PROGRAMME DE RENATURALISATION
DU VILLAGE NORDIQUE DE KUUJJUAQ

APPENDIX 1

WORK PLAN FOR THE REVEGETATION OF THE NORTHERN VILLAGE OF KUUJJUAQ

presented to

the CANADA MORTGAGE AND HOUSING CORPORATION

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FINAL VERSION

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1. Introduction

The village of Kuujjuak, like many other northern communities, is presently subjected to a rapid socioeconomic development. It has been necessary to rapidly build new houses to respond to the needs of the growing population. This has had some consequences on the quality of life of the residents due to the degradation of the environment. To open up new neighborhoods requires the building of new roads and the leveling of the surfaces to be developed. This kind of work usually implies the removal of the entire vegetation cover. With the extreme weather and site conditions that prevail in these regions, the reconstitution of the vegetation cover is extremely difficult and slow. The sites are usually composed of compacted sand with little or no organic material or nutrients.

In the absence of vegetation, the winds, which are frequent and strong in these northern regions, blow on these denuded surfaces and carry a considerable amount of dust and sand. The sand deteriorates the housings and has some consequences on the health of the population.

The aim of the present project is to improve the quality of the housings and the quality of life in Kuujjuak by restoring a vegetation cover on the denuded surfaces within the village.

To achieve this goal, it is essential to elaborate a restoration plan that locates the degraded sites and establishes priorities in terms of actions to be undertaken. The proposed actions for the restoration on the vegetation cover within the village take into account site vocation.

2. Mapping process

In an effort to give the most accurate portrait of the degradation of the environment in the village of Kuujjuak, a precise plan of the actual vegetation cover and of the denuded sites has been completed (maps 1 and 2, back pocket).

Aerial photographs of Kuujjuak (Geffair inc., 1993) have been used to map the vegetation cover of the village as well as the sandy sites and the different pathways that exist beside the official road system. The information was reported on plans produced by the *Service de l'arpentage* of the *ministère de l'Énergie et des Ressources* (1983, 1986). The photographs give an accurate image of the state of development of the village in date of 1993. Since that date, the village has expended, and consequently it has been necessary to update the information.

In July of 1996, the mapping of the village was undertaken in the field. All the information that had been mapped was cross-checked, the new developments were mapped and the service areas were located for each building. The location of the service areas was impossible to do from the aerial photographs but was an essential information for the conception of the revegetation plan. Many pathways exist between houses which need not be. Yet, we could not recommend to close them without knowing if they were essential for the services (water and fuel delivery, sewage and garbage pick up).

The proposed revegetation plan aims at minimizing the amount of denuded sites within the village. The closure of some pathways or driveways and the greening of some areas are recommended only if they are thought not to interfere with the activities related to the distribution of services.

3. General recommendations

Actions have already been taken to improve the environment of Kuujjuak. In the recent years, the Centre d'études nordiques (CEN) with the municipality of Kuujjuaq has initiated a revegetation program for the village and the municipal council has started a vast program of road pavement which is still under way. These actions will contribute significantly to diminish the bare surfaces exposed to the wind and then ameliorate the living conditions in the village.

Beside these actions, the CEN has put forward a public awareness program. Indeed, the implication of the population is a key factor that will contribute to the success of the project.

To ensure the success of the program, we recommend:

- to pursue the revegetation project around the houses. All bare surfaces not used around and between the houses should be seeded or planted;
- to close as many pathways as possible and to revegetate these areas;
- to spread gravel or to pave large sectors where it is not possible to revegetate (large access to warehouses, large parking lots);
- to give a specific formation to the staff employed to deliver the services. The importance of their contribution to the success of the program should be emphasized. For example, a significant contribution would be to avoid using shortcuts in front of houses or between houses to eliminate the stamping of the vegetation;
- to renew the specific formation as the staff changes;
- to renew the specific formation at critical periods during the course of a year. For example, in spring time, remind the workers of the importance of respecting the revegetated areas;

- to make the population more aware of the importance of the project through community programs on the radio or on TV, at school, and at summer camp;
- to keep as much of the vegetation cover as possible when putting in new buildings;
- to revegetate the surroundings of new buildings after construction is over;
- when new roads are built, to close old roads and revegetate.

4. Specific recommendations

The specific location of the 16 sections is presented on maps 3 (section 1 to section 9) and 4 (section 10 to section 16). For each of these sections, we recommend specific restoration work of three types: to close trails, to seed surfaces and to plant willow cuttings or seedlings of other woody species.

The trails should be closed either at both ends or at any place indicated on the map specific to each section. We recommend to use lines of rocks about 30 cm (12 in.) high to close trails. We strongly stand against the use of local trees to build wood fences. In the Kuujjuaq area, spruce and tamarack trees grow very slowly; the ones cut for poles that are used around some houses in the village could easily be older than 100 years old. The methods of seeding and plant production are described in chapter 5 of this work plan. All seeded or planted surfaces should be delineated with rocks.

Section 1

This section is located west to the Kaivivvik circle. The restoration work recommended for this section concerns two areas; the first one is located at the corner of Kaivivvik circle and Naalavvik street and the second is along Kaivivvik circle, between buildings #601 and #611. In section 1 we recommend to:

- close the trail between Kaivivvik circle and Naalavvik street;
- seed the surface at the southeast end of the playground, between the corner of Kaivivvik circle and Naalavvik street and the houses #T-101 and #T-102;
- widen the vegetated surface along Kaivivvik circle between Naalavvik street and the Airport road by seeding grass seeds and planting willow cuttings.

Section 2

This section is located inside the Kaivivvik circle. Large areas are unvegetated inside the block surrounded by the Kaivivvik circle. These areas are mainly located close to the Northern store and the school. In section 2 we recommend to:

- reduce the width of Ploughman lane by seeding a 1-2 m wide stripe on the west side of the pathway along the already established vegetation;
- seed the surface between the Northern store and the apartment building west of it;
- close and seed pathways behind the post office, between the post office and the school, and between the school yard and the northern part of Kaivivvik circle;
- seed the surface located between the playground (behind the school) and house # 706;
- seed the surface in front of the school, between the school and the driveway.

Section 3

This section includes the Berthe crescent and the intersection of Kaivivvik circle and Imirtavik road. In section 3 we recommend to:

- close and seed the trail going from Kaivivvik circle to Imirtavik road between houses #296 and #345;
- seed the surface located along Berthe crescent behind house #296;
- close the trail going from Kaivivvik circle to Imirtavuk road at the corner of these two streets;
- seed the surface delineated around house #507.

Section 4

This section covers the two blocks located between Kaivivvik circle and Katingajiit road. The Kativik Regional Government (KRG) and Transport Canada buildings are located in this section. It has several trails that should be closed to ATV circulation. Some trails have already been closed in front of houses #432 and #810, and between houses #433 and #728 on Turainnatuk street. At both of these places, residents have placed rocks about 30 cm high along the street to put a stop to all kind of circulation between the houses. This will allow the natural vegetation to re-establish and constitutes a good example of action that people can take to help revegetating the village. In section 4 we recommend to:

- close and seed the trail west of house #78;
- close the trail west of the Transport Canada building and seed the delineated area;
- seed the surface between houses #T-104 and #729;
- close and seed the trail going from Turainnatuk street to house #729;
- close and seed a network of trails located northwest of house #432;
- close and seed the trail between houses #810 and #811;
- close all access to and seed the surface west to the KRG building;
- close and seed the trails between houses #812 and #151.06;
- close and seed the trail between houses #151.06 and #433;
- close and seed the trails surrounding house #832.

Section 5

This section covers the two blocks located between Siuralikuut street and Makaiuk street. Here again, many unnecessary trails were found between houses. In this section we recommend to:

- close the trail at the corner of Kaivivvik circle and Siuralikuut street;
- close the trails and seed the surface between houses #715-716 and #717-718;
- close and seed the trail between houses #713 and #731;
- close the trails and seed the surfaces between houses #719 and #731;
- close and seed the trails between houses #510 and #307;
- stop the circulation between Siuralikuut street and Akianut street near house #907 by seeding the surface between houses #907 and #911;
- close the trails west to the house #911;
- seed the surface east to the Québec government building;
- seed the surface between the Sureté du Québec building and house #808;
- close the trails south of the Sureté du Québec building;
- seed the surface between houses #1 and #102;
- close and seed the trail network Makaiuk between street and Akianut street;
- seed the surface between the daycare center (building #513) and house # 171;
- seed the surface in front of the C.H.U. building.

Section 6

This is the section located south to the Council building. It is bordered by Siuralikuut street and Katujivik street. In this section we recommend to:

- pave or put gravel in front of the Council and Hydro-Québec buildings;
- close the trails and seed the surface south of Hydro-Québec building;
- close the trail and seed the surface behind the Council building;
- close the trail and seed the surface between #216 and Watt avenue;
- seed the surface near house #227.

Section 7

The revegetation of this area, open to dominant winds, is very important. In this section we recommend to:

- seed the surface at the corner of Katingajiit road and Katujivik street;
- close the trails and seed the surfaces down the Kuujjuaq Inn;
- seed the surfaces between the sheds behind the houses on the west side of Ford road and Suppa road;
- seed the surfaces between houses #109, #110 and #111;
- close the trails and seed the surface between Ford road and Suppa road at the corner of these two streets.

Section 8

This section was built recently. The space between the houses is in a way often large enough to be seeded. In this section we recommend to:

- seed the surfaces between the houses where and as indicated;
- seed the surfaces between the sheds.

Section 9

This is Chopper crescent. This section was also built recently. In this section we recommend to:

- close and seed the trails and bare surfaces at the corner of Chopper crescent and Imirtavik road as delineated;
- seed the surface between houses #277 and #279, and behind houses #279, #281 and #283;
- seed the surfaces between houses # 285 and #287, houses #287 and #289, and houses #289 and #291;
- close and seed all trails between houses in the western middle part of Chopper crescent;
- seed and plant willow cuttings in the surface delineated in the western middle part of Chopper crescent;
- seed the surface at the west side of house #286;
- seed the surfaces between houses #286 and #735, and houses #735 and #737;
- close and seed the trail between houses #81 and #288;
- seed the surface between houses #81 and #83;
- close and seed the trail between house #744 and Imirtavik road;
- seed and plant willow cuttings on the surface between houses #744 and # 288;
- seed the surfaces between houses #297 and #299, houses #299 and #834, and houses #834 and # 105.

Section 10

This is the section located south of Ford road, between airport road and Katujivik street. In this section we recommend to:

- plant trees and shrubs along the ditch at the north-east end of the summer construction site. Willow cuttings should be planted on the slope of the ditch, whereas spruce and tamarack seedlings should be planted beside the ditch to serve as a wind breaker;
- seed the surface delineated on the other side of the ditch;
- close and seed the trails in front of houses #188, #189, #150 and #154;
- seed the surfaces between houses #152, #153 and #154;
- close and seed the trails and surfaces between houses #150 and #151, and houses #148 and #149;
- close and seed the wide pathway between Ford road and Flood square near the corner of Ford road and Saunders street;
- close and seed the trail between houses #137 and #141;
- seed the surface in front of houses #10, #142, #141, #145, #149, #151, #155, #198, #16 and #18;
- close and seed the trails in front of houses #143, #153 #197 and #214;
- close and seed the trail between houses #196 and #12;
- close and seed all the trails in the sector bordered by houses #195, #12, #146 and #147;
- close and seed the trails in front of houses #128, #118 and #11;
- seed the surfaces between houses #11 and #135, and houses #321 and #122.

Section 11

This section is located between Katujivik street and Siuralikuut street. In section 11 we recommend to:

- seed as many surfaces as possible around the elder's house;
- seed the surface behind house #123;
- seed the surfaces between houses #121 and #123, and houses #835 and #837;
- close and seed the trails between house #835 and the corner of the two adjacent streets;
- close and seed the trails north of the hospital bachelor building (C.H.U.);
- seed the surface in front of house #920.

Section 12

This section is bordered by the Fairview crescent and Gordon street. In this section we recommend to:

- seed the large surface behind house #702;
- seed the surface between houses #703 and #704;
- seed the surface in front of house #705;
- seed the surface between houses #240 and #241.

Section 13

This section is bordered by Fairview crescent and Akianut street. In this section we recommend to:

- close the trail and seed the surface between the Newviq'vi corner store and house #187;
- seed the surface between houses #706 and #707;
- seed the surface at the corner of Fairview crescent and Gordon street near house #707;
- seed the surface between houses #229 and #230;
- close and seed the road between houses #230 and #231;
- close and seed the trails behind house #230;
- seed the surfaces between houses #255, #256, #257 and #258.

Section 14

This section is located north of Fairview crescent. In this section we recommend to:

- seed the surfaces between houses #260, #213, #224, #225, #270, #271, #272 and #273 as delineated;
- close and seed the trails in front of houses #271 and #272;
- close and seed the trails beside and in front of house #269;
- seed the surfaces between houses #267, #268 and #269;
- close and seed the long trail between houses #266 and #262;
- close and seed the trail between houses #264, #265 and #266;
- seed the surface between houses #262 and #263.

Section 15

This is the section of the Bell Canada building. In this section we recommend to:

- plant willow cuttings on the slope in front of and beside house #856;
- seed the surface north of the Bell Canada building;
- plant willow cuttings on the slope behind the Bell Canada building.

Section 16

This section covers the corner of Akianut street and the road going to houses #25 and #26. In this section we recommend to:

- close and seed the trail making a shortcut between the two streets behind house #261;
- seed the surface along the road and west of house #25.

5. Restoration methods

This chapter describes all the methods to be used for the revegetation project, from the site preparation and plant production stages to seeding and plantation phase.

5.1 Growing lawns on sandy surfaces

The commercial mixture of grass seeds used for the revegetation of sandy surfaces in front of the houses lead to the establishment of a good vegetation cover. Experimentations conducted in 1996 have shown that adequate results can also be achieved by using seeds of local grass and legume species. However the preparation of a local seed stock is time consuming. Since local species are more adapted to local climatic conditions, we believe that the use of seeds of local species should be encouraged. The seeding of the sandy surfaces should be undertaken early in the summer, from early June to the end of July.

Site preparation and seeding

Before putting seeds on the site you must soften the ground to a 15-20 cm depth. This is best achieved by using a rototiller, but you can also use shovels and rakes. When the ground is soft, make sure that you level it to a flat surface. We recommend that you **leave the rocks in the ground** so not to make holes that would accumulate water.

Put fertilizer on the surface. Use 1 kg of a granular fertilizer containing nitrogen, phosphorus and potassium for each 25 m^2 surface (270 square feet). Then spread the seeds. You should use 4 L of seeds for each 25 m^2 surface. Make sure that you cover the surface with the fertilizer and the seeds evenly.

Gently rake the soil in order to barely cover the seeds with half a centimeter of soil. Then water the site until it is very wet and the water stays on the surface.

Seed germination and site protection

When this is done, cover the surface with a transparent plastic. Besides protecting the seeds from the wind and the birds, this will keep the soil wet and allow the germination of the seeds. Make sure that you put enough rocks on the plastics to keep it down on windy days. If the wind can find its way under the plastic, the soil will dry out and the seeds will not germinate. Remove the plastic after 10-14 days. We recommend that you water the surface after removing the plastic, and once a week for the rest of the summer.

Long term site maintenance

We recommend that you put seeds again at the beginning of every summer for at least three years. You should also add fertilizer. Do not cover with plastic after seeding the second and third year.

5.2 Production of willow plants from stem cuttings

The greenhouse production of rooted cuttings of willow is very easy and takes only from 5 to 8 weeks. The cuttings should be collected early in spring to allow for the plantation of the willow plants no later than the end of July. Later plantation work does not give the plants enough time to establish successfully and to survive the cold temperatures of the first winter.

Other species, such as blueberry shrubs, Labrador tea and junipers do root. But these species root less easily than willows and their production is more complicated. Furthermore, rooting percentages rarely reach 50% for those

species, compared to 95-100 % for willows. Cuttings of green alder and dwarf birch do not root.

Cutting collection

Willows grow everywhere around Kuujjuaq. Tall willow shrubs can be found along the creeks, such as the one along the road to the Range at the end of the landing strip or the one crossing the same road just before the quarry. The best time to collect the willow stems is during **the last two weeks of April** when the snow still covers the creeks and allows you to get to the stems.

You do not want to kill the shrubs from which you take the cuttings. Hence, we suggest that you do not take more than **3-4 stems on each shrub**. The other stems and the base of the stems you collected will develop new branches that could be collected after a few years. The stems should be cut to a bevel at the point where they reach a diameter not more than 1.5 cm (5/8 in.). Then, cut sections (called stem cuttings) of **15-20 cm** (8 in.) **long**. The diameter of the cuttings should range **from 0.5 cm** (1/4 in.) **to 1.5 cm** (5/8 in.).

Storage

All cuttings should be kept in the greenhouse cooler at **4°C (40°F)** until you are ready to use them. For more storage room, you can ask Air Inuit the permission to use their coolers at the airport.

Preparation

Before planting the cuttings in containers, you have to make sure that their base is beveled. Then, with a scalpel, make **two 2.5 cm (1 in.) long slits** (remove the bark) at the bottom of each cutting before you put **them to soak** (the base of the cutting only) **in water for 24 hr.**

Plant production

First, plant the cuttings in containers IPL-45 filled with a mix of three parts of sand and one part of peat moss. Water the cuttings with the greenhouse watering system **twice a day for 30 minutes**. New leaves should appear on the plants after one week. Roots take longer to grow. Five-week old cuttings can be transplanted outside, but we recommend you wait **8 weeks** before doing so, as experiments indicated that 8-week old cuttings have more roots.

Transplantation

For better survival rates, willow plants should be transplanted outside from **mid-June to late-July**. Do not pull on the plants when you take them out of the container. Instead, push the cuttings with a stick through the holes under the container. Before planting, **the ground should be softened to a 15 cm** depth with a rototiller or shovels and rakes. When the ground has been softened, make a hole using a planter, put the plant in the hole and make sure that you fill the hole with soil. It is very important to push the soil in the hole so the cutting stands solid.

Planting unrooted cuttings

It is possible to plant the cuttings on the site after the preparation phase. We planted a few hundreds of unrooted cuttings beside the greenhouse in 1995 and 1996. For both years, more than 75% of the cuttings grew new shoots. Most of the cuttings that produced shoots in 1995 were still alive in 1996.

Indeed, this method would be a lot cheaper and less time consuming. However, we did not compare both methods in experimental plantations, and we have no data showing that unrooted cuttings grow or survive better than rooted cuttings.

5.3 Production of other woody plants from seeds

The production of woody plants from seeds takes at least two seasons in the greenhouse before the plants can be put into the ground. It is more time consuming and more expensive than the production of willow stem cuttings, but we observed better survival rates for green alder, dwarf birch and tamarack than for willows planted in experimental plantations.

Seed collection and preparation of seed stock

Fruits of green alder and dwarf birch, and cones of tamarack and spruce can be collected in fall, from **mid-September to mid-October**. For dwarf birch, simply squash the fruits to free the seeds located between the scales of the fruits. For green alder, first let the fruits dry at room temperature, and then squash and/or shake the fruits to free the seeds. For tamarack and spruce, first dry the cones at 30-35°C (85-95°F) until they open (one or two hours). Then shake the cones to free the seeds. The best method to shake the cones is to use a shaker for paint gallons and an empty gallon or a big coffee can.

Seedling production **A** - Alder and birch

For the production of alders and birches, fill growing containers IPL-45 with a mix of **three part of sand and one part of peat moss** (75%-25%). Then put **4-5 seeds** on top of each hole. Always keep the soil surface and the seeds wet by watering **4 times a day** until the seeds germinate (until the appearance of the first pair of round leaves). Water carefuly so the seeds are not disloged from the container cavities. This phase of germination should take 2-3 weeks.

When the first pair of true leaves (toothed leaves more or less the shape of the ones on mature shrubs) are developed, remove all but one seedling in each

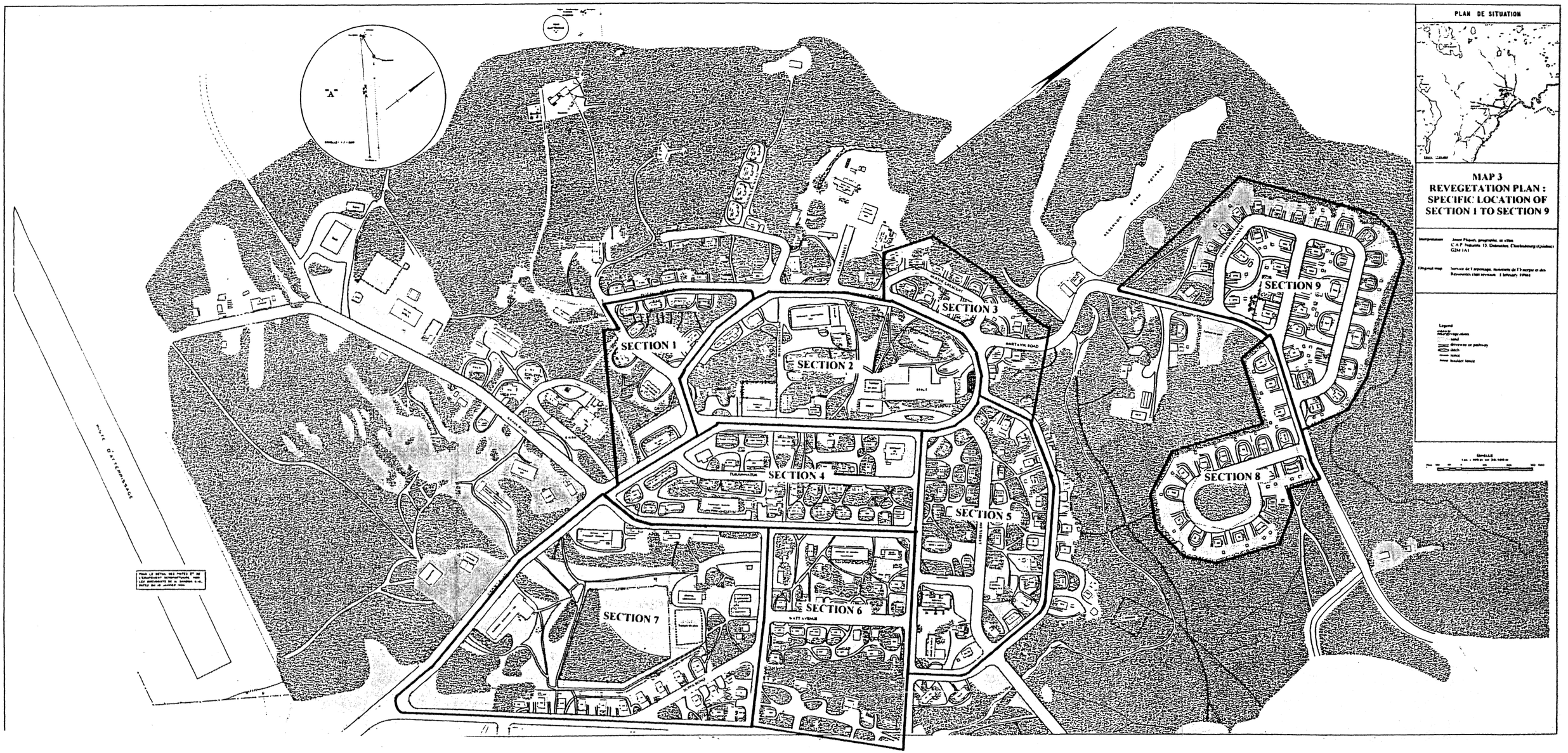
hole. At this point, you can water the plants twice a day and you can start fertilizing the plants **once a week**. We recommend that you use the small water tank at the greenhouse to fertilize the plants. For regular concentrations, add 300 g of 20-20-20 blue powder to a full tank (300 gallons). Make sure that the valve between the small tank and the big tank is always closed.

B - Tamarack and spruce

For the production of tamarack and spruce seedlings, fill growing containers IPL-45 with a mix of **one part of sand and one part of peat moss** (50%-50%). Before planting, put the seeds in cold running water for 24 hours. Then, put **4-5 seeds** in each container hole. Always keep the soil surface and the seeds wet by watering carefuly **4 times a day** until the seeds germinate (until the appearance of the first set of needles). This phase of germination should take 2-3 weeks. When the needles are completely out of the seed, remove all but one seedling in each cavity. At this point you can water the plants twice a day and you can start fertilizing the plants **once a week**.

Production steps

We recommend that you put the seeds in the containers in early-May. **Fertilization should start early in June and stop early in August**. The plants should be 10-20 cm high when you stop fertilizing. From August to September they will grow mostly in diameter, little in height. **In early-September**, all the containers should be moved outside to an area where the snow cover will be high enough to protect the plants from winter temperatures. Take the containers back in the greenhouse as early as possible the following spring (early May). Besides watering the plants twice a day, fertilize them once a week until the end of July. The plants should be transplanted outside no later than **September**.



MAP 3
REVEGETATION PLAN : SPECIFIC LOCATION OF SECTION 1 TO SECTION 9

SECTEUR TERRES

MINISTERE DE L'ENERGIE ET DES RESSOURCES DU QUEBEC

SERVICE DE L'ARPENTAGE

SECTION 10

SECTION 11

SECTION 12

SECTION 13

SECTION 14

SECTION 15

SECTION 16

R I V I È R E

K O K S O A K

VOIR CARTOUCHE

MAP 4
REVEGETATION PLAN :
SPECIFIC LOCATION OF
SECTION 10 TO SECTION 16

REVEGETATION PLAN

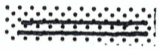
LEGEND FOR SECTION 1 TO SECTION 16


vegetation


sand


boulder fence


earth mound


pathway or driveway

services


barrier to close the pathways

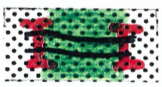

revegetation

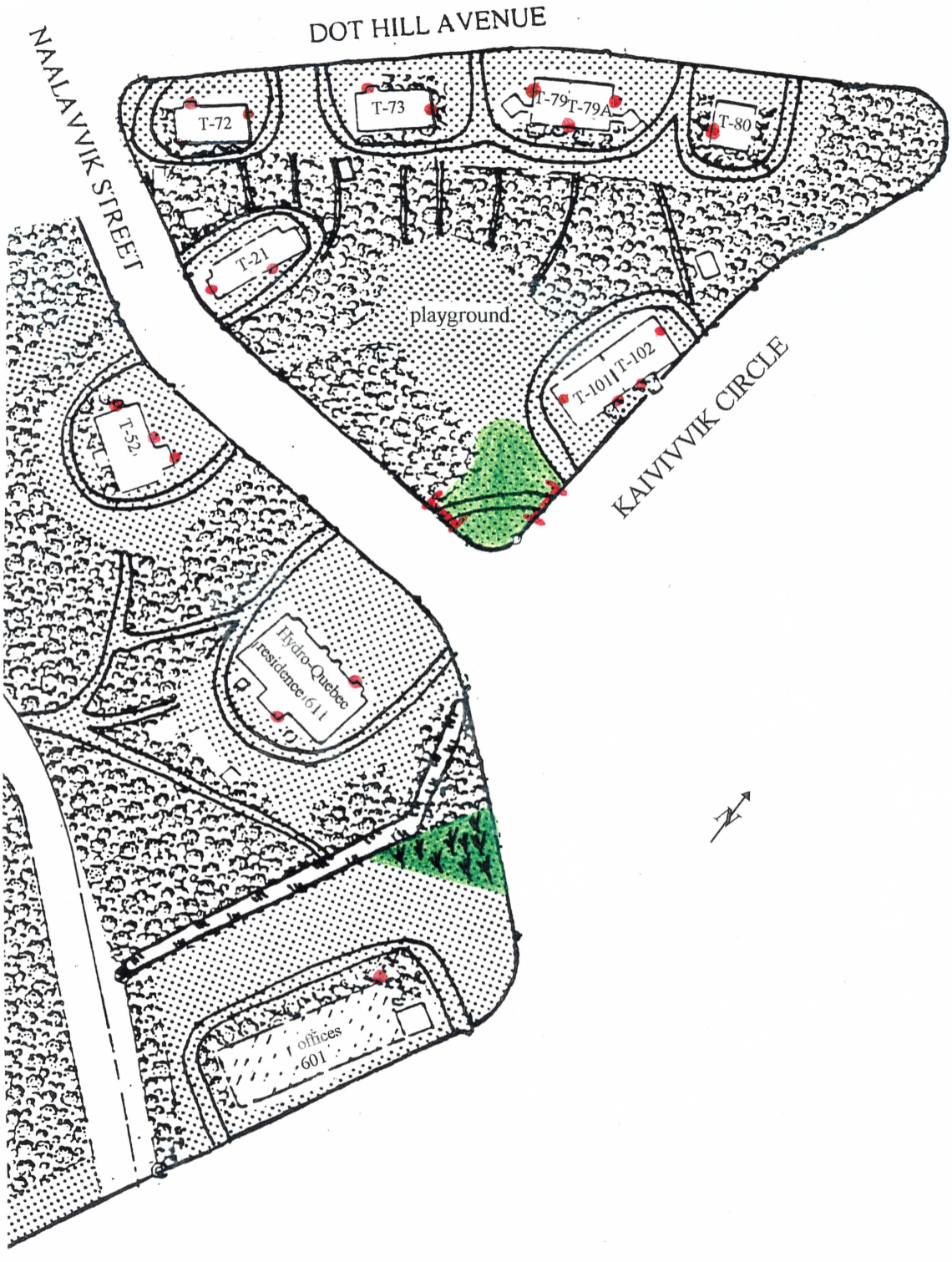

willow plantation


evergreen plantation (spruce, larch)

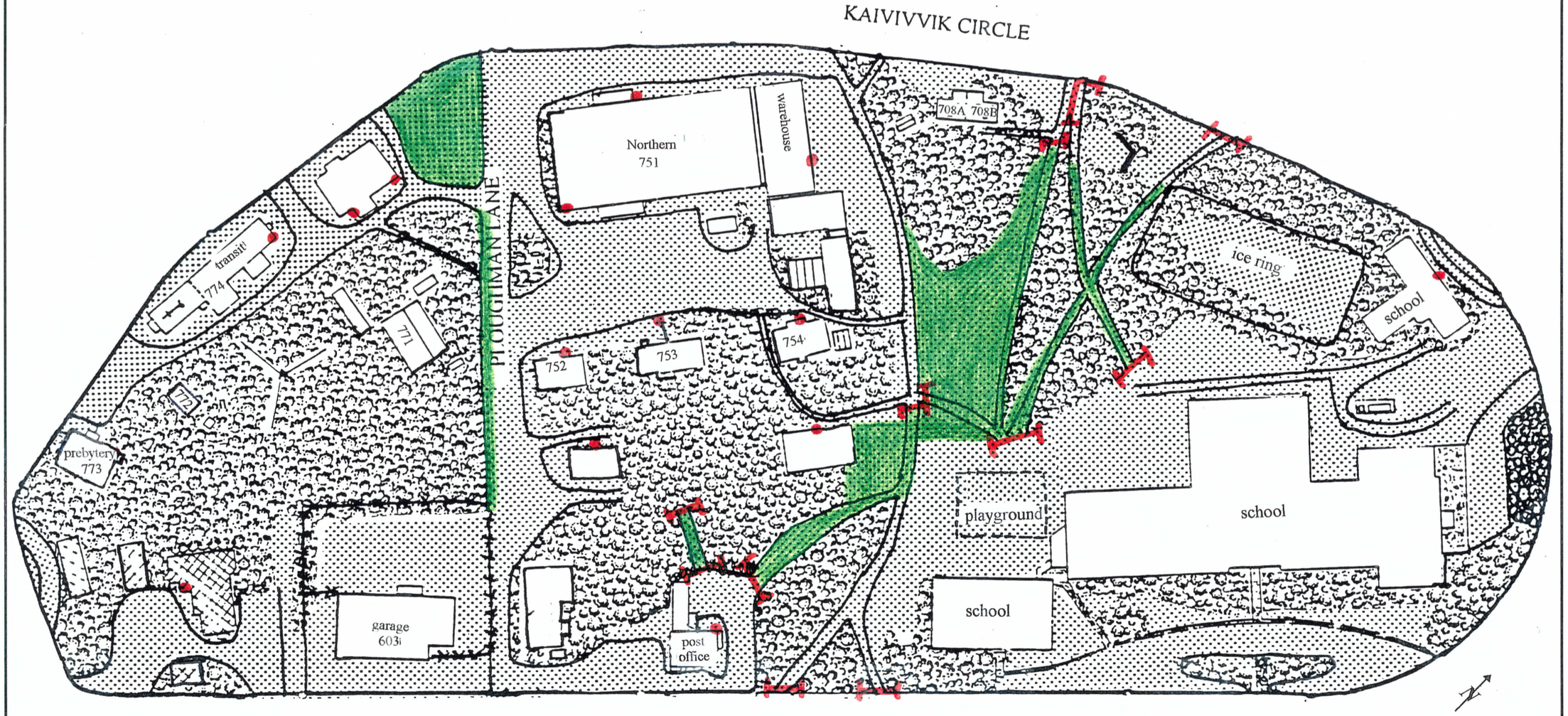
EXAMPLES :


close and revegetate the pathway

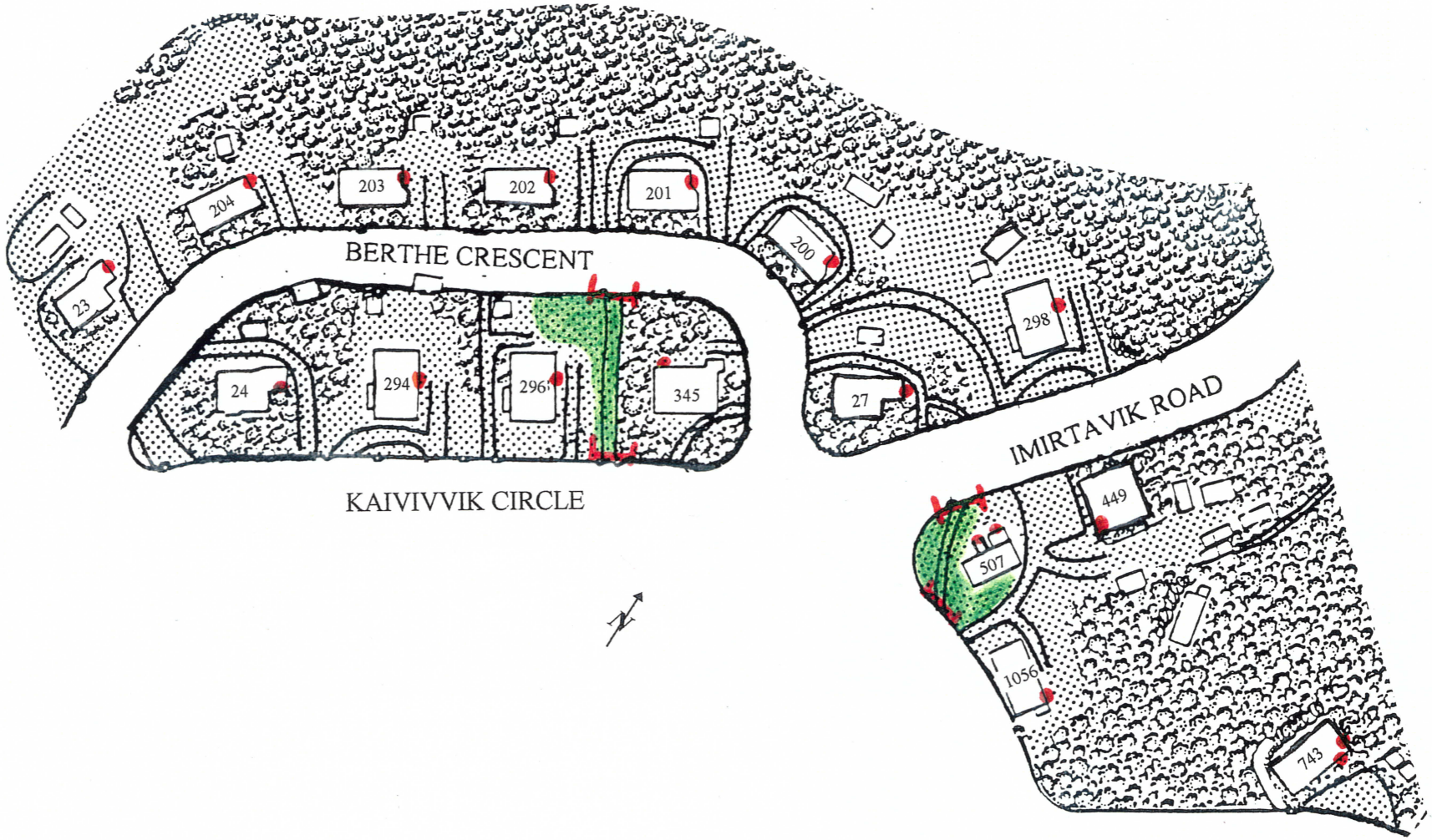

close and revegetate the pathway as well as the surrounding area



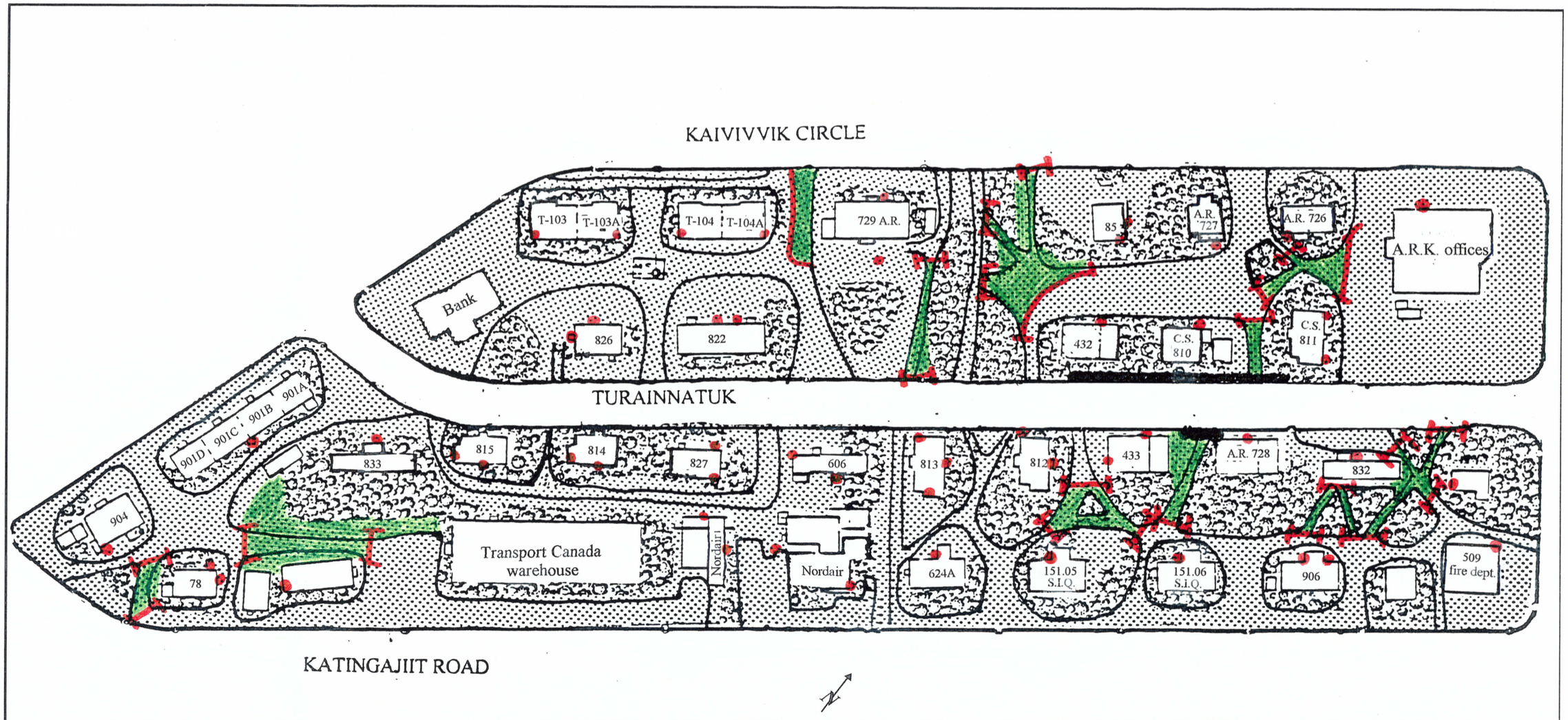
REVEGETATION PLAN : SECTION 1



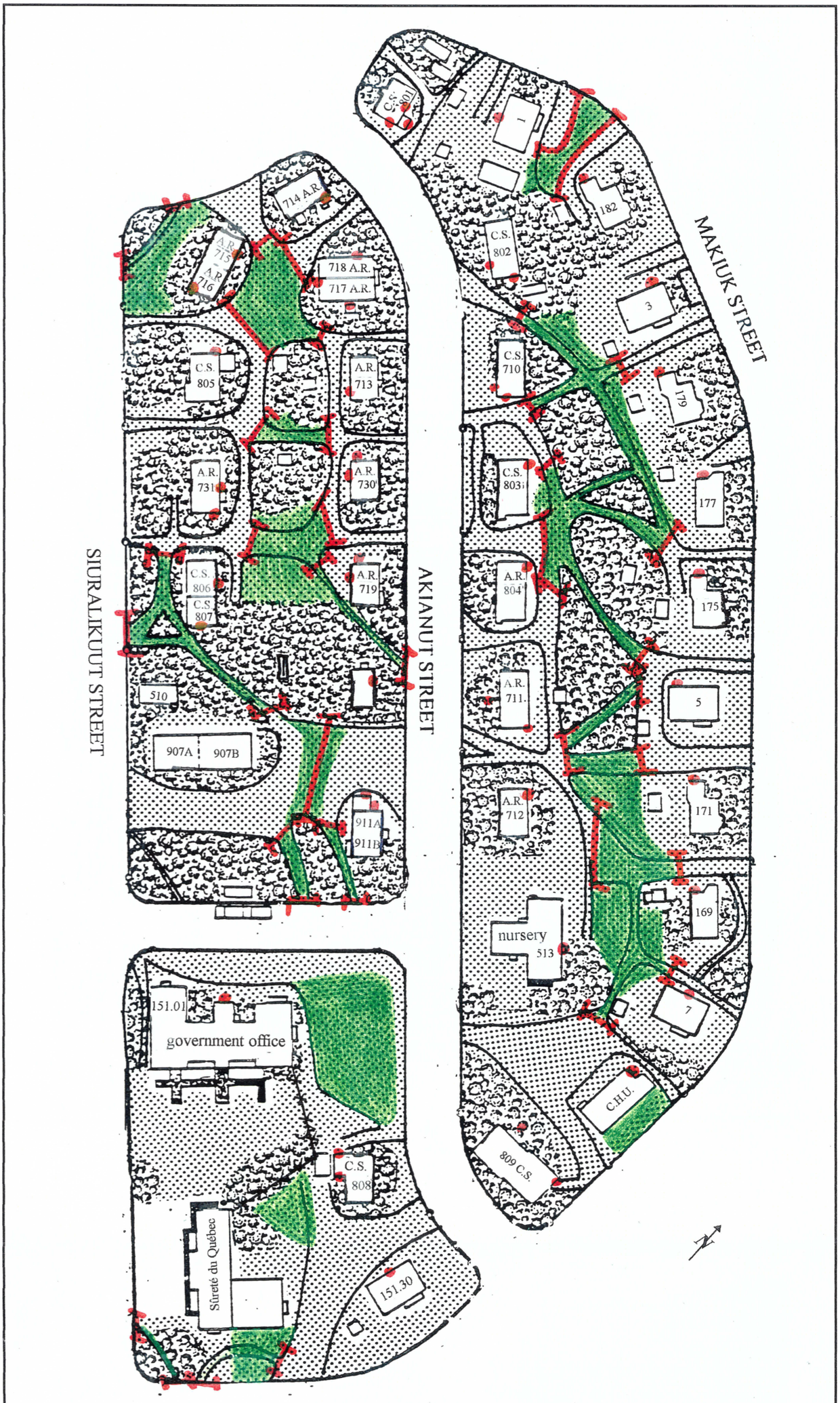
REVEGETATION PLAN : SECTION 2



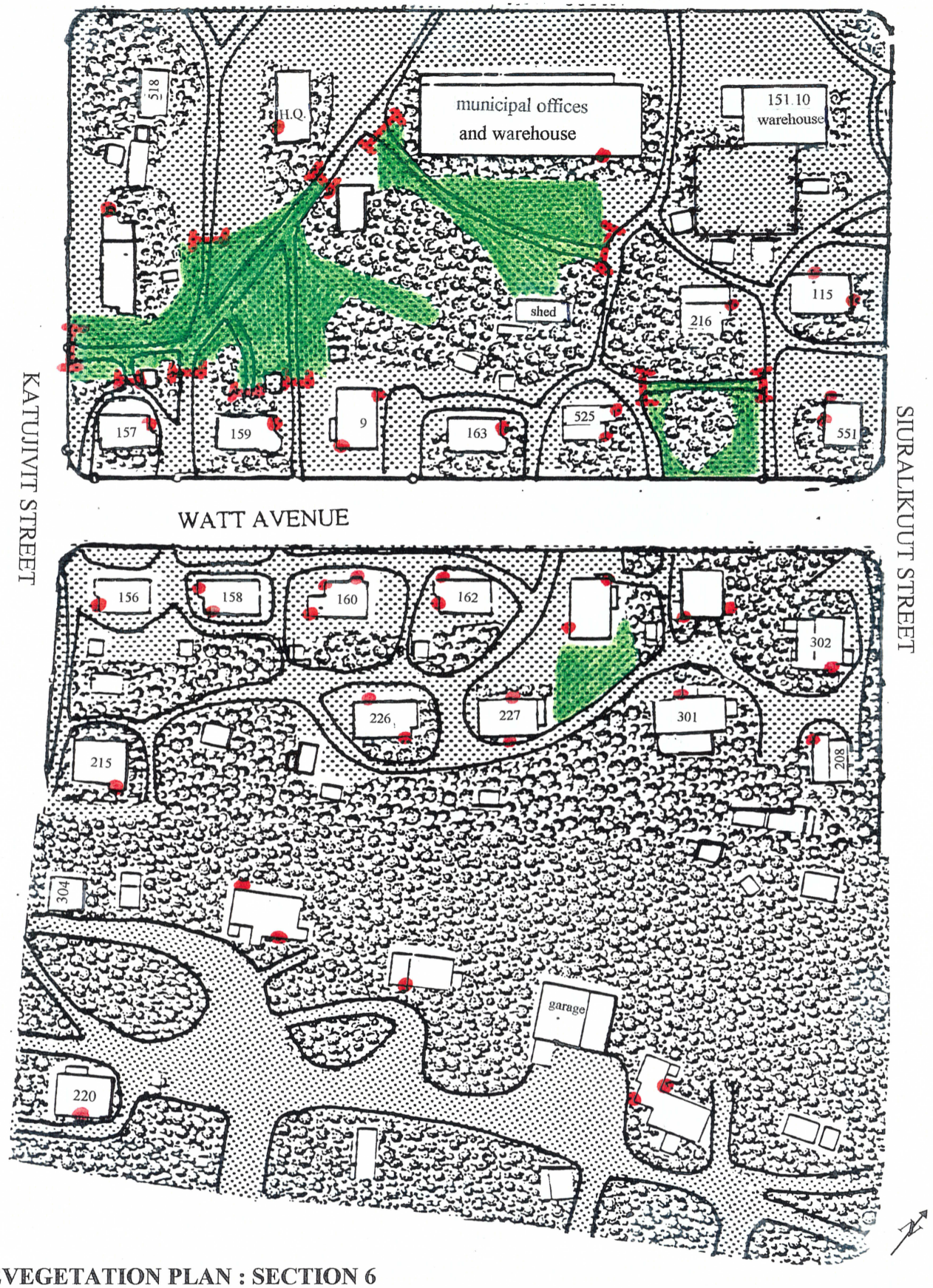
REVEGETATION PLAN : SECTION 3



REVEGETATION PLAN : SECTION 4



REVEGETATION PLAN : SECTION 5



REVEGETATION PLAN : SECTION 6

KATINGAJIIT ROAD

AIRPORT ROAD

garage
Transport Canada

T-61

warehouse

store

playground

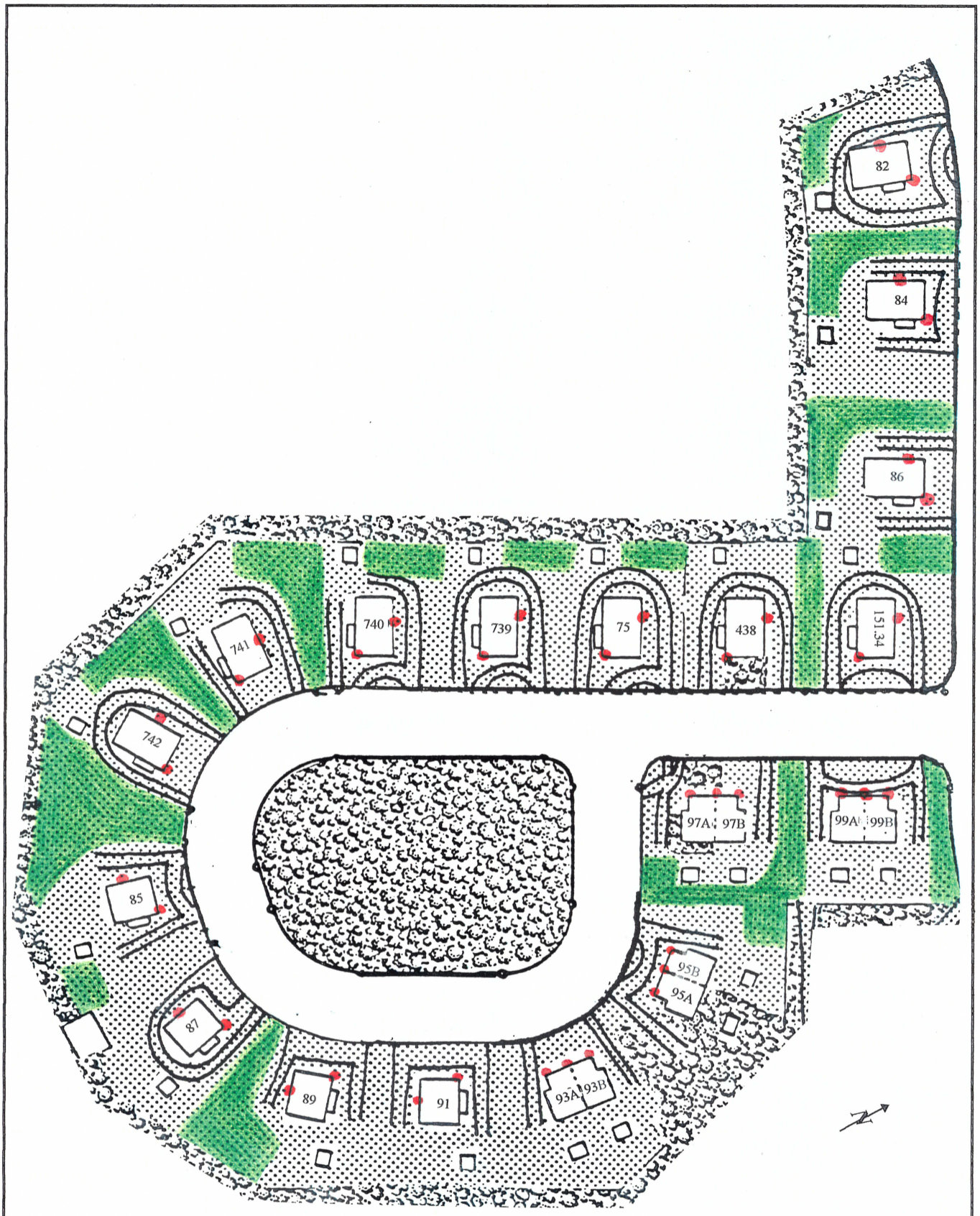
Kuujjuak Inn

SUPPA ROAD

FORD ROAD

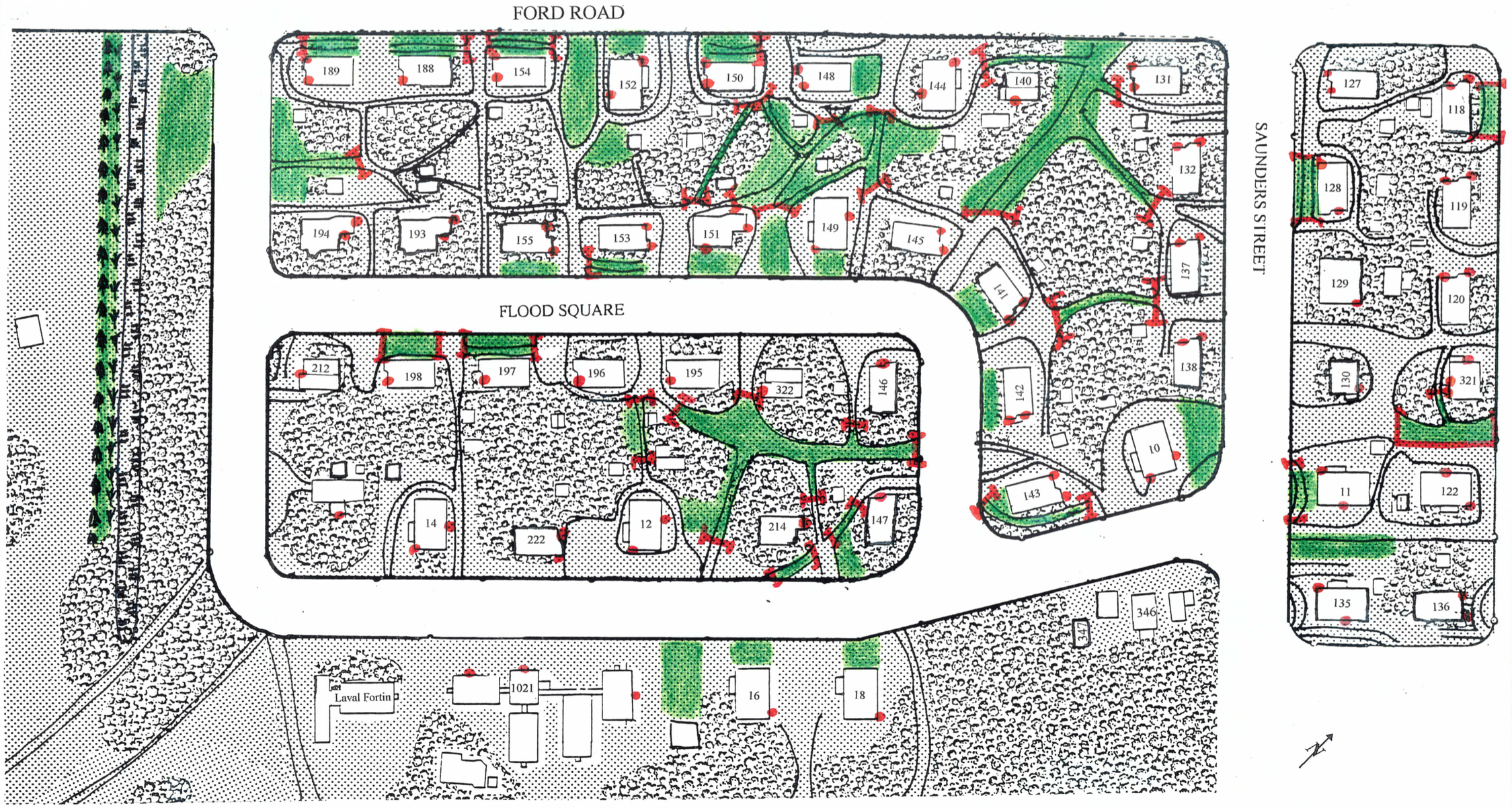
192
191
217
114
113
112
111
110
109
108
107
106
207
8
508
205

REVEGETATION PLAN : SECTION 7



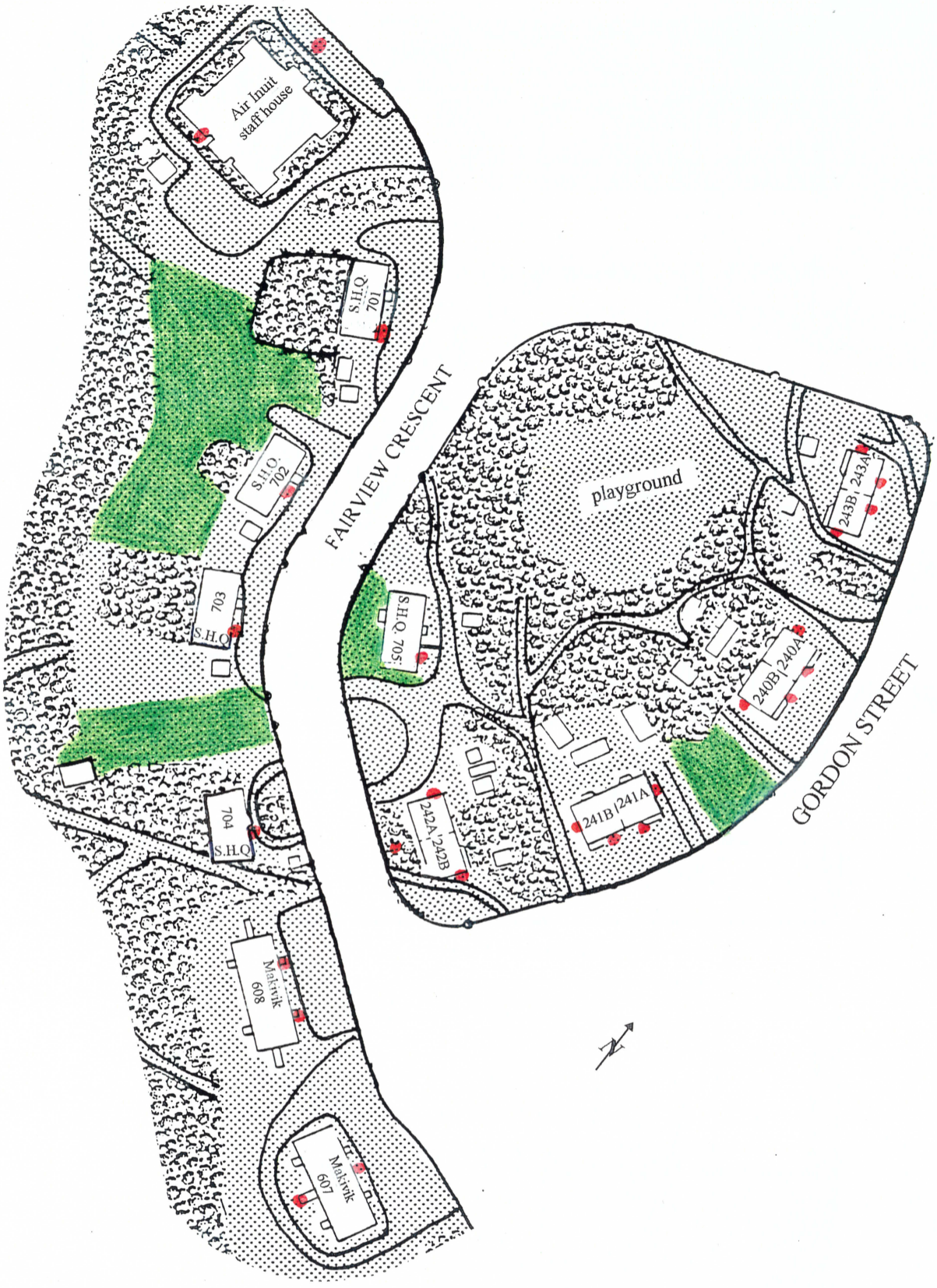
REVEGETATION PLAN : SECTION 8

REVEGETATION PLAN : SECTION 9



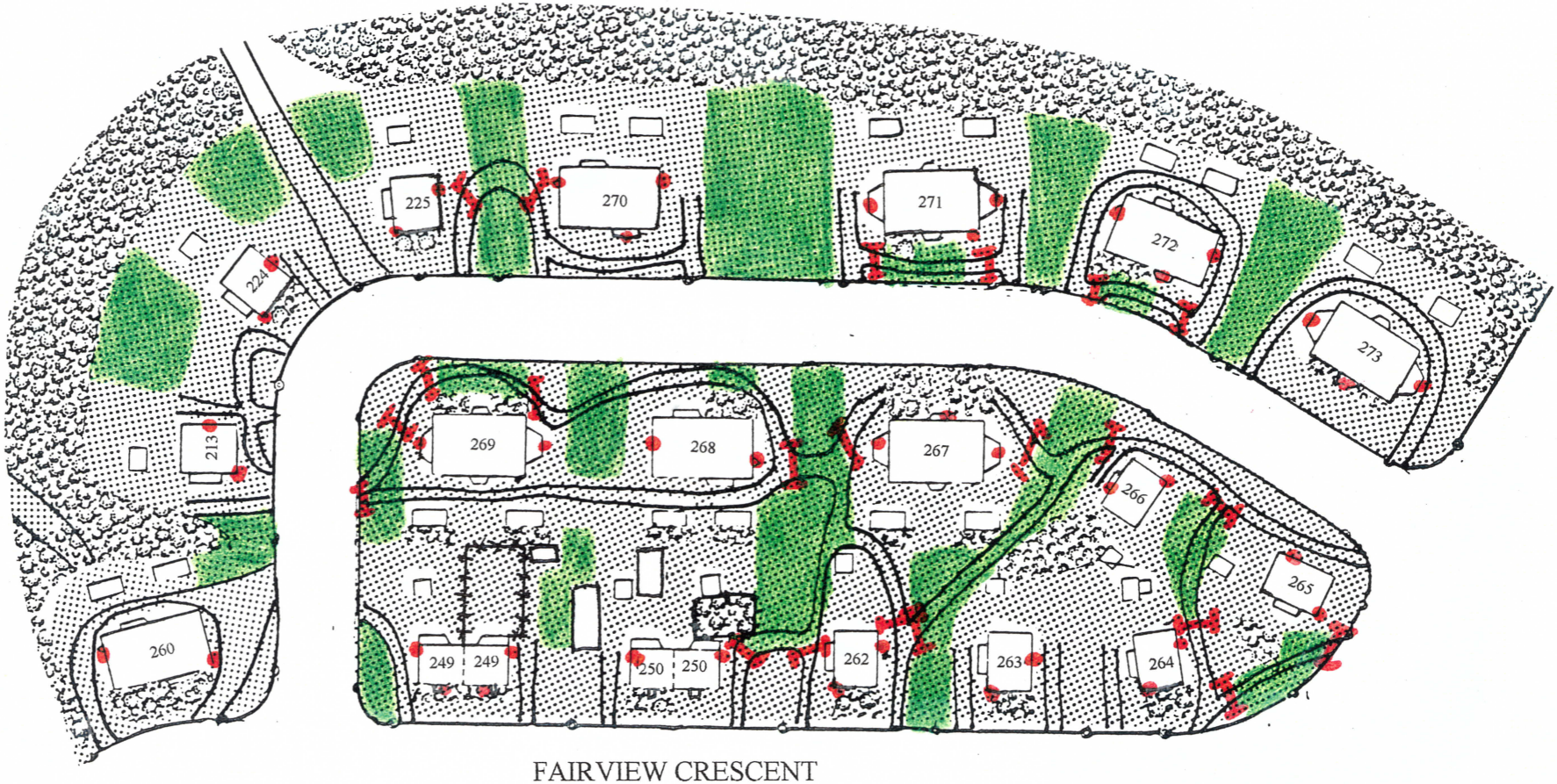
REVEGETATION PLAN : SECTION 10

REVEGETATION PLAN : SECTION 11



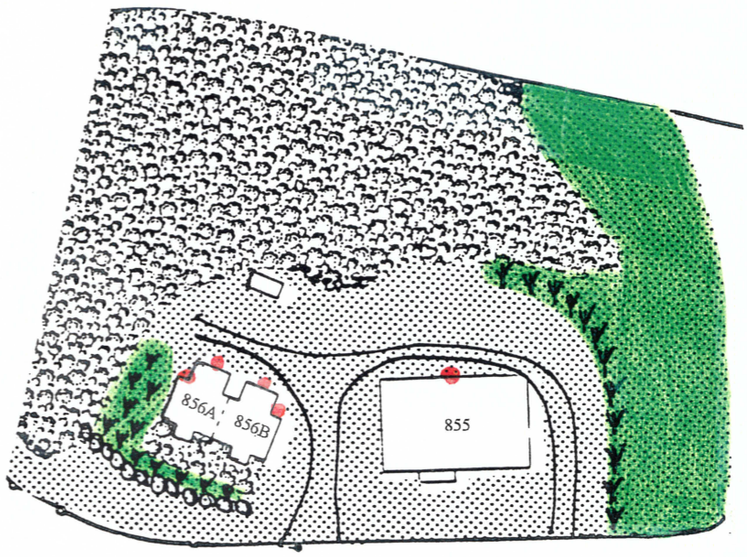
REVEGETATION PLAN : SECTION 12

REVEGETATION PLAN : SECTION 13

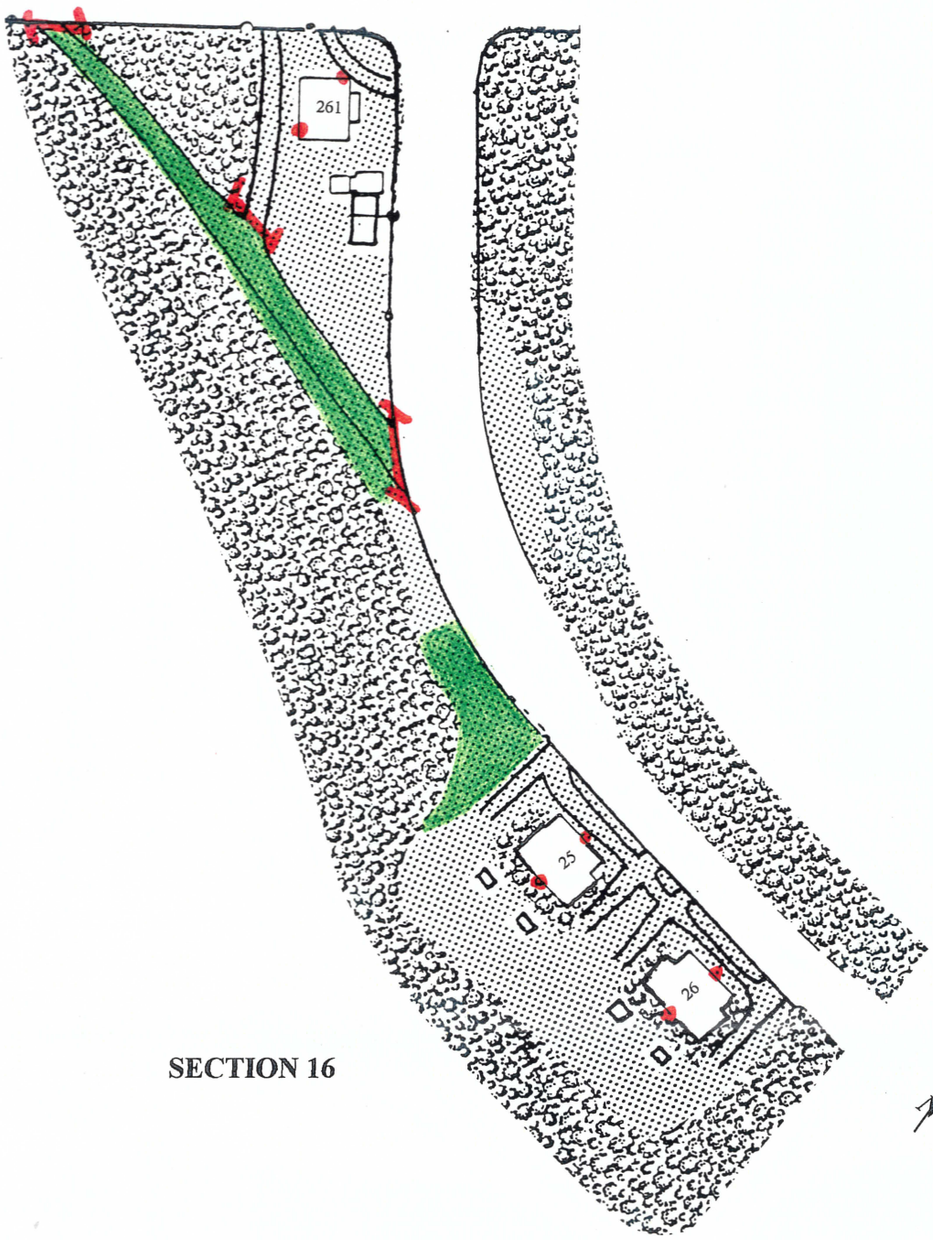


FAIRVIEW CRESCENT

REVEGETATION PLAN : SECTION 14



SECTION 15



SECTION 16

REVEGETATION PLAN


PLAN DE SITUATION
scale 1/50.000
MAP 1
REVEGETATION PLAN :
VEGETATION COVER OF THE
VILLAGE OF KUUJJUAK IN 1996
Interpretation : Josée Pâquet, géographe, M.ATDR
C.A.P. Naturels, 15, Desroches, Charlesbourg (Québec)
G2M 1A1
Original map : Service de l'arpentage, ministère de l'Énergie et des
Ressources (last revision 1 february 1996)
Legend
vegetation
sand
driveway or pathway
ditch
fence
boulder fence
Scale
feet 100 50 0 100 200 300 feet
SEE INSET
DOT HILL AVENUE
KAIVIVVIK CIRCLE
IMIRTAVIK ROAD
TURAINNATUK
KATINGAJIIT ROAD
WATT AVENUE
Transport Canada

MAP 2
REVEGETATION PLAN :
VEGETATION COVER OF THE
VILLAGE OF KUUJJUAK IN 1996

Interpretation : Josée Pâquet, géographe, M.ATDR
C.A.P. Naturels, 15, Desroches, Charlesbourg (Québec)
G2M 1A1

Original map : Service de l'arpentage, ministère de l'Énergie et des Ressources (last revision : 30 january 1996)