



**CHAPTER 4.0**  
EDMONTON'S NATURAL  
AREAS ANALYSIS



## 4.0 EDMONTON'S NATURAL AREAS ANALYSIS

### 4.1 Introduction

The State of the Natural Areas Project represents the first time since 1993 that the City has revisited its inventory and delineation of Natural Areas. It also represents the first time the City has undertaken a holistic review of Natural Areas using principles of landscape ecology. In doing so, the City has the opportunity to analyze its Natural Areas in two important ways. Firstly, a comparison of current data with 1993 data can provide insight into the success of Edmonton's conservation efforts to date and, more generally, can summarize the changes that have occurred over that time period. Secondly, the current and expanded network of Natural Areas, which includes consideration of Natural Areas within the North Saskatchewan River Valley, can be analyzed to provide a baseline for future comparisons. The following sections will discuss those two analyses separately. In addition, by assessing the existing state of Natural Areas within the City it is also possible to develop a list of certain performance measures that can be used to assess the success of future efforts to conserve Natural Areas and the City's performance in managing its Ecological Network.

### 4.2 Methods

We analyzed Edmonton's Natural Areas from several perspectives, including:

- ∅ Protection Status of Natural Areas
- ∅ Lost (or partially lost) Natural Areas
- ∅ MDP Land Development Concept areas
- ∅ City quadrants
- ∅ North Saskatchewan River Watershed sub-basins

The methods associated with these analyses are described below.

#### 4.2.1 Protection Status of Natural Areas

As part of Objective 1, several different levels of protection were identified for Edmonton's Natural Areas, including different categories for Tableland and NSRV Natural Areas. Those categories included:

- ∅ Protected as a Natural Area – City Ownership;
- ∅ Protected as a Natural Area – Private Ownership;
- ∅ River Valley Natural Areas zoned A-Metropolitan – City Ownership;
- ∅ River Valley Natural Areas zoned A-Metropolitan – Private Ownership;
- ∅ Crown-owned waterbodies;
- ∅ Natural Areas Owned by the City (not formally recognized by the City for protection);
- ∅ Unprotected Natural Areas;
- ∅ Natural Areas outside the jurisdiction of the City of Edmonton; and



∄ Existing Natural Areas approved for development in statutory plans as of 2006.

The results of that categorization exercise were illustrated in a map titled *Protection Status of Edmonton's Natural Areas* (Spencer Environmental 2006a). That original map is included here as Figure 4.1. for reference during review of results.

#### 4.2.2 *Lost Natural Areas*

As part of Objective 1 of this State of Natural Areas Project, the boundaries of the original (1993) inventoried natural sites in Edmonton were updated based on detailed review of 2005 aerial photography. Losses were considered to have occurred if the recent aerial photography showed a smaller site relative to the digital overlay of the site's 1993 boundary. Sites were considered completely lost if the remaining portion of a site was less than the minimum Natural Area size criterion of 1.0 ha.

#### 4.2.3 *MDP Land Development Concept areas*

MDP Land Development Concept areas are based on information shown on the map titled *Land Development Concept - Edmonton Municipal Development Plan* (Bylaw No. 11777, with Amendments to September 14, 2005) (Figure 4.2). The concept areas discussed in the following sections include the North Saskatchewan River Valley and Ravine System, Transportation and Utility Corridor, Agriculture Area, Suburban Area and Business and Employment Area.

#### 4.2.4 *City Quadrants*

The discussion of Natural Areas in terms of City quadrants is based on the delineation of four (northwest, northeast, southeast and southwest) quadrants completed as part of the original inventory work in 1993. Roughly defined, the North Saskatchewan River separates the northern and southern quadrants, Calgary Trail separates the southeast and southwest, while 97<sup>th</sup> Street is the key separation between northeast and northwest.

#### 4.2.5 *North Saskatchewan River Watershed sub-basins*

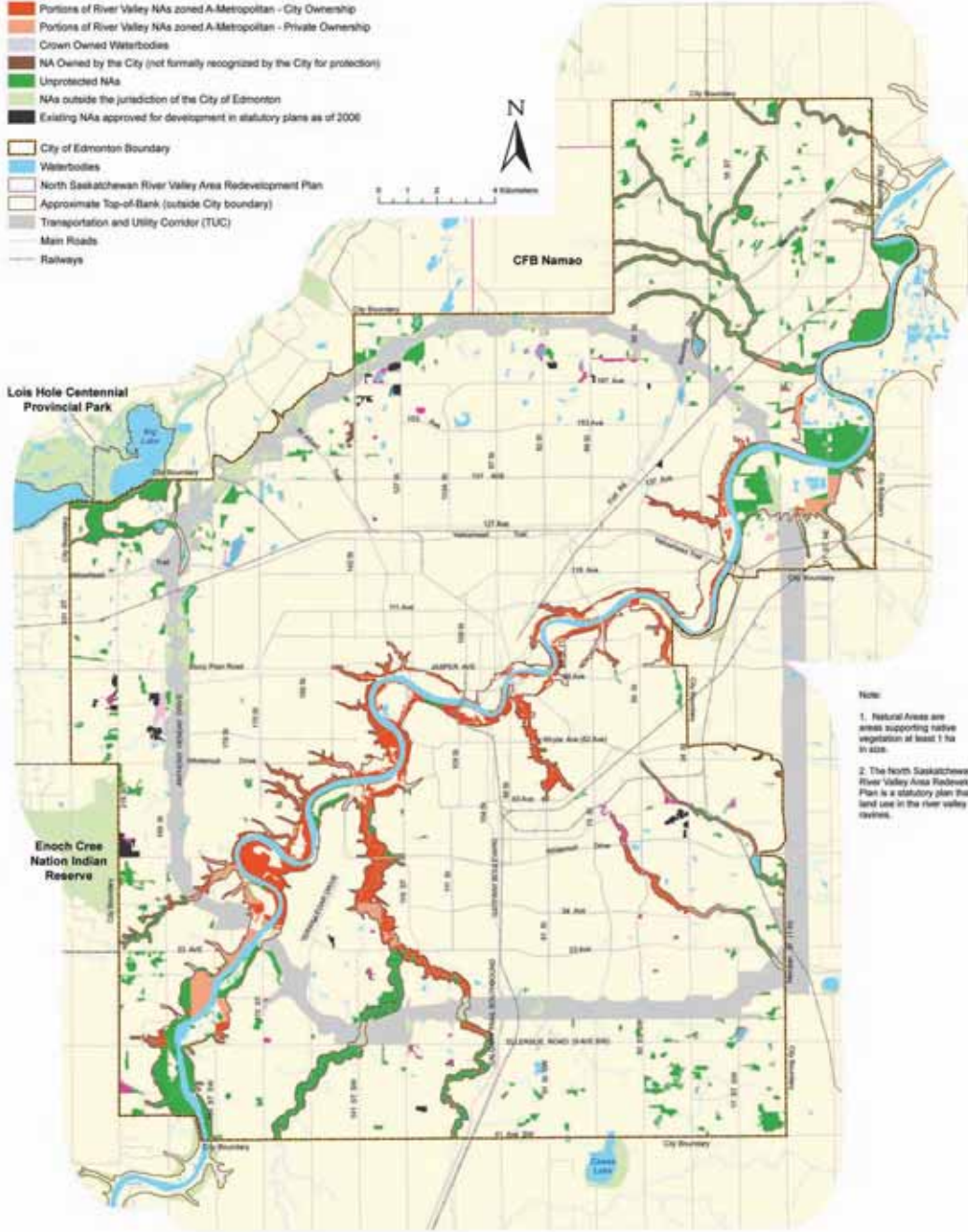
The entire North Saskatchewan River (NSR) watershed (i.e., the area that directly or indirectly drains into the river) is divided up into many different watershed sub-basins. The City of Edmonton comprises parts of three different sub-basins. The Strawberry sub-basin, which occupies much of west and south Edmonton, and the Beaverhill sub-basin, located in east and north Edmonton, both drain into the NSR within the City. However, the Sturgeon sub-basin, with only a small portion located in the northwest corner of the City, drains north into the Sturgeon River. The Sturgeon River then drains into the NSR just northeast of the Edmonton, near Fort Saskatchewan. The use of these sub-basins as a category for spatial analysis is new for the City of Edmonton and represents the consideration of Natural Areas in terms of ecological boundaries, in addition to political boundaries.



# PROTECTION STATUS OF EDMONTON'S NATURAL AREAS (2006)

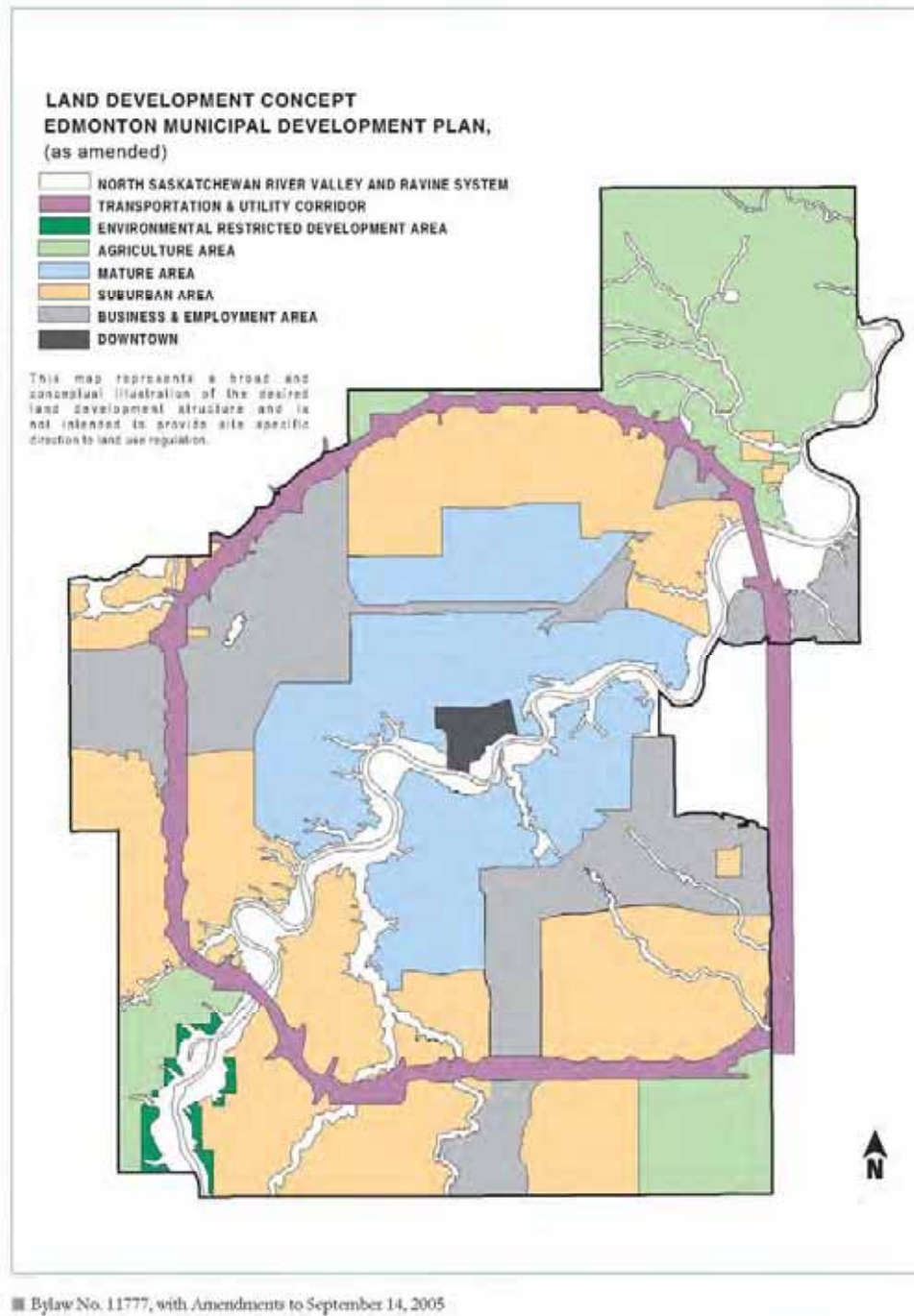
## Legend

- Natural Area (NA) Protection Status**
- Protected as NA - City Ownership
  - Protected as NA - Private Ownership
  - Portions of River Valley NAs zoned A-Metropolitan - City Ownership
  - Portions of River Valley NAs zoned A-Metropolitan - Private Ownership
  - Crown Owned Waterbodies
  - NA Owned by the City (not formally recognized by the City for protection)
  - Unprotected NAs
  - NAs outside the jurisdiction of the City of Edmonton
  - Existing NAs approved for development in statutory plans as of 2006
- City of Edmonton Boundary  
 Waterbodies  
 North Saskatchewan River Valley Area Redevelopment Plan  
 Approximate Top-of-Bank (outside City boundary)  
 Transportation and Utility Corridor (TUC)  
 Main Roads  
 Railways



**Note:**

1. Natural Areas are areas supporting native vegetation of least 1 ha in size.
2. The North Saskatchewan River Valley Area Redevelopment Plan is a statutory plan that guides land use in the river valley and vicinity.



**Figure 4.2. Land Development Concept, Edmonton Municipal Development Plan**



In addition, two categories of analyses were undertaken: Firstly, we compared the current data with the 1993 data resulting in a summary of the changes that have occurred over that time period. Secondly, we examined the current and expanded network of Natural Areas, which includes consideration of Natural Areas within the North Saskatchewan River Valley, to provide a baseline for future comparisons.

### 4.3 Results

Throughout this section, various statistics relating to Edmonton's Natural Areas are presented and discussed, including area calculations (in terms of hectares). In all cases, area calculations for Natural Areas were performed using our GIS. In some cases, the areas determined through these means were slightly different than areas known to have been used by the City in the past. For the most part, these small discrepancies are likely the result of using slightly different datasets with varying levels of detail. Considering the detail available in our GIS, the areas used below are likely the more accurate of the two.

#### 4.3.1 Comparison of ESAs and SNAs between 1993 and 2005

Since the 1993 inventory, the City of Edmonton has undergone significant growth and, for ten years now, has operated under a Natural Areas policy. Not surprisingly, that growth has resulted in changes to the Environmentally Sensitive Areas (ESAs) and Significant Natural Areas (SNAs) as originally identified in 1993. Those changes have taken the form of protection and losses, itself a measure of the success of Policy C-467.

##### Losses

The 1993 inventory identified 85 ESAs and SNAs totaling 1323.94 ha. Between 1993 and 2005, 48 sites have experienced some degree of loss (eight sites completely lost (Table 4-1), 40 sites partially lost). Combined, the losses to ESAs and SNAs since 1993 total 308.08 ha.

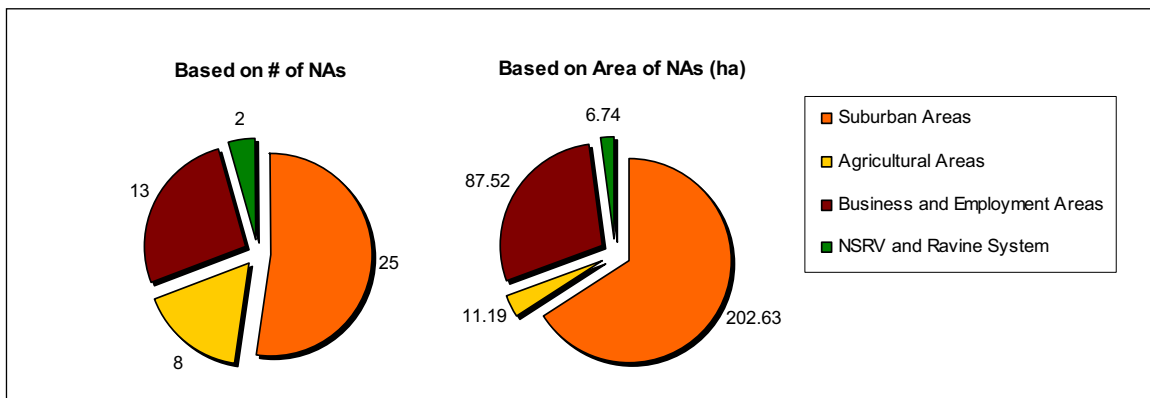
**Table 4-1. ESAs and SNAs Completely Lost between 1993 and 2005**

NE 8084	NW 288
NE 8095	NW 7050
NE 8093	NW 204
SE 5098	NW 132

The losses to Natural Areas occurred primarily in the northwest quadrant of the City, where 22 sites experienced some loss. In terms of number of sites, this represents 45.8 percent of the total losses (47.7 percent in terms of area); proportionately greater than the 35.3 percent of ESAs and SNAs that are located in the City's northwest. Fifteen losses occurred in the northeast, 6 in the southeast and 5 in the southwest.



Among the 48 sites that have experienced some loss, the majority (52.1 percent in number, 65.8 percent based on area) occurred in areas planned as suburban neighborhoods (based on the Land Development Concept, Edmonton Municipal Development Plan), including six of the eight complete losses (Figure 4.3). This majority is proportionately greater than the 36.5 percent of sites that occur within suburban areas. Similarly, a proportionately lesser amount of loss occurred in agriculture areas relative to the amount of loss that could be expected based on the occurrence of sites alone (16.7 percent of sites that have experienced some loss, 27.1 percent of all sites). In terms of area, the magnitude of loss in agriculture areas has been even lower. Losses totaling only 11.19 ha, or 3.6 percent of the combined area of all sites, have occurred in agriculture areas (Table 4-2). Two sites located within the NSRV experienced some loss, but together those losses totaled only 6.74 ha. The distribution of sites that have experienced loss is suggestive that the loss of Natural Areas is largely a result of the continuing development of suburban areas. Natural Areas located in agriculture areas have remained largely intact, largely a function of the low interest in converting those areas to other land uses. The losses that have occurred in agriculture areas are primarily situations where small portions of sites have been lost. This ‘nibbling away’ of sites is likely as a result of small scale clearing and filling activities by private landowners.



**Figure 4.3. Distribution of ESAs and SNAs that have Experienced Some Loss according to MDP Land Development Concept Areas**



**Table 4-2. Distribution of ESAs and SNAs that have Experienced Some Loss, according to City Quadrants and MDP Intended Land Use Areas**

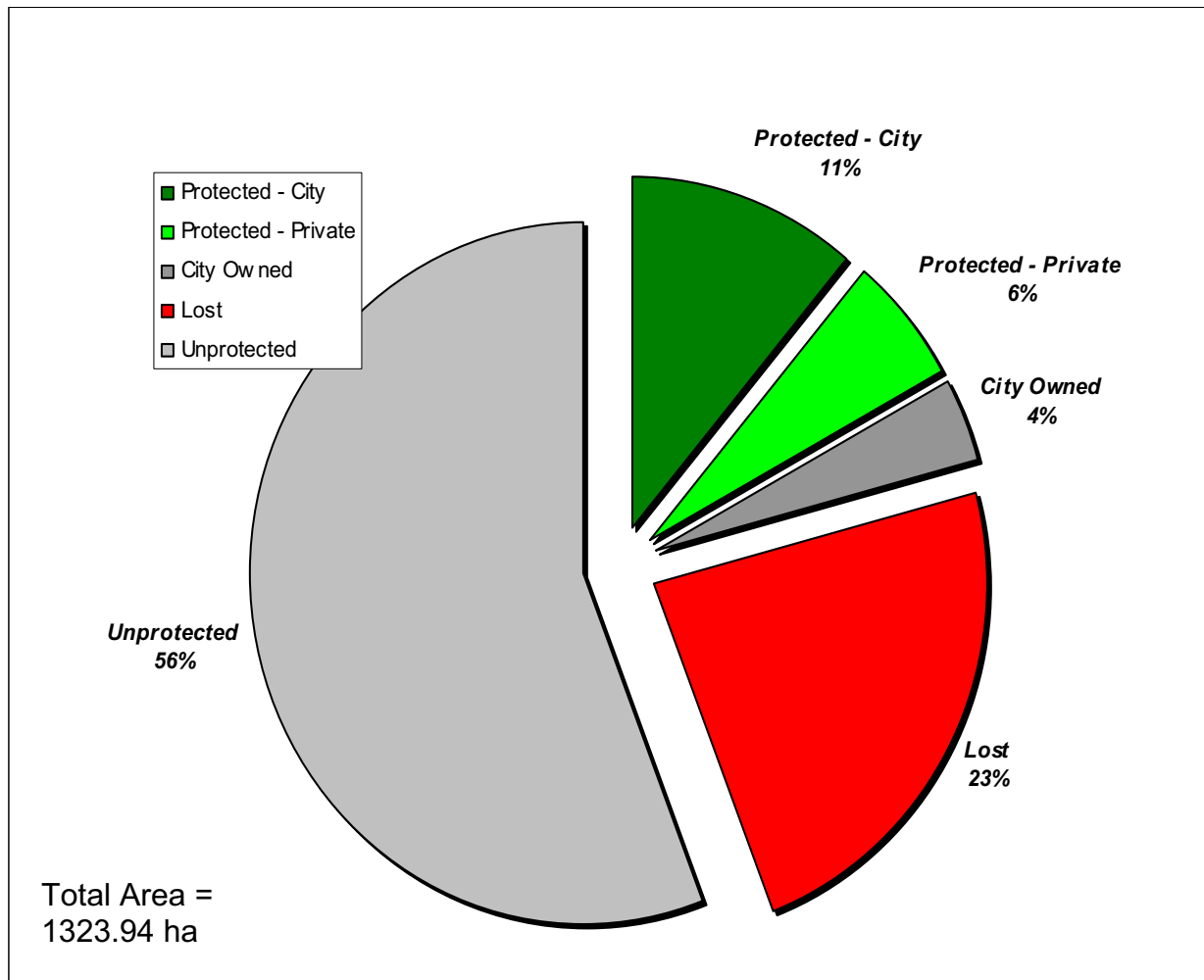
City Area		Original ESAs and SNAs (1993)		Losses as of 2005		
		# of sites	% of total # of ESAs and SNAs	# of affected sites	% of original (1993) # of sites	Combined total affected area (ha)
City Quadrant	Northwest	30	35.3	22	73.3	146.96
	Northeast	29	34.1	15	51.7	106.13
	Southeast	17	20.0	6	35.3	26.50
	Southwest	9	10.6	5	55.6	28.49
MDP Intended Land Use Area	Suburban area	31	36.5	25	80.6	202.63
	Business and Employment area	22	25.9	13	59.1	87.52
	Agriculture area	23	27.1	8	34.8	11.19
	North Saskatchewan River Valley and Ravine System	9*	10.6	2	22.2	6.74
<b>Totals</b>		<b>85</b>	<b>100</b>	<b>48</b>	<b>56.5</b>	<b>308.08</b>

\* note: an additional 8 NSRV sites are described in the 1993 inventory, however, those sites were not mapped and, as such, area information for those sites is not available.

### Protection

Between 1993 and 2005, 22 sites were protected in some form or another for a total protected area of 250.19 ha (Figure 4.4). Nineteen (147.89 ha) of those sites have acquired formal status as protected Natural Areas through the planning process and ownership by the City of Edmonton, while the remaining three (75.90 ha) were protected through private initiatives. Another six sites (34.83 ha) are owned by the City of Edmonton, but were not acquired specifically for the purpose of Natural Area protection. Although these sites are not formally protected, given the City's desire to protect as many ESAs and SNAs as is feasible (Policy C-467), City ownership of Natural Areas presents an increased likelihood of future protection.

Despite the occurrences of both losses and protection, the majority of lands occupied by ESAs and SNAs identified in 1993 remain on the landscape but in an unprotected state. Of the original combined total area of 1323.94 ha for all ESAs and SNAs, 735.93 ha, or 55.4 percent of that total area, still persists today, in an unprotected state.



**Figure 4.4. Protection Status of 1993 Tableland Inventory Sites as of 2005, Shown as Percent of Total Area**

#### 4.3.2 Analysis of Current Network of Natural Areas (2005)

The following is an analysis of the updated, expanded and integrated inventory of Edmonton Natural Areas identified in Objective 1 (see Figure 4-5).

##### *Descriptive Statistics*

Including both NSRV and Tableland Natural Areas, there are 424 Natural Areas in Edmonton covering a total of 7226.62 ha. Tableland Natural Areas (n=318, 2047.27 ha) are by far more numerous, however, in terms of area, it is the NSRV Natural Areas (n=106, 5179.35 ha) that make up the majority (Table 4.3). In fact, NSRV Natural Areas average 48.86 ha, while Tableland Natural Areas average almost eight times less at 6.44 ha. Combined, the NSRV Natural Areas account for 63.0 percent of the entire NSRV



area, compared to only 3.3 percent of the Tablelands supporting areas of natural vegetation. Expressed as density the story is similar: Natural Areas within the NSRV average 1.3 patches per 100 ha, Tableland Natural Areas average 0.4 patches per 100 ha, approximately two thirds less densely distributed.

**Table 4.3 Comparison between Tableland and NSRV Natural Areas using Descriptive Statistics**

Descriptive statistic	Tableland Natural Areas	NSRV Natural Areas
# of Natural Areas	318	106
Total area (ha)	2047.27	5179.35
Average size	48.86	6.44
Range of size	1.0 – 865.8	1.0 – 49.4
Proportion of landscape (%)	63.0	3.3
Natural Area density (#/100 ha)	1.3	0.4

The larger average size of NSRV Natural Areas is a function of a broader range (from 1.0 ha to 865.8 ha) and a more balanced distribution among the small to medium sized Natural Areas (Figure 4.5). There are several very large Natural Areas (450 and 650 ha) in the southwest part of the NSRV that probably act as Core Areas. Because of their large size, they likely support the highest biodiversity within Edmonton's Ecological Network, and in combination with the large regional Core Areas, support the biodiversity across the City landscape. The range of sizes represented by the Tableland Natural Areas is much smaller (1.0 – 49.4 ha)<sup>2</sup>, with most of the sites being quite small (Figure 4.6). There are, however, a few Tableland Natural Areas that are large enough (25+ ha) to support relatively high species diversity. These larger Natural Areas on the tablelands also play an important role in sustaining the biodiversity within the City.

<sup>2</sup> Note that the Tablelands and NSRV sites have the same minimum size due to the 1.0 ha minimum size criteria used to define Natural Areas.



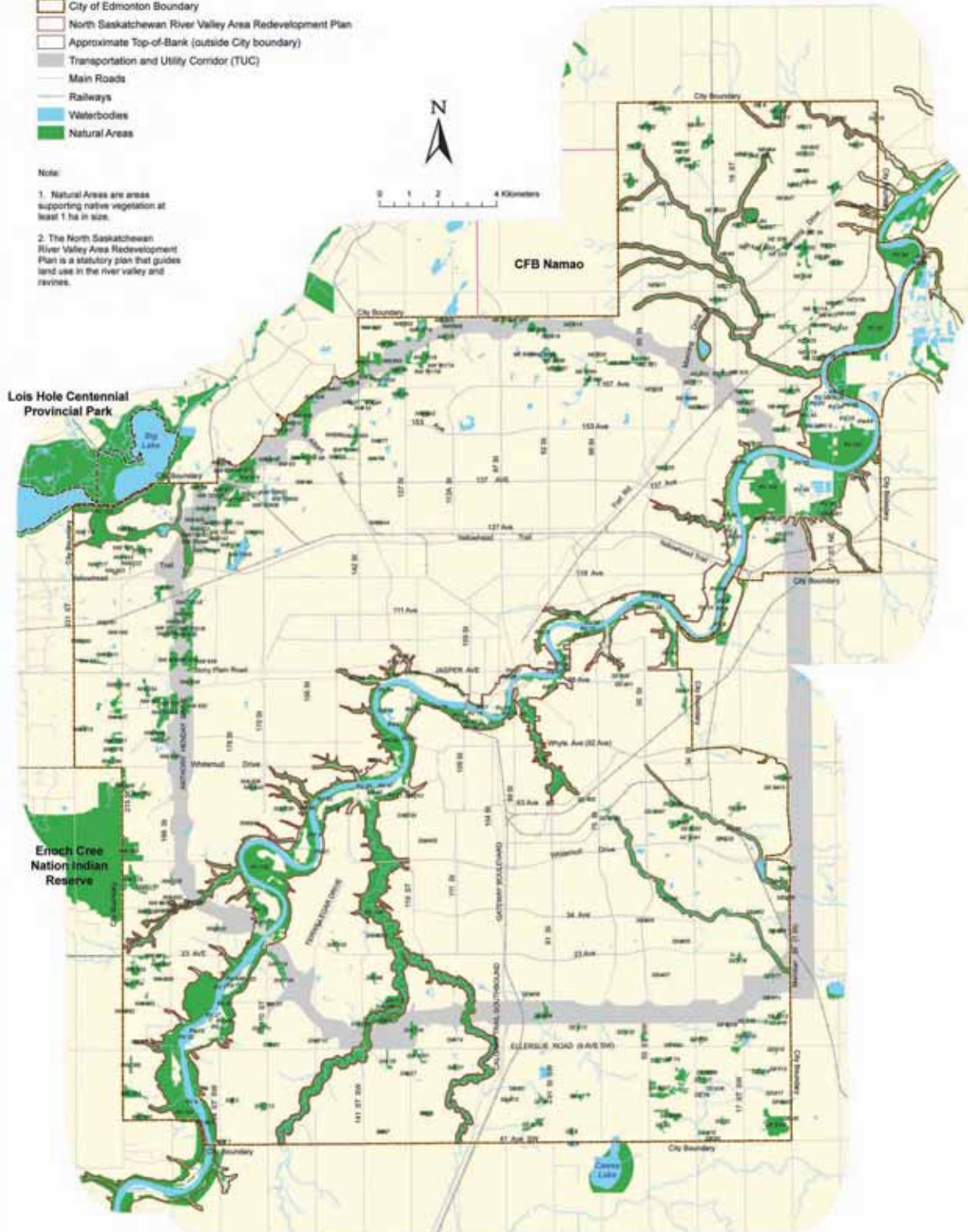
# EDMONTON'S NATURAL AREAS IN 2005

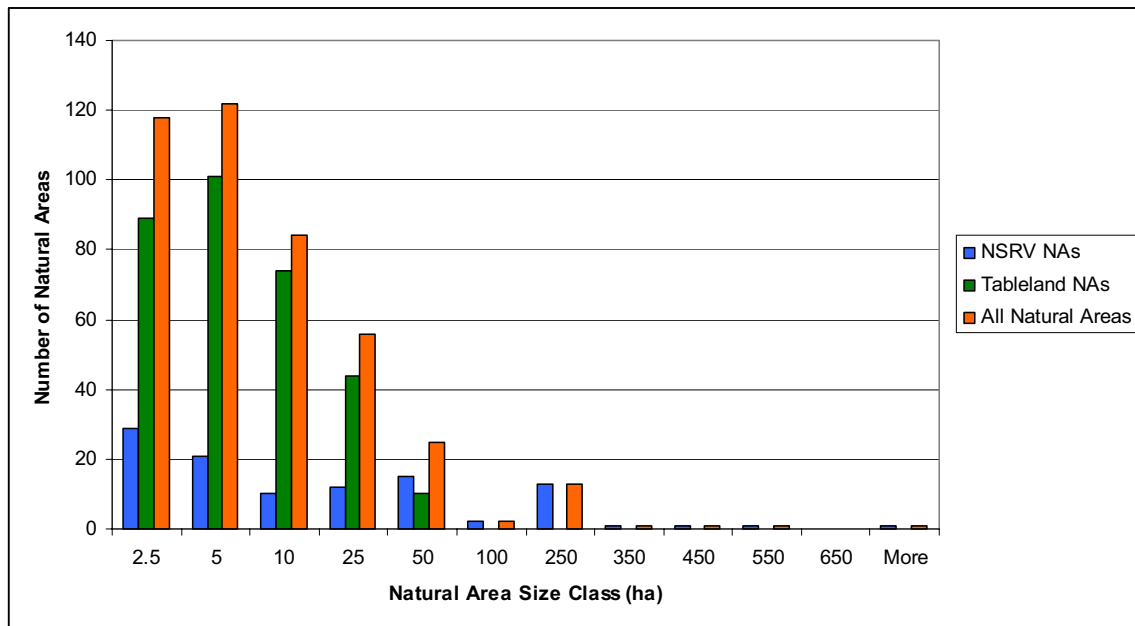
## Legend

- City of Edmonton Boundary
- North Saskatchewan River Valley Area Redevelopment Plan
- Approximate Top-of-Bank (outside City boundary)
- Transportation and Utility Corridor (TUC)
- Main Roads
- Railways
- Waterbodies
- Natural Areas

## Note:

1. Natural Areas are areas supporting native vegetation at least 1 ha in size.
2. The North Saskatchewan River Valley Area Redevelopment Plan is a statutory plan that guides land use in the river valley and ravines.





**Figure 4.6. Size Distribution of Edmonton's Natural Areas**

#### *Spatial Distribution*

The 106 NSRV Natural Areas are, as defined, all located within the boundaries of the North Saskatchewan River Valley Area Redevelopment Plan. Most of those Natural Areas lie within the relatively narrow confines of the NSRV system (the exceptions being areas in the Kirk Lake drainage and on shore of Big Lake, and are generally more closely grouped than the Natural Areas on the Tablelands. As a result, the majority are well-connected, particularly in the southwest part of the NSRV.

The Tablelands, however, comprise a much larger area throughout which the 318 Natural Areas are scattered. As a result, they are less densely distributed than the NSRV, and less directly connected. Tableland Natural Areas are most numerous in the City's northwest quadrant, with 41.5 percent of the total number, and 51.7 percent of the total area accounted for in the northwest. The northeast contains the second greatest number, followed by the southeast and the southwest (Table 4-4).

**Table 4.4. Distribution of Tableland Natural Areas**

City Area		# of Natural Areas	Area (ha)
City Quadrant	Northwest	132	1057.45
	Northeast	96	473.35
	Southeast	62	365.28
	Southwest	28	151.19
MDP Intended Land Use Area*	Suburban area	105	560.19
	Business and Employment area	64	397.27
	Agriculture area	108	619.52
	Transportation and Utility Corridor (TUC)	77	459.32
<b>Total</b>		<b>318</b>	<b>2047.27</b>

\* note: some Natural Areas occur in more than one MDP Intended Land Use Area, as such, the number of Natural Areas totaled across the four MDP area is greater than 318.

The distribution of Natural Areas relative to the MDP land development concept area provides another useful perspective from which to assess the spatial distribution of Tableland Natural Areas. A similar number of Natural Areas occur in suburban and agriculture areas (105 and 108, respectively), while business and employment areas have the fewest Tableland Natural Areas. Despite this fact, one of the four regionally significant Tableland Natural Areas (i.e., NW 7026, Kinokamau Lake) occurs within a business and employment area. Further, the business and employment area in the City's southeast includes portion of two important connective drainages, Fulton and Mill Creek. The Transportation and Utility Corridor (TUC) includes portions of 77 Natural Areas. This concentration of sites in the TUC is noteworthy for two reasons. Foremost, the TUC is provincial land and, as such, the Natural Areas within it are the jurisdiction of the Province, not the City. This lack of direct control highlights the need for cooperation between the City and the province regarding the management of those Natural Areas. Further, the primary purpose of the TUC is for locating freeways and utilities, therefore intense development will likely occur. The ongoing and planned expansion of Anthony Henday Drive within the TUC will result in a reduction in size of many Natural Areas. This emphasizes the vulnerability of those 77 Natural Areas and, again, suggests the need for cooperation between the City and the Province if planning of the TUC is to acknowledge the presence of those Natural Areas. The two governments should meet to discuss the importance of those Natural Areas to the sustainability of Edmonton's inventory (see Spencer Environmental 2006b).

Another spatial perspective from which Edmonton's Natural Areas can be analyzed is the three sub-basins of the North Saskatchewan River watershed that occur in Edmonton: the



Sturgeon, Strawberry and Beaverhill sub-basins. It is the Beaverhill sub-basin that has the largest geographic representation within the City, slightly larger than the Strawberry sub-basin, but it is the Strawberry sub-basin that is characterized by the greatest combined area of Natural Areas (3441 ha; Table 4-5) (though not the highest number). This is likely a function of the inclusion of the Natural Areas that consist of the heavily vegetated riparian areas along Whitemud and Blackmud Creeks within the Strawberry sub-basin (see NSRV contribution). The Beaverhill sub-basin includes 3012 ha of Natural Areas, while the Sturgeon sub-basin, comprising only a small portion of the City's northwest corner, and, very roughly four times smaller than the other two basins, includes 494 ha of Natural Area.

**Table 4.5. Distribution of Edmonton's Natural Areas in Terms of the North Saskatchewan River Watershed Sub-basins.**

NSR Watershed sub-basin	Tableland Natural Areas		NSRV Natural Areas		All Natural Areas	
	# of NAs	Area of NAs (ha)	# of NAs	Area of NAs (ha)	# of NAs	Area of NAs (ha)
Sturgeon	36	197.26	1	296.70	37	493.96
Strawberry	132	989.72	55	2451.71	187	3441.43
Beaverhill	163	860.30	52	2151.82	216	3012.13

### Protection Status

#### **Tableland Natural Areas**

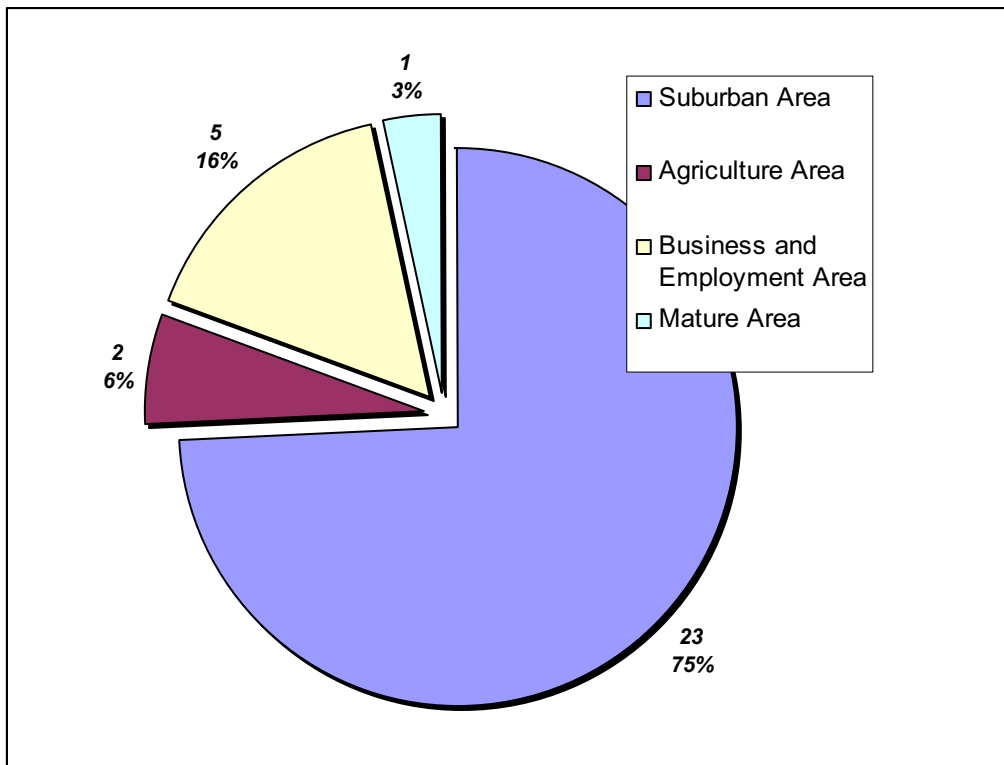
Within the tablelands, 31 sites are considered protected for a total of 245.19 ha, or 12.0 percent of the total area of Tableland Natural Areas (Table 4.6). Twenty-eight (169.29 ha) of those sites are protected under city ownership, including eight Natural Areas that were protection through incorporation into urban neighborhoods prior to the 1993 inventory work. A further two sites (19.70 ha) are owned by the City, but were not acquired specifically for the purposes of Natural Area protection. Despite not being protected, the increased potential for the protection of those sites leaves them in a protection category of their own. Three sites within the City have been protected independent of the City through private initiative: Kinokamau Lake (NW 7026), McDonough Peatland (NW 7009) and the Celanese Woodland (NE 8006). Those three sites alone total 75.90 ha, or 31.0 percent of all protected Tableland Natural Areas. As seen above, portions of 77 Natural Areas (459.32 ha) are located within the TUC and, in terms of planning, are outside the jurisdiction of the City of Edmonton. Lastly, there are 24 sites totaling 164.24 ha (8.0 percent) that were still present in 2005, but for which development plans have been approved that would result in at least a partial loss to the Natural Area. In six of those cases, a portion of the site was also planned for retention (i.e., protection). Including the Natural Areas within the TUC and those owned by the City, but not recognized for protection, 80.0 percent of Tableland Natural Areas are unprotected. That so many Natural Areas remain unprotected, highlights the fact that there are still many Natural Areas with potential for protection by the City.



**Table 4.6. Summary of Protection Status of Tableland Natural Areas**

<b>Protection Status</b>	<b># of Natural Areas</b>	<b>Area (ha)</b>	<b>% of Total area of Tableland NAs</b>
Protected – City ownership	28	169.29	8.3
Protected – Private ownership	3	75.90	3.7
<i>Protected Totals</i>	<i>31</i>	<i>245.19</i>	<i>12.0</i>
Owned by City – not for protection	2	19.70	1.0
Outside City’s jurisdiction (i.e., in TUC)	77	459.32	22.4
Otherwise unprotected	-	1158.82	56.6
<i>Unprotected Totals</i>	<i>-</i>	<i>1637.84</i>	<i>80.0</i>
Existing but approved for development in statutory plans	24	164.24	8.0

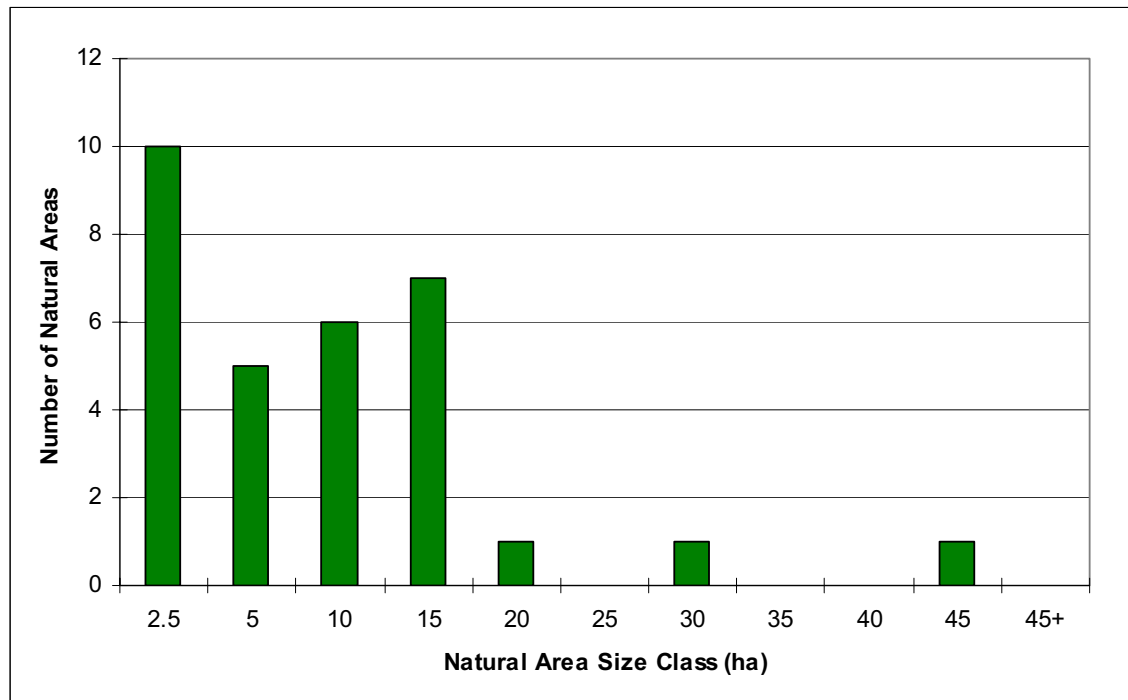
Analysis of the distribution of protected Tableland Natural Areas (n=31) across the City provides some interesting insight. In terms of City quadrants, the distribution of protected Natural Areas is relatively consistent across the City: 9 in the northwest, 7 in the northeast, 7 in the southeast and 8 in the southwest. However, in terms of the MDP Land Development Concept areas, the story is much different. The vast majority (74.2 percent; 23 of 31) of protected natural areas are located in suburban areas, with the remainder distributed between business and employment areas (n=5), agriculture areas (n=2) and the mature area (n=1; Figure 4.7). The fact that so many protected Natural Areas occur in suburban areas is strongly suggestive that, up to this point, the City has realized most of its successful conservation efforts through the planning process. In fact, between 1993 and 2005 the City was successful in protecting (at least partially) 15 of the 33 (i.e., 45.5 percent) ESAs and SNAs located within suburban areas. At the other end of the spectrum, the presence of only 2 protected Natural Areas in agriculture areas suggests that limited resources in terms of conservation have been focused on areas outside the parts of the City that are planned for development.



**Figure 4.7. Distribution of Protected Tableland Natural Areas in terms of MDP Land Development Concept Areas (based on Number of Sites)**

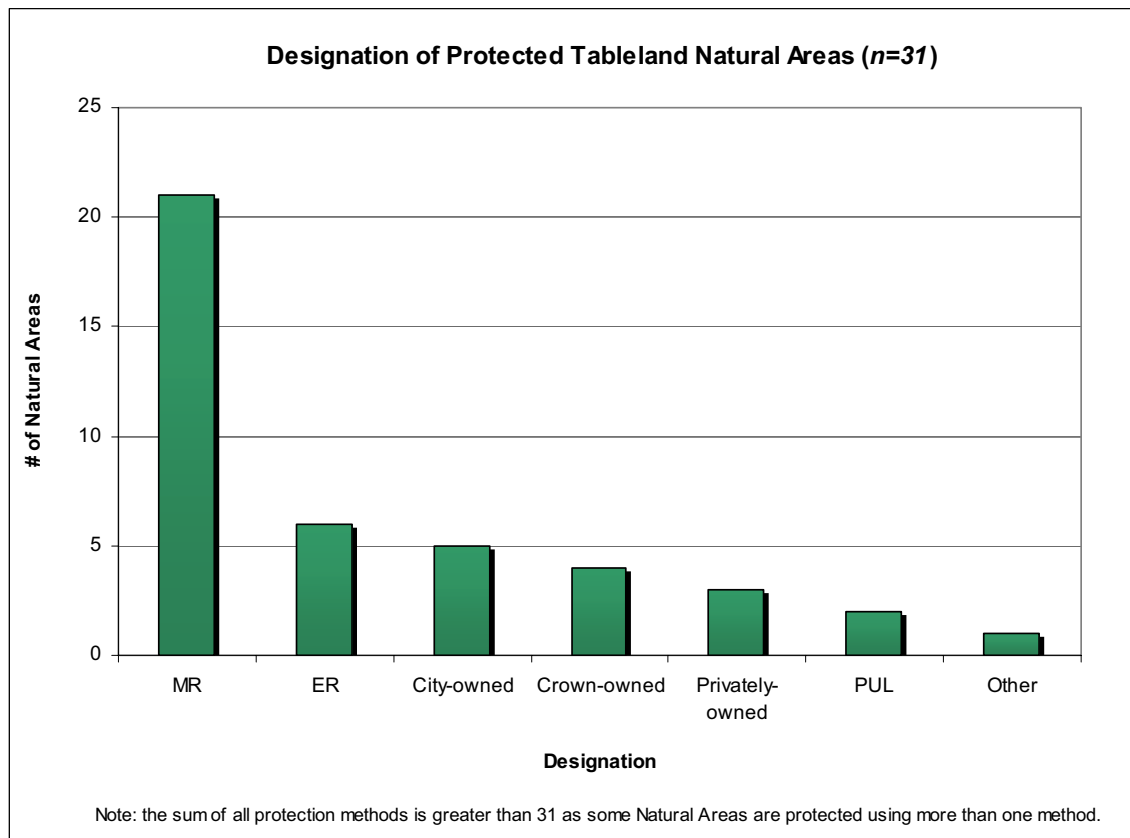
The distribution of protected Tableland Natural Areas can also be analyzed in terms of the three sub-basins of the North Saskatchewan River watershed. The sub-basin that encompasses the largest portion of Edmonton, the Beaverhill sub-basin, also comprises the greatest number and area of protected Tableland Natural Areas (i.e., 17 sites for 128.44 ha). The remaining 14 protected sites occur within the Strawberry sub-basin (116.75 ha); none are within the Sturgeon sub-basin.

In terms of area, protected Tableland Natural Areas are typically quite small in size, with 90.3 percent of those being less than 20 ha in size (Figure 4.8), however, protected Natural Areas actually average slightly larger (i.e., 7.91 ha) than the average Tableland Natural Area size of 6.44 ha. The two largest protected Tableland Natural Areas have come as a result of private initiative. Focusing on just those Tableland Natural Areas protected by way of City ownership, the average size of protected area drops to 6.05 ha.



**Figure 4.8 Size Distribution of Protected Tableland Natural Areas**

Another interesting approach to assessing the protected Tableland Natural Areas is to analyze the designation, or protection mechanism of those sites. The designation of sites as Municipal Reserve (MR) has been, by far, the most common means of protecting Tableland Natural Areas, with 67.7 percent (i.e., 21 of 31) of protected sites being at least partially designated as MR (Figure 4.8). The remaining designations (Environmental Reserve - ER, City-owned, Crown-owned, Privately-owned, Public Utility Lot – PUL and other) have been used much less often. Despite being less common, these other designations have been effective tools for protecting larger Natural Areas. Because the dedication of MR is limited to a certain percentage of developable land, there is a limited capability for the use of MR in the protection of larger sites. It has, however, been implemented in combination with the use of other mechanisms, such as ER and PUL to protect a few larger sites around Edmonton. However, when used alone the majority of Natural Areas dedicated as MR measure less than 5 ha, the approximate size that characterize the majority of Tableland Natural Areas. As such, despite being not specifically geared towards the protection of Natural Areas, MR remains a viable and practical tool for protecting smaller Natural Areas. The protection of larger Natural Areas is, however, generally better suited to the use of other mechanisms. In fact, the use of other protection mechanisms, such as acquisition through the Natural Areas Reserve Fund and private dedication of Conservation Easements, have been responsible for the protection of some of Edmonton’s larger Tableland Natural areas (i.e., NW 384 and NW 7026, respectively).



**Figure 4.9. Designation of Protected Tableland Natural Areas**

### NSRV Natural Areas

The protection status of NSRV Natural Areas presents a different situation relative to the Tableland Natural Areas. A total of 2127.16 ha of NSRV Natural Areas are zoned as Metropolitan Recreation Zones and, therefore, considered at least somewhat protected. In fact, 77 of the 106 NSRV Natural Areas (i.e., 72.6 percent) are at least partially protected. Expressed in terms of area, the percentage of protected Natural Areas drops to 41.1 percent. The majority of the protected Natural Areas (1704.73 ha) is also under City ownership, providing yet another level of certainty to the protection status of those areas. The remaining protected NSRV Natural Areas (422.43 ha) are privately owned. In addition to the NSRV Natural Areas protected through the above means, there are also a few locations within the NSRV that are not zoned as Metropolitan Recreation Zones and not owned by the City, but which are protected through private initiatives (e.g., McTaggart Sanctuary and University of Alberta Forest Reserve). Despite the apparent large size of the protected areas, 3052.19 ha of NSRV Natural Areas remain unprotected, primarily in the reaches of the river valley in the northeast and southwest portions of the City, i.e., the Horseshoe Creek drainage basin and the upper reaches of the Whitemud and Blackmud Creek drainage basin.



Relative to the North Saskatchewan River watershed sub-basins, the majority of protected NSRV Natural Areas occur in the Strawberry sub-basin, with 1442.03 ha, or 67.8 percent of Natural Areas having a protected status (Table 4.7). The remaining NSRV protected areas (685.13 ha) are located within the Beaverhill sub-basin. As was the case for the Tableland Natural Areas, no NSRV protected areas are located within the Sturgeon sub-basin. The prominence of protected NSRV Natural Areas within the Strawberry sub-basin is the opposite situation from the Tablelands, where the majority of protected Natural Areas are within the Beaverhill sub-basin. The majority of protected NSRV areas in the Strawberry sub-basin is the result of the large protected areas within Whitemud Creek Ravine and the southwest parts of the NSRV.

**Table 4.7. Distribution of Protected Natural Areas in Terms of the North Saskatchewan River Watershed Sub-basins.**

NSR Watershed sub-basin	Protected Tableland Natural Areas	Protected NSRV Natural Areas	Totals
	<i>Area of NAs (ha)</i>	<i>Area of NAs (ha)</i>	<i>Area of NAs (ha)</i>
Sturgeon	0.00	0.00	0.00
Strawberry	116.75	1442.03	1558.78
Beaverhill	128.44	685.13	813.57
<b>Totals</b>	<b>245.19</b>	<b>2127.16</b>	<b>2372.35</b>

#### **Tableland and NSRV Natural Areas**

Combined, the protected Tableland and NSRV Natural Areas total 2372.35 ha (Table 4.7). The fact that the protected NSRV Natural Areas (2127.16 ha) comprise almost a full 90 percent (89.7 percent) of the total clearly underlines the significance contribution of the NSRV to the inventory of protected Natural Areas in the City of Edmonton.

#### **4.4 Performance Measurement and Trend Analysis**

The City of Edmonton is now in a position, with a comprehensive and updated inventory of its Natural Areas, to monitor its successes in conserving those resources. Monitoring performance of any activity is best approached in a considered manner, to determine the goals of such monitoring and to set some criteria defining “good” measures of performance (IMI *strategics* 2006). Before proceeding with an analysis of Edmonton’s Natural Areas program, we first considered a potential framework for repeated measurement.

##### **4.4.1 Criteria for Performance Indicators**

Before initiating performance monitoring, it is worthwhile to consider first what indicators will best measure implementation of organizational goals. There are practical



and logistic elements to consider as well, as measurement must be within the capacity of the organization's resources. The criteria that we considered in selecting indicators for the analysis of Edmonton's efforts in Natural Areas conservation to date included the following:

- ∄ **Relevance** – indicator linked to activities, goals and strategies
- ∄ **Reliable** – results can be duplicated using the same methodology
- ∄ **Responsive** – indicator responds meaningfully to the interventions of the organization
- ∄ **Credible** – Reputation for accuracy and stability
- ∄ **Unbiased** – Neutral and fair means of collecting and reporting
- ∄ **Useful** – suitable input for planning decisions
- ∄ **Timely** – reported in time to influence decisions
- ∄ **Comparable** – Allows comparisons annually and to other similar initiatives
- ∄ **Outcome-oriented** – focuses on outcomes obtained through intervention of the organization
- ∄ **Cost effective** – benefits of the indicator should exceed the costs of its measurement

#### 4.4.2 *Indicators for Trend Analysis of Edmonton's Natural Areas Management Success*

As evident in the preceding section, the analysis of the status of Edmonton's current network of Natural Areas can be performed in many different ways. However, to analyze the success of the City's management of Natural Areas, and more specifically, to assess the City's success in terms of protecting Natural Areas, monitoring a few key parameters will be useful. An appropriate performance monitoring approach for the Natural Areas program should build on the existing data, and ideally, use the baseline data as a starting point for selection of indicators. Selecting more indicators is typically better than few, because inevitably, some indicators may prove more successful than others and the list of tracked indicators will likely become more concise over time (IMI *strategics* 2006). Beginning with a wider selection of indicators that meet the criteria described above will ensure an adequate selection endures over the duration of monitoring.

At the most basic level, analysis of the number and area of Natural Areas can provide insight into changes that may occur to Edmonton's Natural Areas. Decreasing totals in either number or area of Natural Areas would obviously imply that losses have occurred within the network. An analysis of the number and area of conserved sites will quickly yield information that can be used to assess and track the success of the City in terms of protecting Natural Areas. Assessing the number and area of Natural Areas with respect to their spatial distribution can provide insight into areas of the City that may require additional investigation or specific management action.

Analysis of basic descriptive statistics (i.e., number and area) is, however, of limited use in assessing performance of the whole network. A deeper understanding of the status of



Edmonton's Natural Areas, and how those Natural Areas are working as a network requires a finer level of analysis. Maintaining a functional network requires the management and protection of the largest Natural Areas, and particularly the Core Areas. Retention of those areas and their careful management will help to ensure that a pool of high diversity is available in the system. Further, maintaining a range of Core Areas, distributed across the City, provides additional capacity to maintain a minimum level of biodiversity across that system. Specific analysis of Core Areas over time is recommended.

Ideally, periodically re-analyzing the network to the extent undertaken in Objective 2 (Spencer Environmental 2006b) (or a subset of that) would provide the best means of determining trends in the management of the network as a whole. It may be appropriate to do this very decade or so. However, such a complex approach is not feasible for more frequent monitoring. As such, the following is a recommended approach that is more sensitive to the consideration of time and effort.

At a minimum, Office of Natural Areas should track protection and losses of Natural Areas on an annual basis. The key questions are:

- € How many Natural Areas have been newly-protected?
- € How many have Natural Areas have been newly-lost?
- € By what means and where?

We also propose monitoring, on an annual basis, the status of all individual Natural Areas that have recently been through the planning process, through a combination of aerial photography analysis and a review of planning documents and following a checklist of questions. For each area, the analysis would consist of working through the set of questions within the checklist and providing answers to each. The following is a suggested list of questions:

- € Has the site decreased in size? By how much? As a result of development? Or as a result of actions of private landowners?
- € Has a road newly-fragmented the site? How wide and busy is the road? Have culverts or other crossing structures been installed associated with those roads?
- € Has fencing being erected within or around the site? Does that fencing act as a barrier to wildlife movement? Is that fencing located in an area that might act as a wildlife movement corridor?
- € Has the use of the site changed? Has public access to the site changed? What are the public uses of the site? Are they sustainable?
- € Have adjacent or surrounding land uses changed? Have they become more or less permeable in terms of wildlife movement?
- € Has any portion of the site been protected in any way? How large an area? How permanent is the protected status?



- € Have other nearby Natural Areas been reduced in size? Protected? Has this resulted in the site becoming more isolated?
- € Has any restoration occurred within or adjacent to the site? Has that restoration resulted in an increased area? Is this likely to enhance structural or functional connectivity?
- € Has any development within or adjacent to the site acknowledged ecological considerations and accommodated ecological connectivity? By what means?
- € Have development plans been developed for the site? Are there plans to retain the site? Portions of the site?

Developing answers to these questions will provide a detailed snapshot of the impact of the proposed development and an area's ecological function. Then, consideration of that site in the context of other key areas will provide insight into the condition of the Ecological Network as a whole. Ideally, with a successful implementation of conservation initiatives, the repeated review of these questions would reveal that sites of key interest within Edmonton have remained largely intact, with very few adverse impacts. However, in situations where adverse impacts are noted, answers to these questions will provide the detailed information necessary to successfully and qualitatively assess those impacts and, begin to assess the need for mitigative measures. At the very least, the information gained in answering the above questions will act as a feedback loop for the City, helping them adaptively manage their network of Natural Areas. If sites must be selectively evaluated in the interest of budgetary constraints, the evaluation should focus on Core Areas.

Although the above approach represents an effective means of monitoring Edmonton's Natural Areas, it does not provide sufficient input to allow for monitoring of Edmonton's network of aquatic linkages. To assess, monitor and analyze the management performance of the aquatic network, a similar checklist approach can be used, however, it must comprise a different set of questions that are specific to characteristics of the aquatic network:

- € Have any new crossing structures been installed? What type? Are they likely to be sufficient in maintaining aquatic connectivity?
- € Have any areas of riparian habitat been cleared? Degraded?
- € Have any watercourses been re-aligned? In a natural way?
- € Has any restoration action been taken within riparian areas?
- € Has land use changed adjacent to key watercourses?
- € Has development along Edmonton's watercourses accommodated riparian habitat and water quality? Were buffers incorporated?

Responses to the above questions will provide useful insight into changes that have occurred to the network of aquatic linkages in Edmonton. In revisiting these questions over time, it will be possible to develop a better understanding of the impacts to the network and, in doing so, help determine the need for future restoration work.



In addition, performance can be monitored at a broader administrative level by asking some simple questions:

- ∞ Have any policies, strategies or plans been implemented by the City to direct or guide conservation of network components?
- ∞ Have any new Natural Areas conservation/protection tools been identified or successfully implemented?
- ∞ Have any multi-jurisdictional conservation planning efforts been initiated?
- ∞ Have any new partnerships been forged with agencies delivering higher-order conservation initiatives?