LAND WATERLOGGING
NORTH OF LAKE TOOLIBIN

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INTRODUCTION

Farmland areas owned by Mr John Chadwick and Mr Ron Miller north of Conservation Reserve A27286 in the Lake Toolibin catchment are subject to frequent inundation after heavy rains. This leads to waterlogging, loss of agricultural production and potential soil salinisation. Rising groundwater levels in the area also mean low lying, poorly drained areas may become saline. Figure 1 shows the study area.

Reserve A27286 experiences similar problems to the farmland and the vegetation on the reserve shows evidence of salinisation with many deaths in the north and east.

The two farmers have been negotiating with CALM reserve managers for a number of years to improve the drainage through the reserve. This would help alleviate the waterlogging of their farmlands. No agreement has been reached primarily because of CALM's desire to leave Reserve A27286 undisturbed (as natural as possible) and concerns about how any drainage works would impact the ecology and salinity of Lake Toolibin and other conservation reserves.

Through its Landcare project Alcoa have been asked to provide hydrological advice on this issue.

HISTORY

Scientific studies for the conservation of Lake Toolibin as a "freshwater" lake have been ongoing since 1977. These studies have concentrated on the lake itself and its immediate environs (see references). Little data has been reported about Reserve A27286 and the farmlands upstream.

SURFACE WATER DRAINAGE

Reserve A27286 and the farmland to the north are extremely flat and no continuous natural drainage channels exist. Infrequent large flood

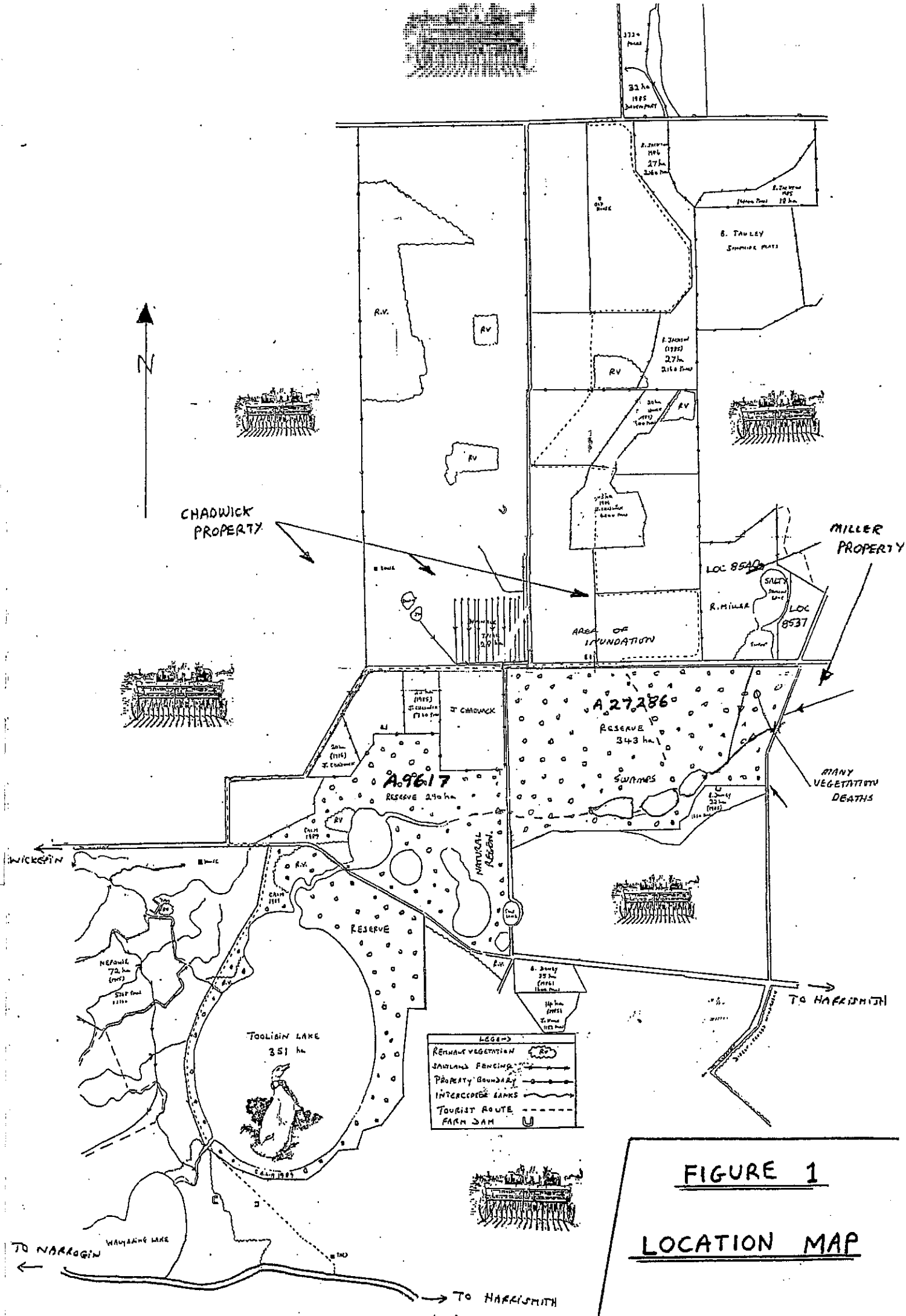

FIGURE 1

LOCATION MAP

events before agricultural development would have been directed through the reserve as it is the "floodway" for the North Arthur river upstream of Lake Toolibin.

Under natural conditions before agricultural clearing of the catchment infrequent flooding of the reserve by fresh water would have been beneficial to the vegetation. Groundwater levels would have been much lower (and most probably fresher) and would not have adversely impacted on the health of the vegetation.

Natural drainage channels through Reserve A27286 are very poorly defined. Some small drainage channels have been constructed in the north-east corner. The combination of poor surface drainage, clayey impermeable soils and increased surface runoff from cleared farmlands upstream means Reserve A27286 acts as a bottleneck to surface water flows. Uncoordinated drainage from upstream farms and poorly designed road drainage exacerbates the problem. After high rainfall events flooding of the reserve and the Miller and Chadwick properties occurs.

Surface water from Reserve A27286 floods west across Oval Road into Reserve A9617 then to Dulbining Lake, then across the Wickepin-Harrismith Road into Lake Toolibin. Poor natural drainage and flooding in Reserve A9617 is similar to Reserve A27286.

Water flow and salinity data is available from the WAWA gauging station on the Wickepin-Harrismith Road. No data is available for all the different tributaries, floodways and drainage channels upstream of this point. However local people state that waters from the West are "fresh" grading to "salty" in the north-east corner of Reserve A27286. A small lake on the border of locations 8537 and 8540 (see figure 1) is saline and in dry periods salt crusts develop.

VEGETATION

Vegetation of the Conservation Reserve A27286 is an open woodland community dominated by Eucalyptus salmonophloia (Salmon Gum) and E. loxophleba (York Gum), with admixtures of E. wandoo. Melaleuca

urceolaris and M. lateriflora are the dominant understorey species, with admixtures of Cyperaceae and Halophytic species. Health of the vegetation within low lying areas of the reserve is in decline. A large number of overstorey deaths are attributed in part to ringbarked trees, (Photo 1) a legacy from when grazing was the main land use of the reserve. This practice ceased a number of years ago.

With the clearing of surrounding areas for agriculture, surface water run off into the reserve has increased. Water samples of bores, established by the Department of Agriculture, have also shown an increase in groundwater salinity levels. Affects on vegetation of the increased drainage from cleared farmland is evident. Recent deaths of Salmon Gum were noted within the reserve. Also a significant number of Melaleuca deaths have occurred within areas of inundation (Photo 2). (Chadwick pers Comm.)

Photographs 3 & 4 show Salmon Gum and Melaleuca respectively in a state of decline. This was typical along drainage routes through the reserve. Studies on the vegetation of Lake Toolibin in 1987 have indicated that the York Gum is not able to withstand even low soil salinities and has a lack of tolerance to soil saturation. Melaleuca sp. is also susceptible to increasing levels of salinity.

Cyperaceae and Halophytic species (Schoenus and Samphire) were the major components of ground dwelling species within wetter areas of the reserve. The presence of this understorey type reflects the underlying soil and moisture conditions. The presence of Samphire became more frequent as inundation increased (Photo 5). The formation of soil mounds (Photo 6) is evident through the effects of grazing, winter waterlogging and summer drying. In some areas salt crusting of the surface of bare soil patches and cracking of the surface suggests that soil structure has been damaged. Plant germination and growth in these areas is severely restricted.

Reserve A9617 (refer figure 1) was cleared for farming but after resumption by CALM it has been allowed to regenerate naturally. The regeneration is mostly successful but plants in low lying areas and the north-east corner are showing signs of stress. Leaf blade

Photograph 1: Eucalyptus wandoo stag ringbarked to allow grazing within the reserve (refer Map 1 for location).

Photograph 2: Melaleuca sp. deaths caused by inundation and increasing salinity (refer Map 1 for location).

Photograph 3: Eucalyptus salmonophloia under stress (refer Map 1 for location).

Photograph 4: Melaleuca sp. in decline within area of seasonal drainage (refer Map 1 for location).

Photograph 5: Area of inundation showing increased Halophyte (Samphire) frequency (refer Map 1 for location).

Photograph 6: Shows mounding of soil surface in an area of drainage and seasonal water ponding (refer Map 1 for location).

necrosis exhibited by numerous eucalypts along Oval Road is one sign of plant response to salt stress.

A comprehensive survey of the Lake Toolibin Conservation Reserve vegetation has been scheduled by Government agencies for 1990 and will provide extremely valuable data when complete. Effects on vegetation health due to any increased drainage through either the reserve or the lake surrounds should be included with the detailed survey.

Policies to promote active management of the reserve are required immediately for the restoration of affected areas and the preservation of remaining healthy vegetation. Reserve A27286 appears to be in danger of becoming severely affected by salinisation.

DISCUSSION

Considering the decline in health of the vegetation within the Lake Toolibin Conservation reserves, and the damage to soil from repeated and prolonged waterlogging any attempt to direct or increase surface runoff from nearby farms requires careful consideration. Water from any drainage options will eventually flow into Lake Toolibin and thus their impact on the lakes water quality are of utmost importance.

The present management system to preserve the "fresh status" of Lake Toolibin is to enhance any fresh water inflows and keep saline groundwater from rising to intersect and discharge into the lake.

Most of the higher surface water inflows into Lake Toolibin are presently of reasonable quality (1000 to 3000 mg/l TSS). Any drainage options must not contribute to a decline in their quality or increase their total salt load.

Drainage improvement work in the whole Lake Toolibin catchment appears to have been on an adhoc basis in previous years. Examples of where drainage channels stop at property boundaries are evident. Clearly an integrated catchment drainage improvement programme needs to be implemented. A integrated approach would; make better use of limited

resources; improve agricultural productivity; decrease water logging; slowdown and may even turn around land salinisation; conserve and improve the Lake Toolibin Flora and Fauna Reserves and help maintain the water quality of Lake Toolibin.

Any drainage option for Reserve A27286 must be part of a total integrated catchment drainage plan and should aim to:

- improve farm waterlogging problems
- improve road drainage and trafficability
- have beneficial impact of the conservation values of reserves A27286 and A9617
- increase fresher surface water flows into Lake Toolibin
- divert saline surface water flows away from Lake Toolibin
- reduce time water ponds upstream of Lake Toolibin so as to reduce recharge to the groundwater system
- reduced ponding will also reduce concentration increases of surface water by evaporation and length of time waterlogging occurs
- not cause increases in the risks of flooding of areas further downstream
- be able to be constructed within tight funding limits
- consider option of creating evaporation basin upstream of the Reserve A27286 for saline water.

With careful research and planning an improved drainage system can be designed to meet most of the above aims. An active catchment and reserve re-vegetation programme should also be integrated with the drainage plan.

DRAINAGE OPTIONS

Several improved drainage options have been put forward for consideration by various people. The options are shown on the attached figures 2 to 5. However to fully appraise the options, data for surface water flow rates and quality must be obtained. Observations and recordings of water flow directions during flood events would also be helpful.

The present system of smaller more saline surface water flows being contained in the chain of lakes north of Lake Toolibin needs to be preserved. Any larger flow events should be relatively fresher and they should continue to overflow to Lake Toolibin.

RECOMMENDATIONS

- Operation of WAWA monitoring stations be maintained
- 1990 vegetation survey should proceed
- a surface water monitoring programme for streams surrounding Reserve A27286 be carried out during the 1990 winter (K. McIntosh, P. Hawker and M. Elliott established this in June 1990 Figure 6). Data on stream salinity and "order of flowrate" to be recorded.
- Water flow directions during a flood event to be recorded in field (K. McIntosh)
- A survey to establish ground levels be carried out along the lines shown in Figure 7.

- A consultant be employed to:

  - review data collected over 1990 winter
  - develop a drainage option that can be incorporated into a integrated catchment plan
  - predict impacts on Lake Toolibin water quality
  - predict any increases in local or regional flooding
  - cost various favourable options
  - prepare an environmental impact assessment for the preferred proposals
  - make sure proposals meet "Goals of Lake Toolibin Catchment Committee"
  - redesign road drains and culverts
  - outline any ongoing maintenance requirements
  - incorporate drainage plan with tree planting programme
  - recommend any ongoing monitoring.

Comment

Funding of $20,000 for a Consultants report has been applied for by CALM to the "Australian National Parks and Wildlife Service State Cooperative Assistance Program". If this application is unsuccessful alternative sources of funding should be investigated as a priority.

CONCLUSION

With the 1990 winter data collection and consultants report a drainage plan to alleviate land waterlogging north of Lake Toolibin can be recommended. The plan can and must ensure that the farmers problem is not remedied only to create other problems downstream to either the conservation reserves or to Lake Toolibin. Construction could take place in summer/autumn 1991 ready for the 1991 winter.

Improved drainage will also enhance the conservation values of the conservation reserves because in particular reserve A27286 is degrading rapidly under the impacts of waterlogging and salinisation.

Action is needed as the farmers are becoming frustrated at the lack of progress over the last few years. Their continued support to landcare projects is critical.

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\km\644.90

FIGURE: 2

▲ SAMPLE PTS → EXISTING DRAINAGE LINES

- DRAINAGE OPTION:

SHOWN

DEPENDS ON QUALITY AND SALT YIELDS OF STREAM FLOWS.

1. DIVERT ALL FRESH WATER TO WEST SIDE AND INTO DULBINING LAKE
2. DIVERT ALL SALINE WATER TO EAST
3. UPGRADE CULVERTS ALONG NTH TOOLIBIN ROAD IN ALL OPTIONS

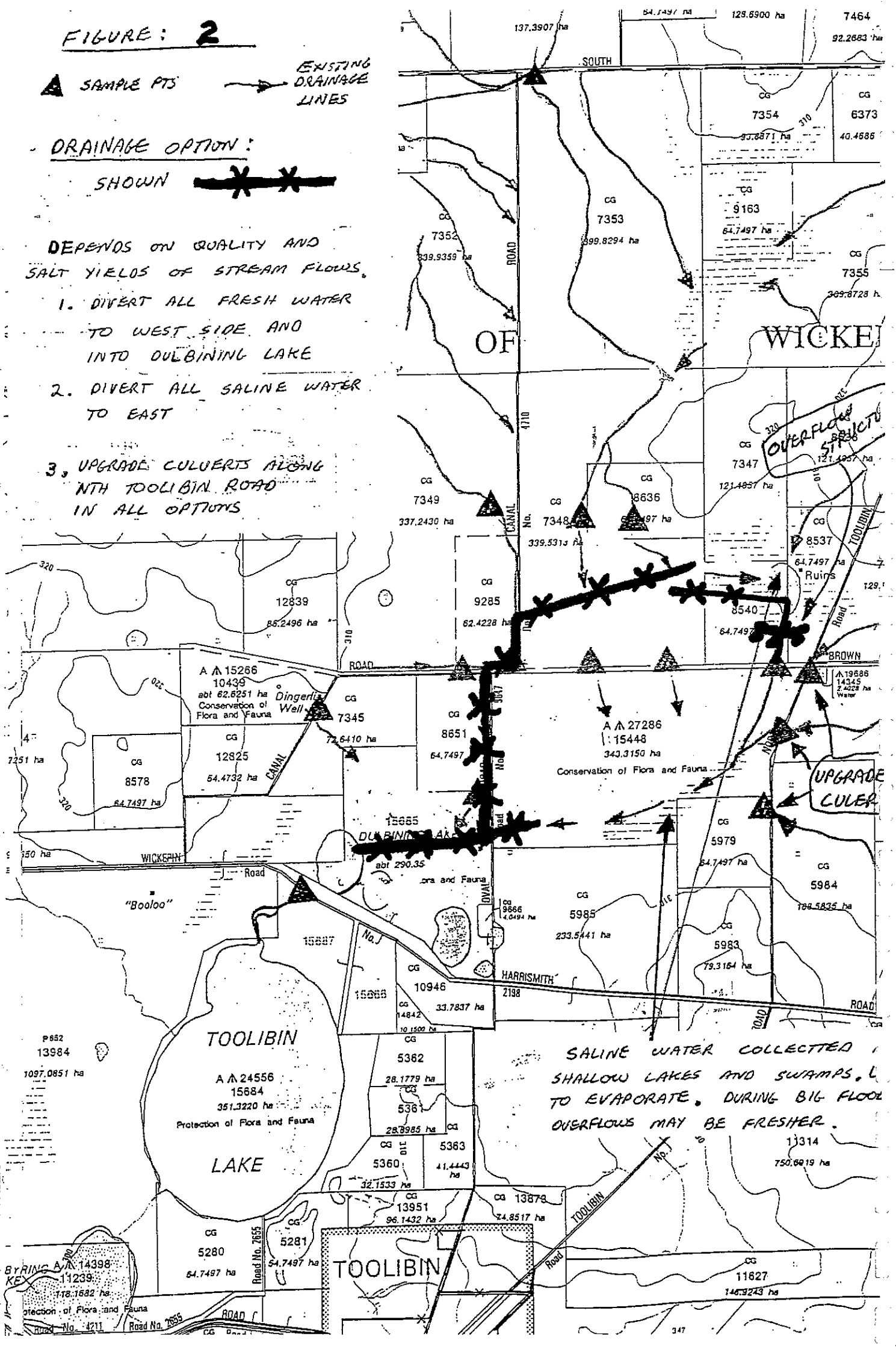


FIGURE: 3

▲ SAMPLE PTS → EXISTING DRAINAGE LINES

DRAINAGE OPTION:

SHOWN ✱✱✱

DEPENDS ON QUALITY AND SALT YIELDS OF STREAM YIELDS

DRAIN ALONG BROWN RD TO WEST PROVIDED WATER IS FRESH

MORE SALINE WATER TO EAST

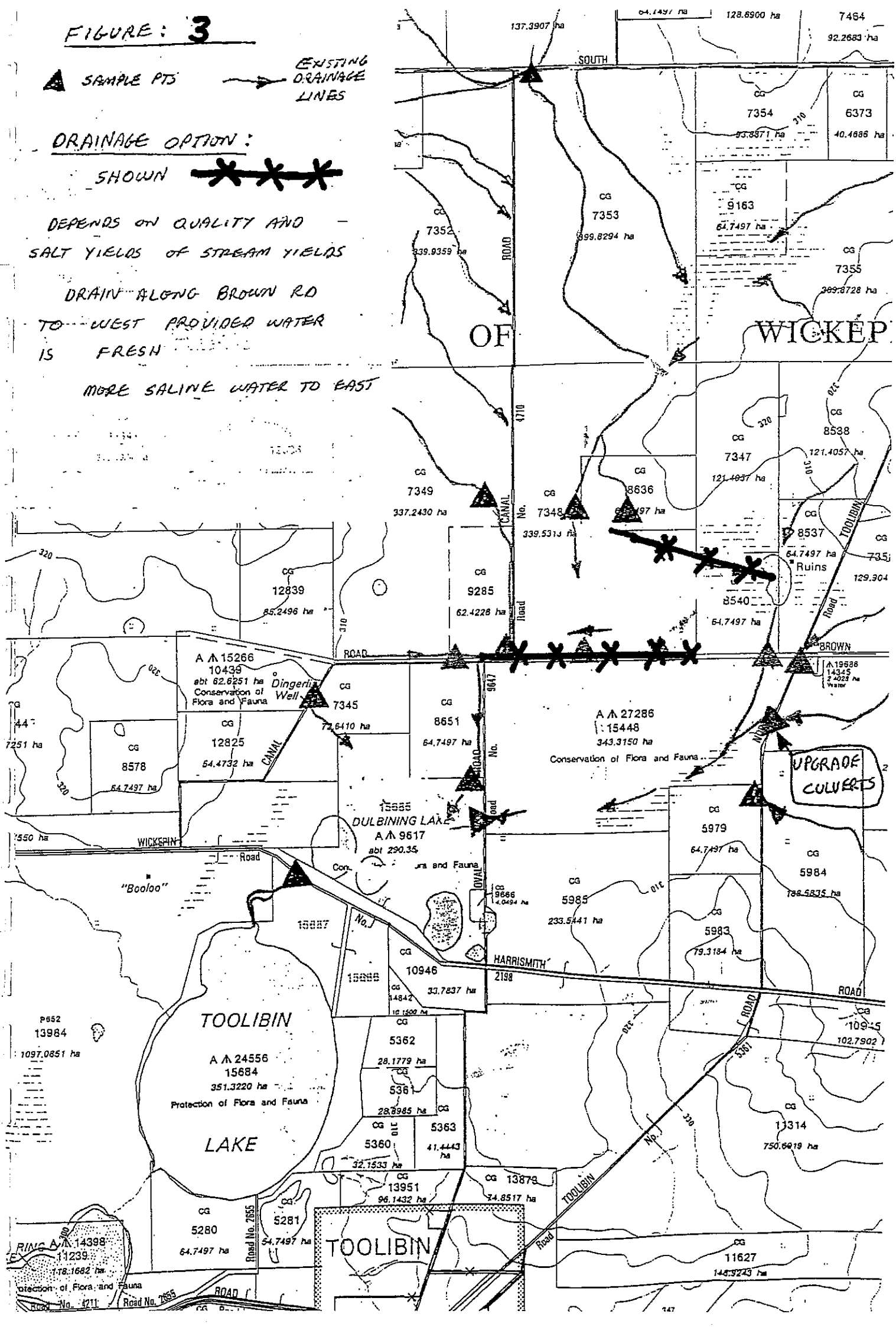


FIGURE: 4

▲ SAMPLE PTS → EXISTING DRAINAGE LINES

DRAINAGE OPTION:

SHOWN ✱✱✱

DIG DRAINING CHANNELS ALONG EXISTING ILL-DEFINED FLOW LINES

REMOVING FALLEN VEGETATION ALONG FLOW LINES WOULD ONLY BE OF MINOR HELP

THIS OPTION WOULD HAVE NEGATIVE IMPACT ON RESERVE A 27286

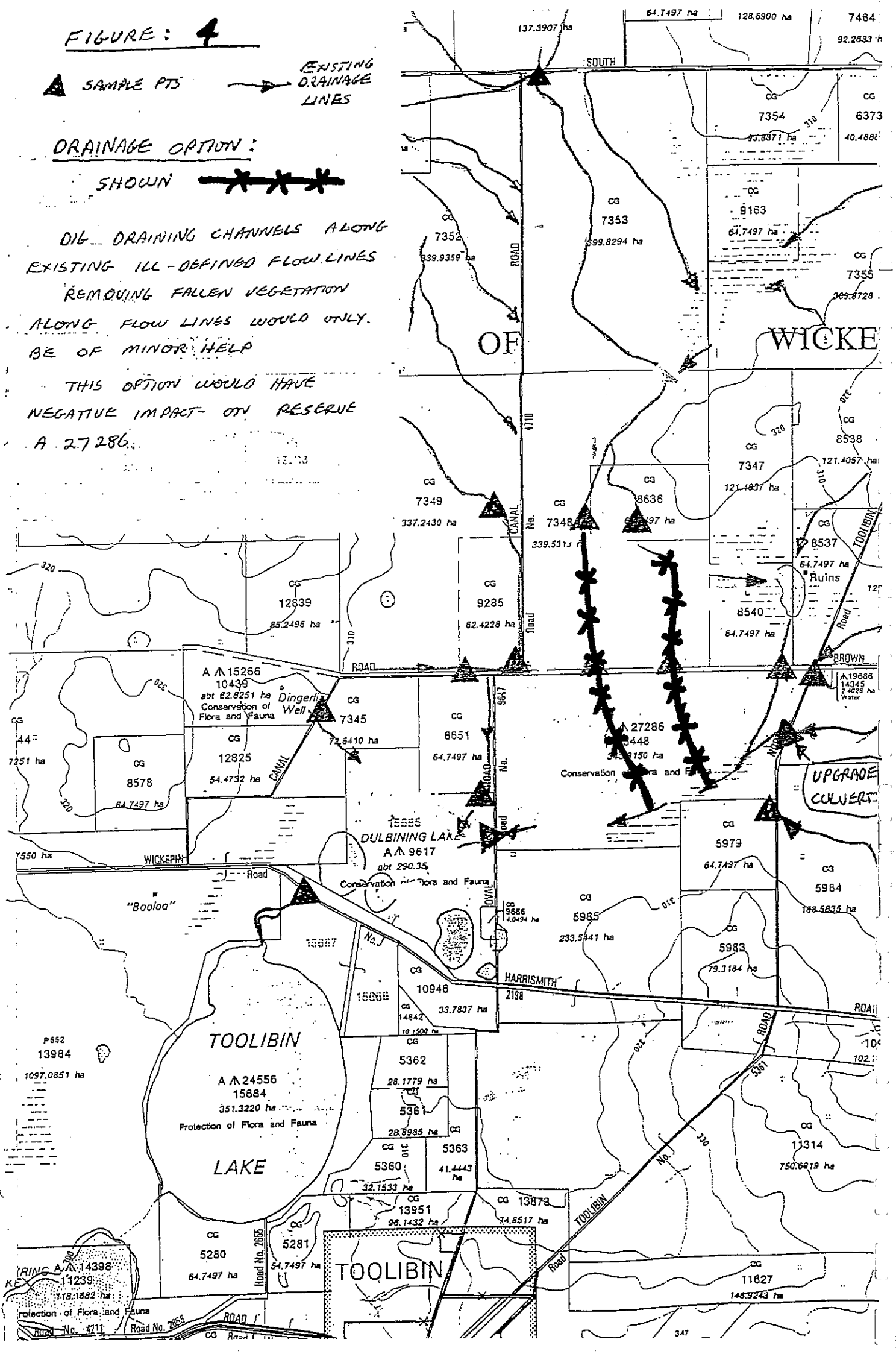


FIGURE: 5

▲ SAMPLE PTS → EXISTING DRAINAGE LINES

DRAINAGE OPTION:

SHOWN ✱✱✱

DIVERT ALL SALINE WATER INTO EVAPORATION BASIN. TO CONTAIN UP TO 1 IN 10 YEAR FLOODS !!

LONGER RETURN PERIOD FLOODS TO OVERFLOW THROUGH CONTROLLED STUCTURE. WATER FROM TOP SHOULD BE FRESHER.

SALINE LAKE. EXCAVATE AND BUILD WALL ON DOWNSTREAM OF THE TO CREATE EVAPORATION BASIN.

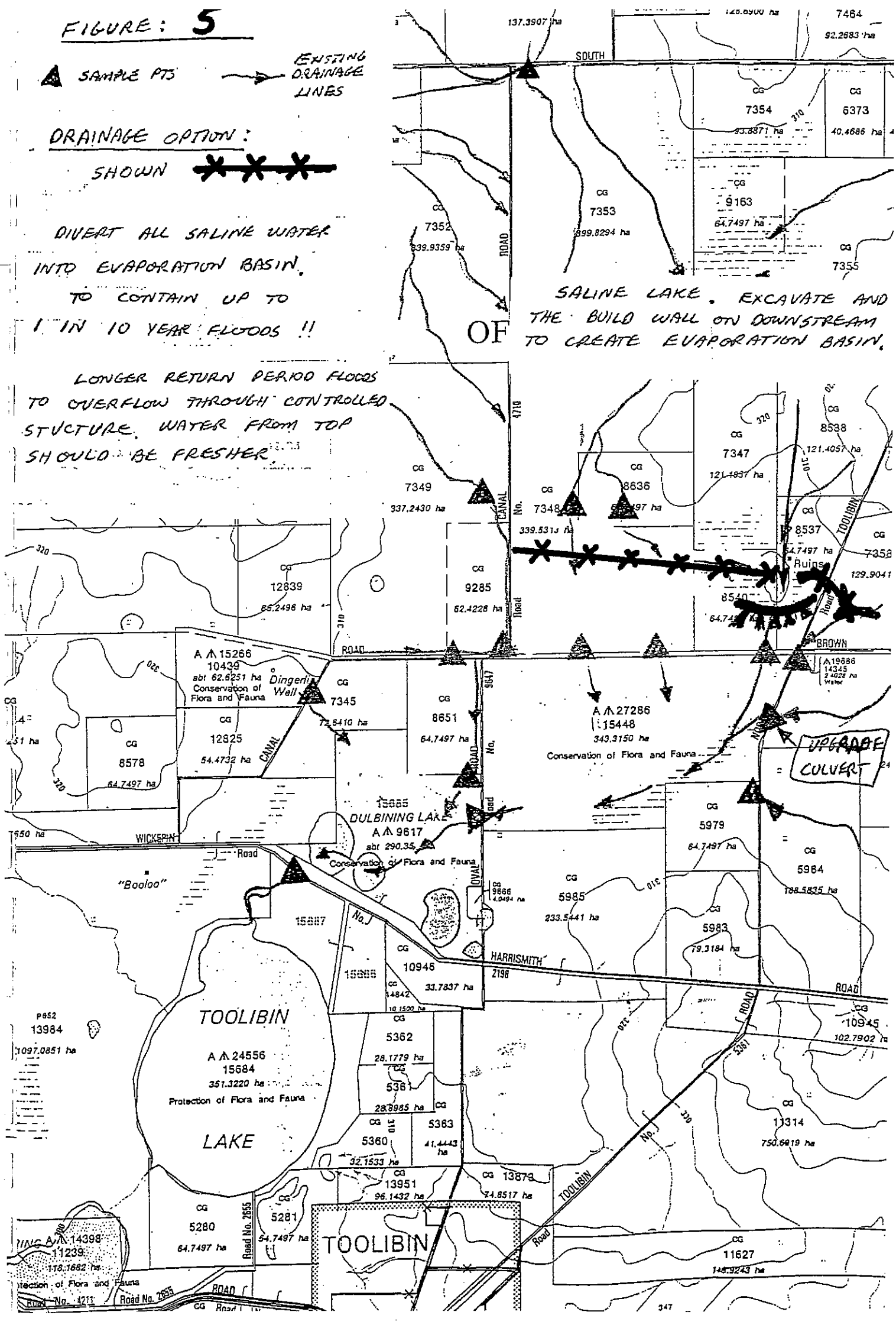
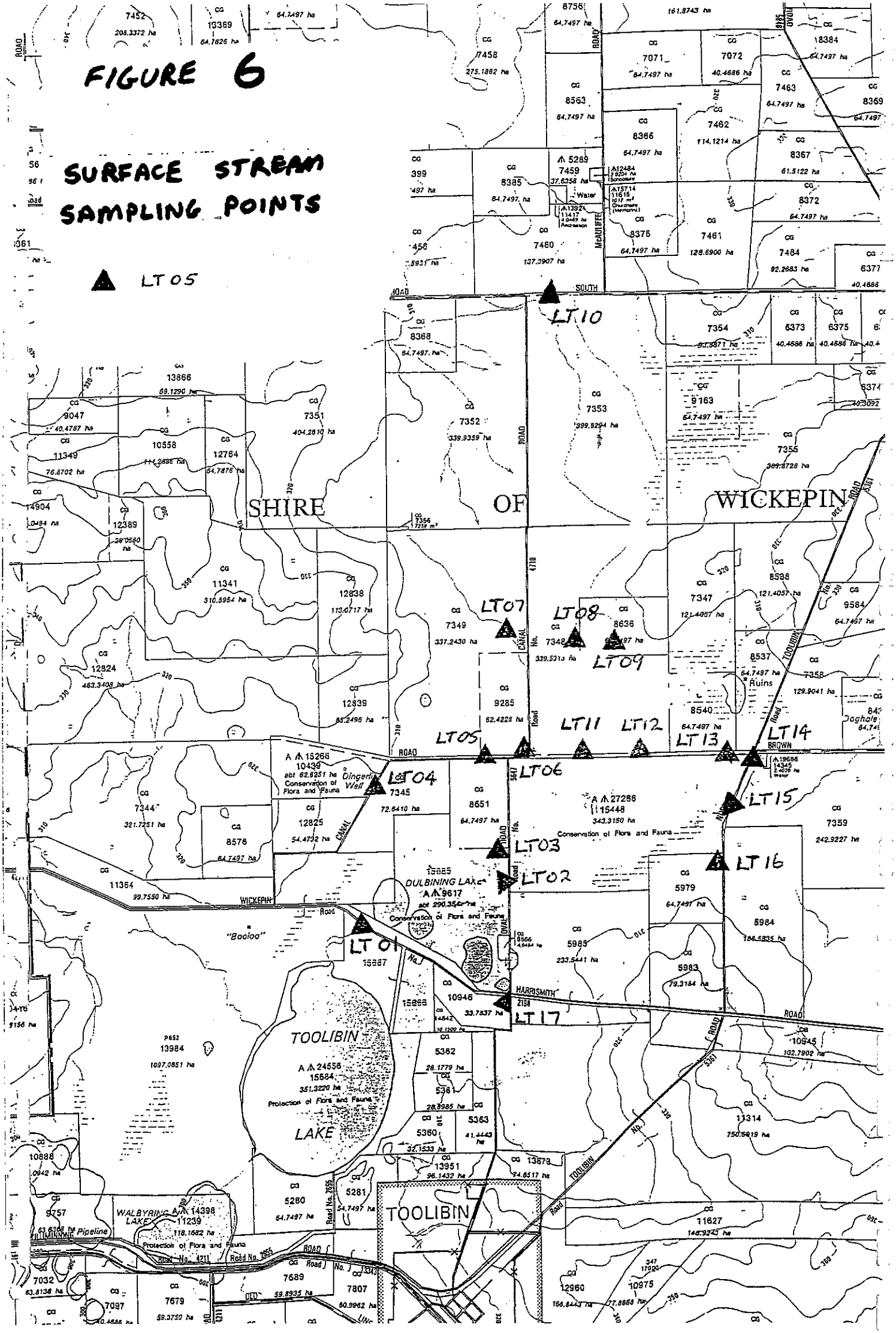


FIGURE 6

SURFACE STREAM SAMPLING POINTS

▲ LT 05



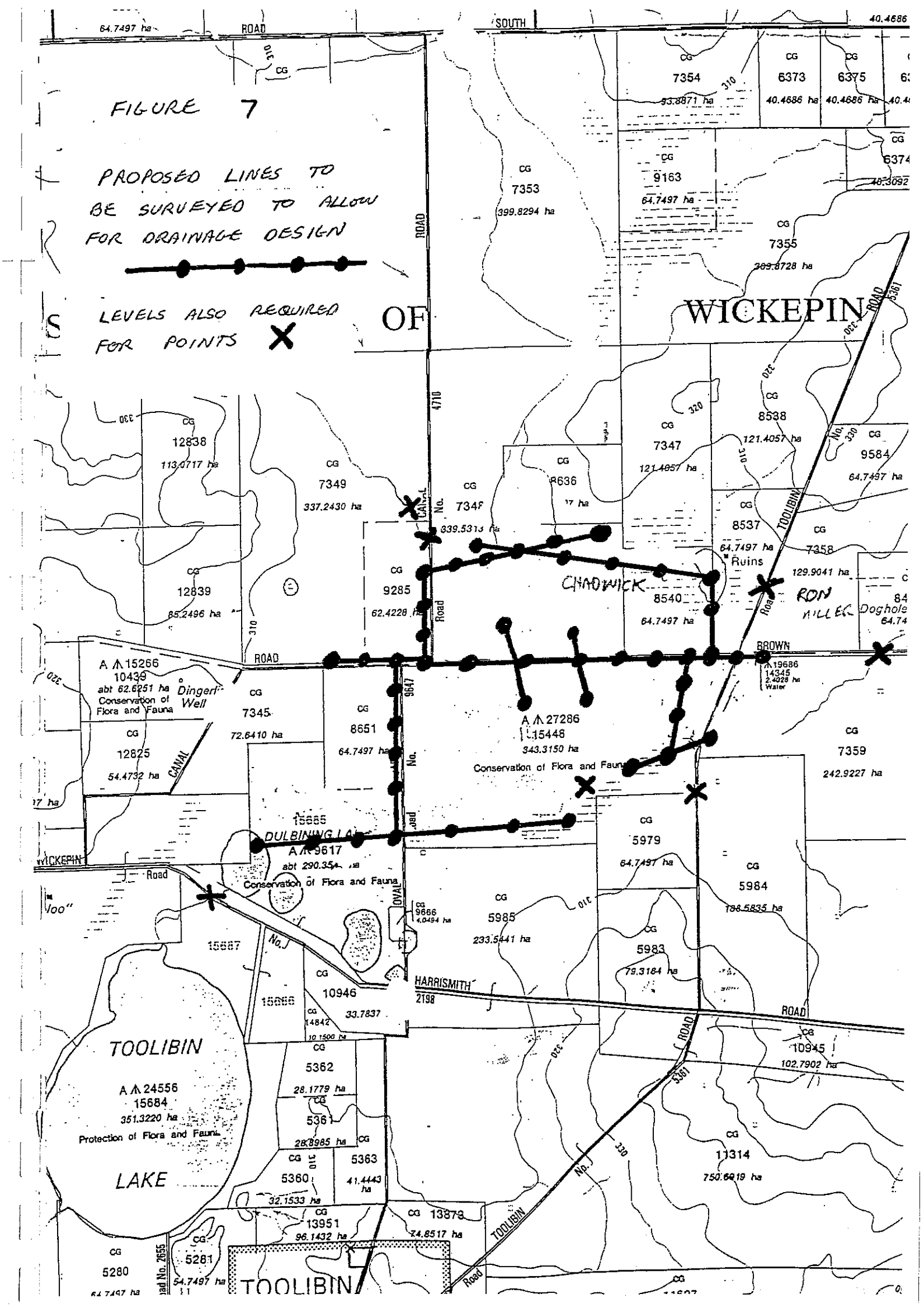


FIGURE 7
PROPOSED LINES TO BE SURVEYED TO ALLOW FOR DRAINAGE DESIGN
LEVELS ALSO REQUIRED FOR POINTS
WICKEPIN
CHADWICK
TOOLIBIN
LAKE
HARRISMITH
DULBINING LA
Dingerl Well
Ruins
RON MILLER
BROWN
Conservation of Flora and Fauna
Protection of Flora and Fauna
ROAD
CANAL
Road
SOUTH