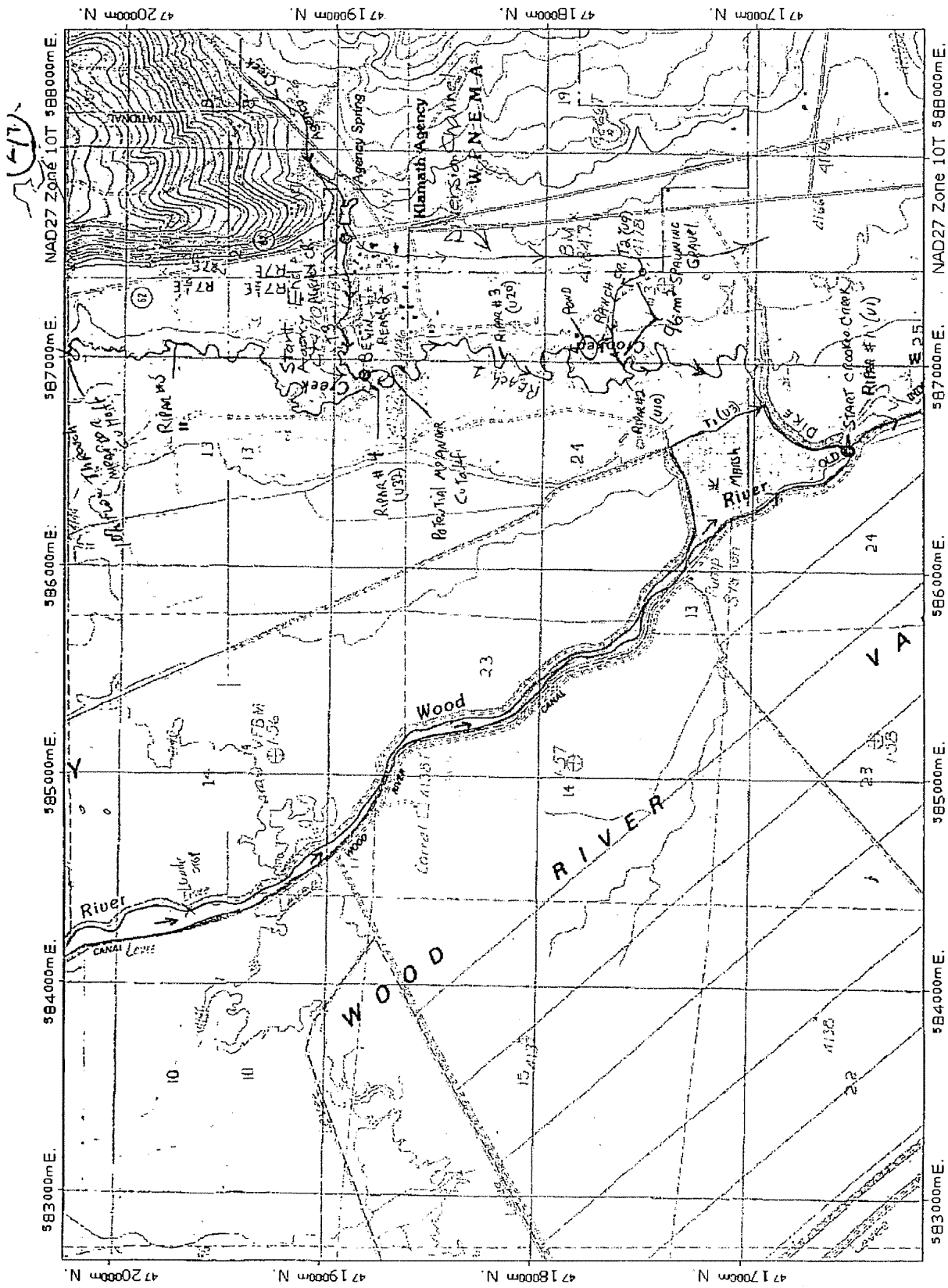


17

Wood River

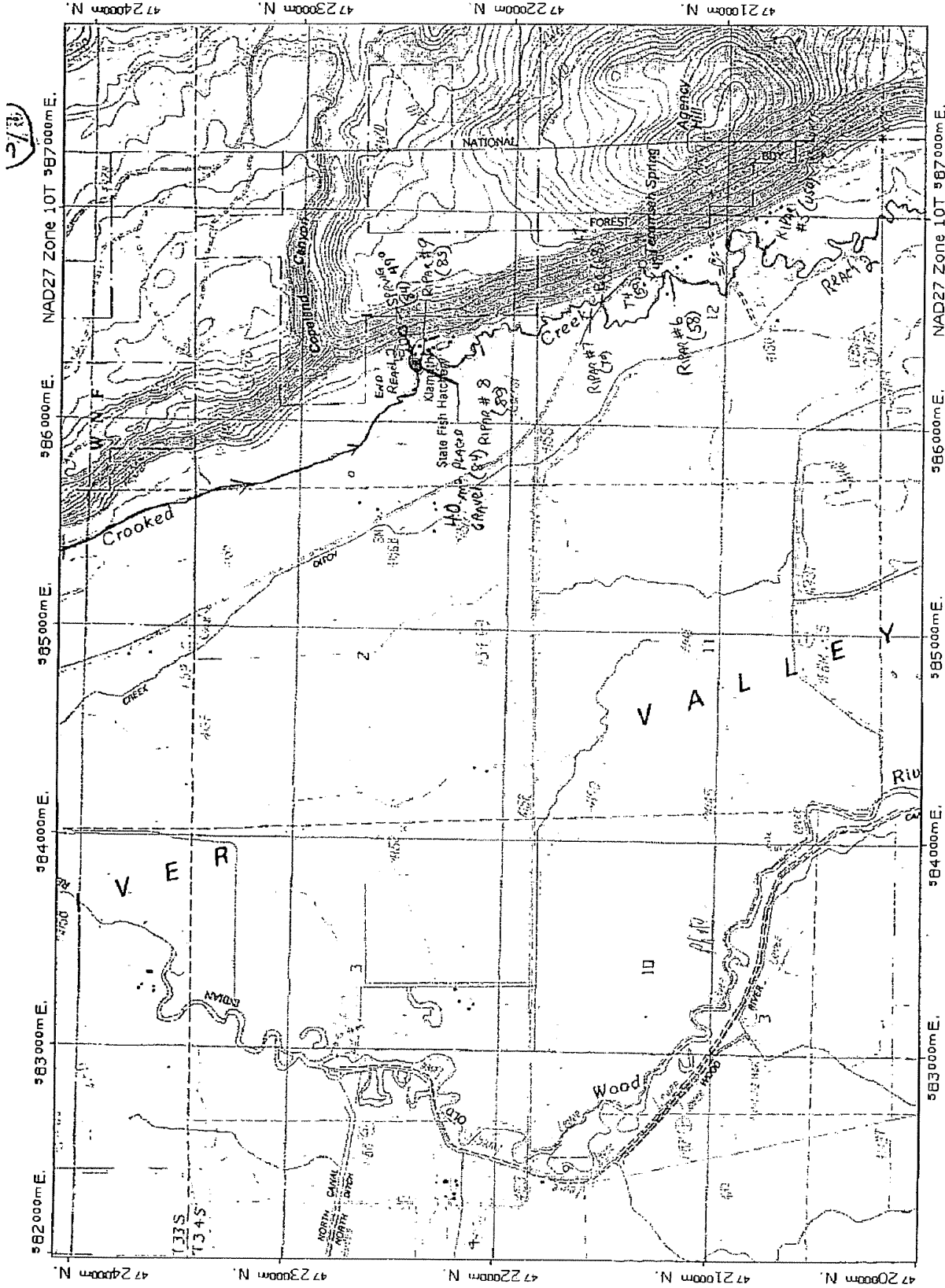
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Wood River + tributaries



(17)  
 Crooked Creek Reach 192  
 Wood River + tributaries  
 Name (mat. Reach 1)

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Crooked Creek Reach 2  
Wood River + tributaries

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