OIL SANDS BIRD CONTACT MONITORING PROGRAM
2015 ANNUAL REPORT

Prepared for:

Canadian Natural Resources Limited, Imperial Oil Canada Limited, Shell Canada Energy, Suncor Energy Inc., Syncrude Canada Limited

March 31, 2016

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March 31, 2016

Terence Ko
Manager, *EPEA* and *Water Act*
Mining Authorizations
Alberta Energy Regulator
4th Floor, 4999 – 98 Avenue
Edmonton, AB T6B 2X3

Dear Mr. Ko:

Re: Oil Sands Bird Contact Monitoring Program 2015 Annual Report

Owl Moon Environmental Inc. (OMEI) is the Program Manager for the Oil Sands Bird Contact Monitoring Program, and in that capacity and on behalf of the five companies participating in the program, I am submitting to you the OSBCMP 2015 Annual Report. This document contains an analysis of the data in a regional context, and five appendices (one per company) that fulfill conditions in their respective *EPEA* Approvals:

- Appendix A: Canadian Natural Resources Limited, *EPEA* Approval 149968-00-04;
- Appendix B: Imperial Oil Resources Ventures Limited, *EPEA* Approval 46586-00-00;
- Appendix C: Shell Canada Energy, *EPEA* Approvals 153125-00-00 (as amended) and 20809-01-00 (as amended);
- Appendix D: Suncor Energy Inc., *EPEA* Approval 94-02-00 (as amended); and
- Appendix E: Syncrude Canada Ltd. *EPEA* Approval 26-02 (as amended).

The specific conditions within each of the approvals that this report fulfills are specified within the submission letters included within each of the above appendices.

Submitted with this report as a separate document is our report on the Searcher Efficiency Study conducted during the 2015 monitoring season. The study methods and the results obtained are referenced within the annual report.

Please contact me at the number or email address above, should you have any questions.

Yours truly,

Kenneth R. Foster, Ph.D., P.Biol.
President
OSBCMP Program Manager

cc: Kenneth Yap & Marie Neitfeld, AER
Joann Skilnick & Andrea McGregor, AEP
Richard Wiacek, CWS
Paul Knaga, Shell Canada Energy
Calvin Duane & Joanne Hogg, Canadian Natural Resources Limited
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EXECUTIVE SUMMARY

The Oil Sands Bird Contact Monitoring Program (OSBCMP) is a region-wide program to quantify bird landings and mortalities on liquid impoundment facilities (LIFs) containing process-affected water at the five oil sands mining facilities, and to provide information supportive of strategies to reduce landings and mortalities.

The monitoring protocol was implemented in 2011 and learnings in each year have resulted in annual protocol improvements. Two major changes were incorporated into the protocol for the 2015 program. The first included the application of LIF inclusion and exclusion criteria, and a risk model designed to identify the LIFs with high risk of bird oiling. This change standardized the types of LIFs included in the monitoring program across the five mining operators. The second involved the normalization of bird survey and mortality search effort on an area basis, with area being partitioned into defined habitat types. The intent was to increase the ability to evaluate data across operator sites, as well as to provide information on the availability of attractive habitats for birds.

Landed birds were counted within delineated survey areas over a minimum 5-minute period, extended as required to identify and count all landed birds to a maximum of 30 minutes. Habitat types and areas within these survey areas were assessed once every two weeks to support analyses of bird-habitat associations. Mortality searches were conducted using one of three methods: (1) transects defined by length and visible search width, (2) fixed-radius scans of a defined visible distance and bearings taken from a stationary location, and (3) small LIF searches, where it was possible to scan the entire LIF from one or a few locations.

A quick scan procedure (two observations per week) was added in 2015, and applied to a subset of LIFs defined as being of low-risk. Incidental observations of oiled birds (live or dead) discovered outside of protocol procedures, and within the protocol monitoring dates were also recorded.

Key Findings

1. A total of 21,161 landed bird observations, across all monitoring components and including incidental observations were made in 2015, including 518 observations of oiled birds.

2. Bird survey landed bird observations totaled 14,797 in 2015. This represents 1.37 observations per survey, or on an area-normalized basis, 0.056 observations/ha. This is a slight increase from observations in 2014 (1.26 observations/survey) and in 2013 (0.78 observations/survey). Changes in the protocol and an evolution to focus survey effort in areas with more birds likely explains all or part of this trend.

3. Vegetated habitats (emergent vegetation, vegetated islands, vegetated banks) are attractive habitat for dabblers, divers and waders.

4. The absence of a strong association between open water availability and observed landed diving duck numbers in the survey areas suggests that the survey areas are not representative of the entire LIF, and that extrapolation of observations beyond the boundaries of the survey area remains inappropriate.

5. About 20% of the landed bird observations represent observations of birds recorded in one or more earlier surveys.

6. Of the 14,797 bird survey observations, 2,248 were of species of conservation concern. American Green-winged Teal, Northern Pintail and Lesser Scaup represented 91% of these observations.

7. Differences in landed bird observations among the five operator sites seen in 2013 and 2014 were again apparent in 2015. These differences suggest that factors not considered or measured in the OSBCMP are affecting the numbers of landed birds observed.

8. A total of 518 oiled birds were observed in 2015, compared to 604 in 2014 and 157 in 2013. Procedural differences focusing on data collection on lightly and moderately oiled birds beginning in 2014 likely explain the apparent increase in oiled bird observations from 2013 to 2014.

9. A total of 158 avian mortalities occurred in 2015: 52 oiled birds discovered dead, 23 unrecovered heavily and completely oiled birds presumed to have died, and 83 oiled birds that were captured and euthanized. This is fewer than the 173 avian mortalities recorded in 2014, and similar to the 157 avian mortalities recorded in 2013.

10. A total of 63 oiled birds were observed during effort-based mortality searches: 59 in transect searches (73,457 ha), and two in each of fixed-radius scan (566 ha) and small LIF (1,254 ha) search programs. This equates to approximately one oiled bird observation per 12 km^2 of area searched.

11. The transect search method was the most effective mortality search technique. Although less effective, the fixed-radius scan and the small LIF search procedures remain appropriate methods for searching in areas where transect searches cannot be conducted.

12. A total of 455 oiled birds were observed outside of effort-based mortality searches (recorded during bird surveys, quick scans or as incidental observations).

13. Of the 518 oiled birds observed, 357 (69%) remained sufficiently agile and/or flight-capable to avoid capture. Some of these birds were observed on more than one day and thus counted more than once. The majority (71%) of oiled birds observed in 2014 were also sufficiently agile to avoid capture.

14. Of the 2,282 observations of landed individuals of species of conservation concern, 79 were observed oiled; 41 were classified as mortalities (birds heavily or completely oiled, captured and euthanized, found dead).

15. The quick scan procedure resulted in higher than expected landed bird observations at some LIFs defined as being of low risk (including observed bird oilings, and one mortality). These data will be used in evaluating the risk of bird mortality associated with these LIFs in preparation for the 2016 monitoring program.

16. On an area-normalized basis, bird surveys conducted at intervals of two to four days would reflect the broad pattern of landed bird numbers that are illustrated in the data acquired from six surveys per week. Some loss of resolution of peak in landed bird numbers is expected to occur at the longer intervals. However, personnel performing other activities on and around the LIFs would be positioned to identify unusual landing activity on days when bird surveys are not conducted.

17. Deterrent data were collected with the intent of correlating observed landed bird numbers and deterrent types, numbers and activity. However, high variability in the deterrent data negated the ability to conduct the analyses. Further attempts to examine deterrent effectiveness within the monitoring program are not recommended.

18. The inclusion criteria, exclusion criteria and risk model used to define the risk of bird mortality associated with site LIFs performed reasonably well, and no material changes to these processes are recommended in advance of the 2016 monitoring season.

GLOSSARY

AHD	Acoustic Hailing Device; powerful directional speaker, including Long Range Acoustic Device (LRAD) and HyperSpike models, typically activated by a bird detection radar linked through wireless signal. May be combined with a visual deterrent (e.g., laser)
Artificial Structure	A man-made structure on which birds may perch (e.g., rafts, barges, docks, buildings, deterrents); may be permanent or temporary, floating or fixed, or may form part of a bank
ATV	All-terrain vehicle, including amphibious vehicles (e.g., Argo)
Bank	The engineered or natural outer perimeter of a Liquid Impoundment Facility; slope may be shallow or steep, may be vegetated or non-vegetated, or consist of artificial materials (e.g., synthetic liners)
Bird Contact	Bird(s) observed touching habitat of a Liquid Impoundment Facility (e.g., artificial structure, bank, emergent vegetation, flat, island, open water)
Bird, Landed (during a survey)	Bird that was in contact with a Liquid Impoundment Facility, within 500 m of the survey station, within the survey census
Bird, Oiled	Bird with any percentage of its body surface oiled, described as light, moderate, heavy or complete. Behaviour may provide clues, as some birds obsessively attempt to preen without successfully removing the substance, and the substance may be visible on the bill"
Bird Survey	Conducted by observers from a survey station; identification and count of birds that landed within the survey area during the survey census along with the collection of other information (e.g., bitumen amount, visibility, bird oiling)
Bitumen Mat(s)	Floating bitumen that may vary in size and pose a risk of oiling to birds
Brood	One or a group of chicks, with a parent usually nearby
Chick	Young local bird that has not yet developed the ability to fly
Effective Search Width	The sum of the distance to the left and to the right of a transect within which an oiled, dead bird can be confidently seen and identified
Effluent	Water and other substances deposited in a Liquid Impoundment Facility, typically through a pipeline
Emergent Vegetation	Vegetation rooted in shallow water and can be seen above the water surface; usually found on edges or shallows in a Liquid Impoundment Facility
Flat	Terrain with minimal slope surrounding open water on a Liquid Impoundment Facility (typically less than 5% or 3 degrees); may be vegetated or non-vegetated (gravel, sand, mud, coke)
Guild, Non-target	Species that peck, fly, glean, stoop/depredate, or scavenge (except gulls) as their primary means of foraging; includes raptors, game birds such as grouse, woodpeckers, and passerines (including ravens)
Guild, Target; or Waterbird	Species that wade, dabble, or dive in water as their primary means of foraging; includes ducks, geese, shorebirds, grebes, loons, cranes, cormorants, swans, pelicans, coots, rails, gulls, terns, herons, and kingfishers
Incidental Observation	An oiled live or dead bird detected outside of a formal bird survey, mortality search procedure, or quick scan

Island(s)	Vegetated or non-vegetated (gravel, sand, mud, coke) island in a Liquid Impoundment Facility surrounded by water, where birds may perch, rest, build nests, or forage; may be permanent or temporary, natural or artificial structure (excepting deterrent devices), floating (includes logs and muskeg mats) or fixed
LIF	Liquid Impoundment Facility; A structure, including its banks if present, that holds process-affected water, and may or may not contain bitumen
OSBCMP	Oil Sands Bird Contact Monitoring Program
Migrant	A bird observed landed during one survey, not observed in subsequent surveys (based on field judgment)
Monitoring	Bird Surveys, Mortality Searches, and Quick Scans
Mortality	An oiled bird found dead, captured and euthanized, or heavily or completely oiled bird that could not be recovered but due to oiling level, was presumed to have died
Mortality Search	Search at a Liquid Impoundment Facility in any habitat type for oiled dead or dying birds. Searches may be conducted by boat, truck, ATV, or walking
QA/QC	quality assurance/quality control
Quick Scan	Surveys conducted at smaller pre-determined Liquid Impoundment Facilities at a lower frequency than bird surveys. The entire Liquid Impoundment Facility is scanned by observers; identification and count of birds that landed within the survey area during the survey census along with the collection of other information (e.g., bitumen amount, visibility, bird oiling)
Resident (Seasonal)	A bird, including chicks, that are nesting in habitats in and around the LIF, and which are observed during multiple bird surveys over a long period (based on field judgment)
Search Radius	The maximum distance from the point from which a fixed-radius scan is conducted within which a dead, oiled bird can be confidently seen and identified
Species of Conservation Concern	Species designated as Endangered, Threatened, or Special Concern under the Canadian *Species at Risk Act*, Committee on the Status of Endangered Wildlife in Canada or the Alberta *Wildlife Act*, or listed within Alberta as At Risk, May Be at Risk, or Sensitive
Stopover	A bird that is observed during only a few bird surveys, suggesting that the bird has stopped to rest and/or forage during migration (based on field judgment)
Survey Area	The area surveyed from the survey station, comprising the habitats within the LIF
Survey Period	Amount of time during which bird surveys were conducted; a minimum of five minutes and a maximum of 30 minutes
Survey Station	A fixed location near the edge of a Liquid Impoundment Facility, from which bird surveys were conducted
WIP	West In-pit

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1.0 INTRODUCTION

The intent of the Oil Sands Bird Contact Monitoring Program (OSBCMP) is to quantify bird landings and mortalities at process-affected ponds at the five regional oil sands mining facilities, and on the basis of these data, to provide site-specific guidance on bird deterrent strategies to reduce these landings and mortalities. This intent is articulated in the five objectives of the OSBCMP:

1. Provide an estimate of bird contacts and mortalities on ponds containing process-affected waters.
2. Provide an estimate of bird contacts on ponds containing fresh water.
3. Develop a standardized monitoring program for all oil sands mine operations to provide comparable data across ponds, sites, seasons, and years.
4. Identify species at risk that have been affected through contact on ponds containing process-affected waters.
5. Provide direction on adaptive management for long-term monitoring and bird deterrent programs.

The OSBCMP is designed to monitor for bird contact with process-affected water in each of the spring (April 16 to July 6) and fall (July 25 to October 31) migratory periods (St. Clair et al. 2013). The bird survey component of the OSBCMP has continued to be conducted within these seasonal periods.

Data acquired from 2011 to 2014 indicated that the numbers of birds interacting with process-affected water at the mine sites were substantially lower than at nearby freshwater ponds (OMEI 2015a). On the basis of these data, the second objective was declared achieved, and monitoring of freshwater ponds was discontinued in 2015. Analyses of the flyover data collected in 2013 and 2014 indicated that the numbers and species comprising the flyover observations were very different than those within the landed bird observations, and on the basis of this analysis, monitoring of birds flying over the survey areas was discontinued in 2015.

A substantial effort has been dedicated to developing a protocol standardized across the mine sites for estimating the numbers of birds contacting process-affected LIFs and the number of birds dying as a consequence of contact with bitumen in the LIFs (objective 3). This has resulted in protocol improvements each year. For the 2015 program, the protocol was revised in two major ways. First, the selection of process-affected water LIFs at which bird contact and mortality search monitoring was to be conducted was based on the application of inclusion and exclusion criteria, and for those not excluded by these criteria, by a risk model. The risk model was designed on the basis of data and information collected to date, emphasizing the data from 2013 and 2014. Second, normalization of effort on an area basis was implemented for the bird survey and mortality search programs, with this area being partitioned into defined habitat types. This focus on area surveyed and survey area habitat characterization was intended to increase the ability to evaluate data within and across operator sites, and to provide information on availability of attractive habitats at each site for use in habitat management programs (adaptive management, OSBCMP objective 5).

2.0 PROTOCOL SUMMARY

2.1 Introduction

To eliminate confusion regarding terminology used in the program through 2014, explicit definition of terms, including introduction of new terms, was included in the 2015 protocol. Structures containing process-affected water are defined as Liquid Impoundment Facilities (LIFs), within which up to 13 defined habitat types may occur (OMEI 2015b).

The protocol for the 2015 season (OMEI 2015b) included a set of inclusion and exclusion criteria used in the first steps of evaluating the risk to birds of exposure to the contents of each LIF. LIFs that were neither included nor excluded were assessed using a risk model that integrated knowledge of bird habitat associations with OSBCMP data collected in 2013 and 2014. A habitat assessment procedure was implemented to more precisely define bird survey areas and the habitats within them. A quick scan procedure was implemented to provide data on LIFs identified as being of low risk as a check on the performance of the risk model. Changes within the mortality search procedure broadened the activities that could be considered formal searches, and allowed for more consistent recording of search effort.

As in previous years, birds were identified to the most precise level possible – species, genus or foraging guild. Observations were classified as being birds of target guilds (dabbling ducks and geese, diving waterfowl, waders, gulls) or of a non-target guild (all other species grouped).

2.2 LIF Inclusion and Exclusion Criteria, and Risk Model

Tailings facilities were by default included in the OSBCMP, requiring both bird surveys and mortality searches. This was the only criterion by which a LIF was explicitly included in the bird survey and mortality search components of the program.

Bird surveys and mortality searches were not required at LIFs meeting all five of the exclusion criteria (Table 1). LIFs not explicitly included (tailings facilities) or excluded by application of these criteria were evaluated using the risk model (Figure 1), a stepwise integration of knowledge of habitats available within the LIF, LIF characteristics, and bird survey and mortality search data to derive a bird mortality risk associated with the LIF. LIFs identified as having a high risk were included in the 2015 bird survey and mortality search programs. A subset of LIFs excluded from monitoring by the risk model (i.e., low risk LIFs) were included in the quick scan procedure, a monitoring activity of lesser effort than the bird survey procedure, as a means of providing additional data and a check on the performance of the risk model.

Table 1: Liquid Impoundment Facility Exclusion Criteria

LIF Characteristics	Exclusion Criteria
Open water area	≤1.5 ha
Target guild landing observations	Landings of target guild species of ≤0.10 per survey (2013 to 2014)
LIF-associated mortalities	Mortalities of ≤1/year due to contact with bitumen in the LIF (2013 to 2014)
Industrial setting	LIF is within 100 m of active industrial operations, staging area(s) and/or roads
Human activity	Daily human presence

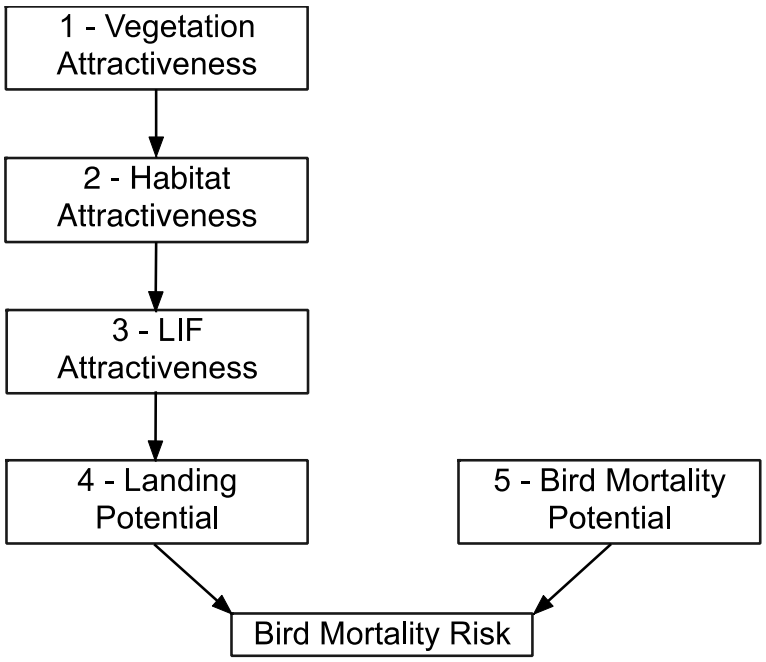

Figure 1: Oil Sands Bird Contact Monitoring Program Risk Model

LIFs included in the OSBCMP in 2015 at the five mine operations (Figure 2) are described in the operator sections (Appendices A to E).

2.3 Habitat Assessment

A habitat assessment procedure was implemented in 2015 to provide habitat data to support the interpretation of the bird survey observations. For each survey area, a habitat assessment was completed every two weeks during the spring and fall monitoring periods. A habitat assessment at each LIF in the quick scan procedure was completed in late August or early September.

2.4 Bird Survey

As in 2014, the bird survey program was conducted six days per week in each of the spring (April 16 to July 6, inclusive) and fall (July 25 to October 31, inclusive) seasons. The seventh day (the comparison day) was used for monitoring at survey stations missed during the preceding week, data quality assurance/quality control (QA/QC), and training.

Landed birds within the survey area were identified to species or guild, and counted. Personnel scanned for landed birds for a minimum of five minutes, extended as required to identify and count all landed birds, and as required to count and identify birds landing continuously and without an obvious break to a maximum duration of 30 minutes. Birds landed at the time of crew arrival were identified separately from birds landing during the survey. Bird survey data were entered into the bird survey data form (OMEI 2015b), or equivalent, and submitted electronically into the OSBCMP database.

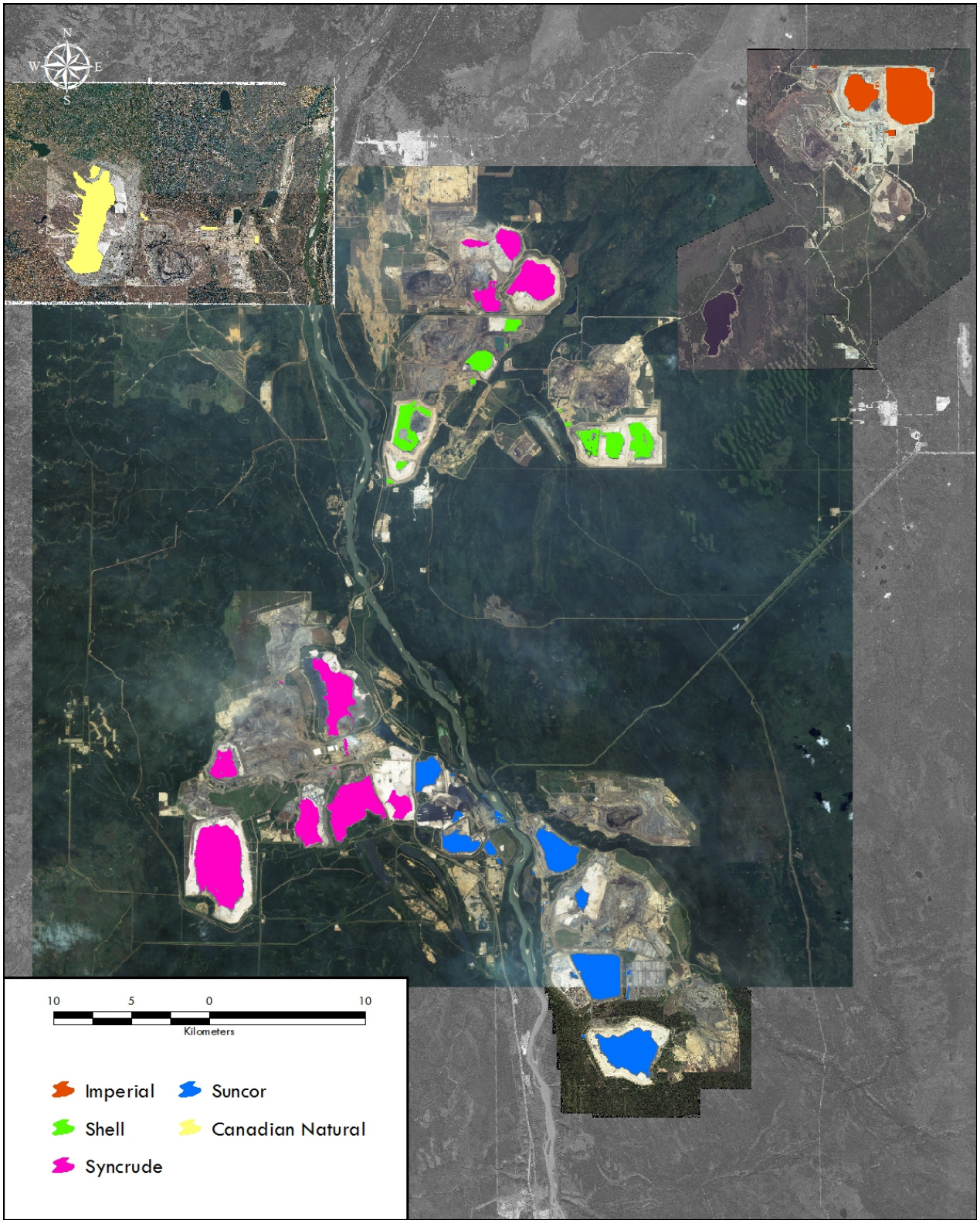

Figure 2: Operator sites and LIFs in the Oil Sands Bird Contact Monitoring Program

2.5 Mortality Search

Mortality searches were conducted from April 16 to October 31, inclusive. Three types of searches were included in the mortality search procedure: (1) transect searches, (2) fixed-radius scans, and (3) small LIF searches where scans of the entire LIF surface could be completed. Mortality search data were entered into the mortality search data form (OMEI 2015b), or equivalent, and submitted electronically into the OSBCMP database. Live and dead birds with evidence of oiling that were discovered outside of the mortality search program were recorded as incidental observations.

Based on the area over water and the amount of vegetated perimeter for each tailings facility as reported in OMEI (2015a), search effort targets for each 10-day period through the season were derived for each site. Operators had the option of conducting more of one search type and less of the other, adapting to the unique and changing conditions in each of their LIFs. Operators were free to conduct mortality searches at any other LIF, as appropriate to exercise due diligence and meet any corporate objectives or regulatory requirements associated with their operations.

To test assumptions regarding distances at which dead, oiled birds could be confidently identified, and to evaluate recovery efficiency of dead oiled birds, a Searcher Efficiency Study was conducted in August to October 2015. Three types of Dokken Deadfowl™ dog trainers (Canada Goose, Mallard, Blue-winged Teal) were deployed in habitats of the larger LIFs at each operator sites. Details of the trial are presented in OMEI (2016).

2.5.1 Transect Search

Crews could conduct transect searches as a single, focused activity, or while conducting deterrent maintenance, hazing, bird capture and other watercraft-based activities providing that distance travelled and effective search width were recorded. Shore-based transects on foot or by all-terrain vehicle (ATV) were also conducted (individually or coupled with other activities), providing that distance searched and an effective search width were recorded. On the basis of the distance travelled and the effective search width, the area searched was derived.

2.5.2 Fixed-Radius Scan

A fixed-radius scan was conducted from a single location, with the search radius defined as the maximum distance within which an oiled, dead bird could reliably be detected. Left and right boundaries (compass bearings) of the search area were determined, and from the search radius and angle between bearings, the area (ha) searched was calculated.

2.5.3 Small LIF Searches

Small LIFs that could be completely searched from one or more ground-based locations were searched completely. The area of the LIF was derived from image analysis (GIS).

2.6 Quick Scan

A subset of LIFs identified as being of low risk and excluded from the bird survey and mortality search procedures were surveyed twice weekly through the monitoring seasons using a quick scan procedure. The entire LIF (open water surface and surrounding habitats within the LIF boundary) was scanned from one or more locations.

2.7 Incidental Observations

Reporting of incidental observations was restricted to entering data on oiled birds, both live and dead, observed outside of the formal bird survey and mortality search procedures.

2.8 Data Collection and Management

2.8.1 doForms Data Forms and Database

Customized doForms data entry forms were created and loaded onto electronic tablets for collection of each of the habitat assessment, bird survey, mortality search and quick scan procedures. Data were transmitted directly from these tablets into the doForms database either immediately upon completion of a survey, or at a later time depending on cellular network coverage and on data management procedures in place at each operator site. At one site, data were entered into tablet forms equivalent to the doForms forms, downloaded into an Excel spreadsheet, and transmitted to the OSBCMP database on a nominal 2-week schedule.

2.8.2 Data QA/QC

Data were retrieved from the database on a 2-week cycle and returned to operator sites for review and correction (as required). Corrected datasets were returned to the program manager generally within 2 weeks. At the end of the monitoring program, datasets were downloaded, reviewed in their entirety by the program manager, and returned to site operators to respond to questions or comments arising from the program manager review. This process was repeated as necessary, until the data were finalized for analyses.

3.0 RESULTS AND DISCUSSION

3.1 Summary of 2015 Observations

A total of 21,161 landed bird observations were recorded (total of bird survey, mortality search, quick scan and incidental observations) in the 2015 monitoring program (Table 2). The majority of these observations (19,860, 94%) were of birds of the target guilds (dabblers, divers, waders, and gulls), the remainder representing species of non-target guilds. The OSBCMP focus on birds most likely to contact process-water in mining operation LIFs is reflected in these data.

Of the 21,161 total landed bird observations, 518 (2%) were reported as being oiled (Table 3). Of these, 77% (400 of 518) were reported as being lightly or moderately oiled, many of which could not be captured (360) as they retained sufficient mobility, including flight capability, to avoid capture. In 2015, 158 mortalities were recorded, comprising birds that were heavily or completely oiled and not recovered (presumed dead), recovered dead, or captured and euthanized (regardless of oiling level).

Table 2: Number of Landed Bird Observations at Operator Sites in the 2015 OSBCMP[1]

Operator	Guild	Landed Birds				
		Bird Survey	Quick Scan	Mortality Search	Incidental Observations	Total Landed
Canadian Natural	Target	8,069	32	20	99	8,220
	Non-target	499	5	1	3	508
Imperial	Target	4,363	823	15	62	5,263
	Non-target	595	138	2	1	736
Shell	Target	128	327	18	34	507
	Non-target	18	8	3	1	30
Suncor	Target	306	4,596	1		4,903
	Non-target	1	19	2		22
Syncrude	Target	813	110	1	43	967
	Non-target	5				5
Totals		**14,797**	**6,058**	**63**	**243**	**21,161**

Note:
[1] Blank cells indicate that no birds ("0") were observed.

Table 3: Bird Disposition and Oiling Levels Observed in all Monitoring Programs in 2015[1]

Operator	Guild	Total Oiled	Disposition and Oiling Level[2]								
			Alive, Not Recovered			Captured & Euthanized			Found Dead[3]		
			Light	Moderate	Heavy & Complete	Light	Moderate	Heavy & Complete	Light	Moderate	Heavy & Complete
Canadian Natural	Target	218	154[4]	18	5	5	17	17			3
	Non-target	2					1	1			
Imperial	Target	114	68	17	15			6		1	7
	Non-target	3			1			2			
Shell	Target	123	72	21	2	3	9	11	1	1	3
	Non-target	4			1						3
Suncor	Target	1									1
	Non-target	2									2
Syncrude	Target	51	9	1			2	9			30
	Non-target	0									
Totals		**518**	**303**	**57**	**23**	**8**	**29**	**46**	**1**	**2**	**49**

Notes:

1 Blank cells indicate that no birds (“0”) were observed.

2 Heavily oiled birds that were not recovered were presumed to have died.

3 Some birds found dead could not be recovered.

4 Includes one lightly oiled bird that was cleaned and released.

3.2 Bird Survey

3.2.1 Landed Bird Observations

A total of 14,797 birds were enumerated within delineated survey areas, across all operator sites in 2015 (Table 4). Higher numbers were observed at the Canadian Natural Horizon and Imperial Kearl mine sites, with these two sites accounting for 13,526 (91%) of bird survey observations in 2015.

Table 4: Bird Survey Observations in 2015[1]

Operator	Target Guilds						Non-target Guilds	Site Total
	Dabbles	Dives	Unknown Duck	Wades	Gulls	Total		
Canadian Natural	3,668	2,094	120	2,141	46	8,069	499	8,568
Imperial	1,267	841	52	1,989	214	4,363	595	4,958
Shell	27	60	1	30	10	128	18	146
Suncor	38	232	5	30	1	306	1	307
Syncrude	312	215	76	35	175	813	5	818
Totals	**5,312**	**3,442**	**254**	**4,225**	**446**	**13,679**	**1,118**	**14,797**

Note:
[1] Observations are not corrected for survey effort.

Bird survey observations, normalized on a per hectare basis, are presented in Table 5. A total of 10,802 bird surveys were conducted over 181 days, over survey areas totaling 265,462 ha.

Table 5: Effort-normalized Bird Survey Observations in 2015

Operator	Number of Bird Surveys	Total Area Surveyed (ha)	Total Number of Landed Birds	Birds per ha
Canadian Natural	1,395	32,802	8,568	**0.261**
Imperial Oil	767	22,174	4,958	**0.224**
Shell	1,868	52,035	146	**0.002**
Suncor	2,721	68,445	307	**0.004**
Syncrude	4,051	90,006	818	**0.009**
Total or *Average*	**10,802**	**265,462**	**14,797**	***0.056***

A peak in landed bird observations occurred in May, representing the migration of waterfowl and waterbirds into and through the region (Figure 3). Bird activity then gradually increased from mid-June to the start of the interval between monitoring seasons, with a broad second peak occurring in August. Numbers decreased through to the end of the fall monitoring season, with intermittent peaks (two in late September, one in mid-October) likely representing pulses of activity as northern flocks passed through on their southward migration.

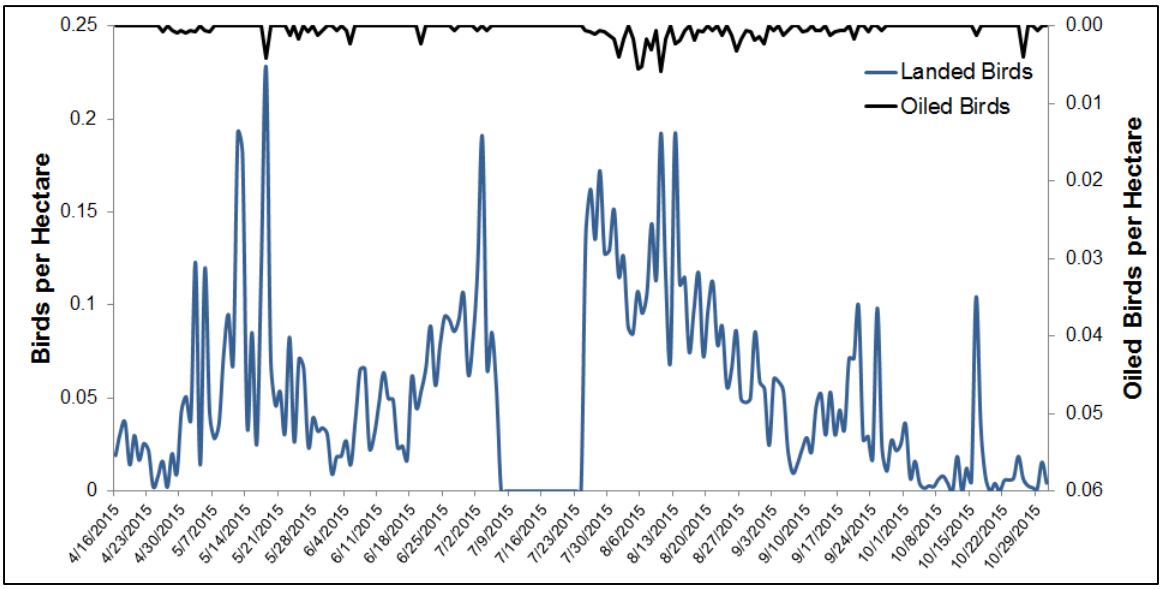

Figure 3: Number of landed and oiled birds per hectare across all mine sites and bird survey stations in 2015

Total oiled bird numbers (per ha) across all survey stations in the program is also shown in Figure 3. Some increases in observed bird numbers in May and August are reflected in the numbers of oiled birds observed during these months, however, this association is not consistent through the year. Nevertheless, the number of oiled birds as a proportion of total bird numbers was relatively low over the course of the season.

3.2.2 Migration and Residency

In 2015, landed birds were classified as being migrant (bird observed once), stopover (bird observed repeatedly over a few days) or seasonal resident (bird observed repeatedly over many days), based on their behaviour and on the judgment of observers. Observers unable to classify a landed bird entered the observation as unknown. For the evaluation that follows, birds classified as unknowns were grouped with those classified as migrants, and stopover birds were grouped with residents as both categories represent potential repeated observations. While imprecise due to the subtlety of bird behaviours that are indicative of residency (particularly early in the season) and varying levels of observer experience, these data are sufficient for a qualitative evaluation of the contribution of birds nesting and raising broods to the total numbers of bird landing observations. Landed bird observations classified as migrant/unknown and as breeding/stopover are presented in Table 6, and through the season in Figure 4.

Table 6: Observations of Landed Migrant and Seasonal Resident and Stopover Birds during Bird Surveys in 2015[1,2]

Operator	Migrant & Unknown		Resident & Stopover		Grand Total
	Target	Non-target	Target	Non-target	
Canadian Natural	6,864	406	1,205	93	8,568
Imperial	3,482	514	881	81	4,958
Shell	99	18	29		146
Suncor	306	1			307
Syncrude	375	1	438	4	818
Subtotals	*11,126*	*940*	*2,553*	*178*	**14,797**
Totals	**12,066 (82%)**		**2,731 (18%)**		

Notes:
[1] Observations are not corrected for survey effort.
[2] Blank cells indicate that no birds ("0") were observed.

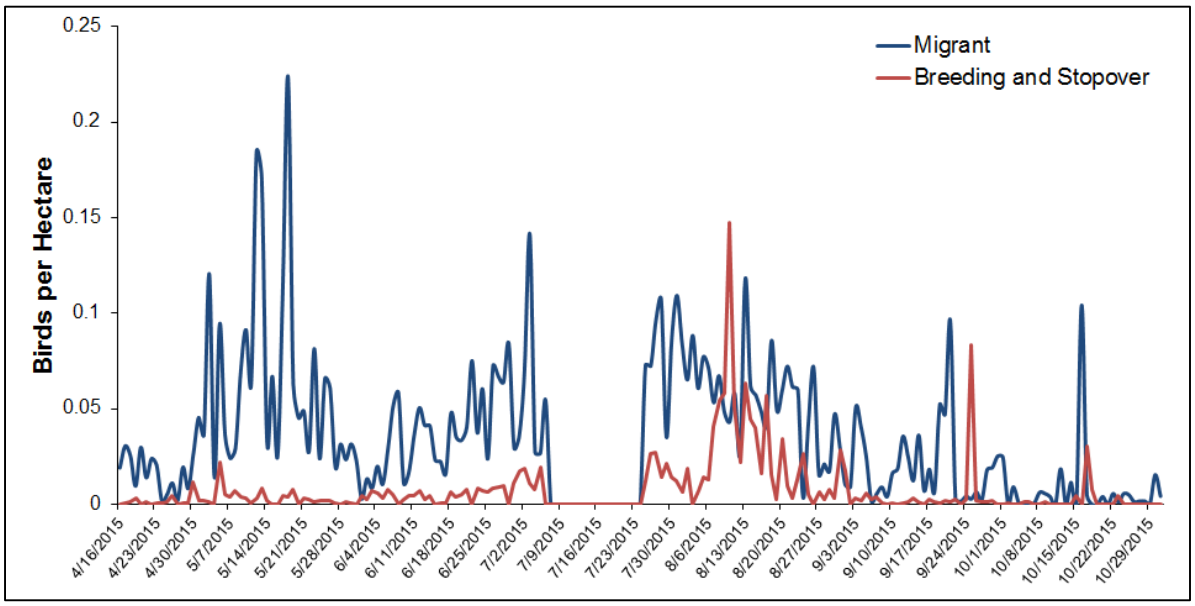

Figure 4: Migrant (including birds of unknown migrant status) and seasonal resident (breeding and stopover) bird observations during bird surveys in 2015 (across all survey stations)

Migrant and unknown landed bird observations represented 82% (12,066 of 14,797) of the landed bird observations in 2015. Birds categorized as being either resident or stopover accounted for 18% of the total observations (2,731 landed birds). For this reason, counting an observation of a landed bird is not equivalent to counting a unique individual. Over the course of the monitoring season, about 1 in every 5 observations represents a repeated observation of a bird counted on a previous day.

While classification of observed birds as migrants or residents is difficult, the proportion of observed birds classified as residents broadly reflects the number of birds residing at and around LIFs through the season. These data would be useful at the operator site level to identify

LIF habitats that attract birds for nesting and breeding, and allocate resources to the management of these habitats and/or reconfiguration of deterrent systems – an adaptive management approach.

At Syncrude, the majority (54%) of landed birds of target guilds were classified as seasonal residents. Reclamation of Syncrude's West In-pit (WIP) and surrounding terrain may be creating suitable nesting habitat, and/or habitat attractive to migrants for resting. Observations at WIP accounted for 40% of Syncrude's total landed bird observations in 2015, and of the 330 landed bird observations at the three survey stations at WIP, 195 (59%) were classified as seasonal residents. Similarly, at the Canadian Natural site, a freshwater wetland near the Dyke 10 Runoff LIF appears to provide attractive waterfowl and waterbird habitat. Of the total 8,568 landed bird observations at Canadian Natural, 2,084 (24%) were observed at this LIF, 668 of which were classified as seasonal residents. These examples demonstrate the challenge of balancing the need for minimization of the availability of attractive habitat in and around process-water LIFs with the need to progressively reclaim areas (or retain naturally occurring habitats) near active LIFs.

3.2.3 Target Guilds

The peaks in bird observations (per ha) in May were mainly observations of individuals of the diving duck guild (Figure 5). Few repeated observations were made of birds during the spring migration (Figure 4), suggesting either that the majority of divers stop at the LIFs for a brief period on their northward migration, or that the survey areas are poorly representative of habitat(s) preferred by diving duck species (whether migrant or resident).

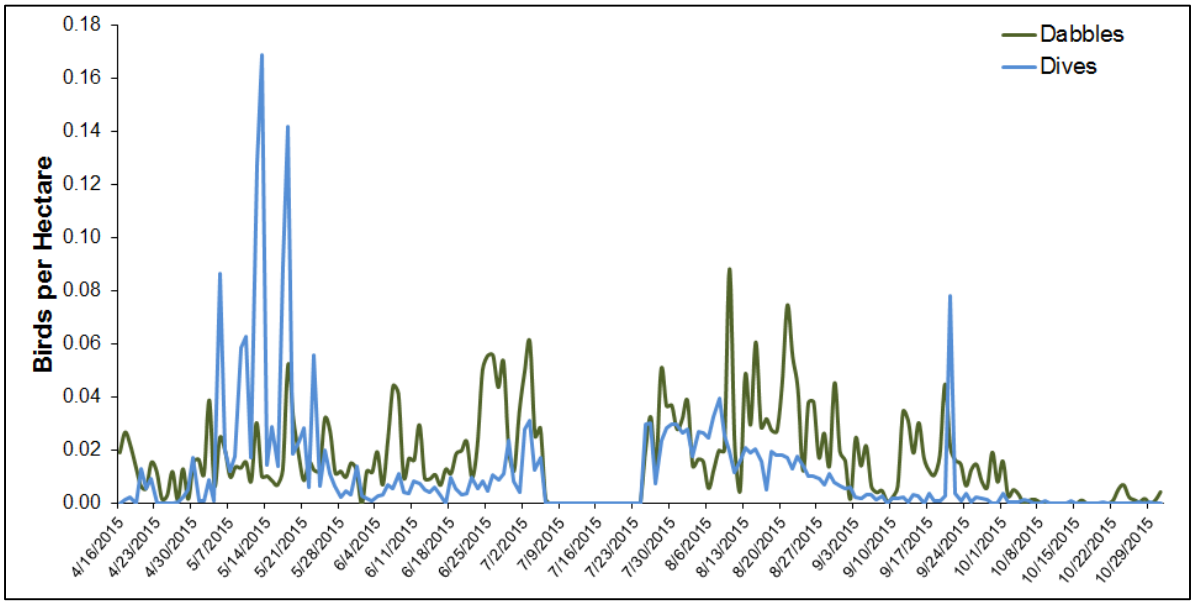

Figure 5: Number of landed dabbling and diving ducks per hectare across all mine sites and bird survey stations in 2015

Observations of landed numbers of dabbling duck and goose species did not follow a similar pattern. There was no peak in dabbler numbers observed during the spring, and a higher number of individuals of the dabbler guild were classified as resident through the year. This is not unexpected, as dabblers are more associated with perimeter habitats and shallower water than are divers. A peak in repeated observations of dabblers occurred early in August, likely due to the appearance of ducklings and goslings of birds resident within LIF habitats and/or breeding near the survey stations.

Wading bird numbers increased through June, and remained high from late July to late August (Figure 6). The fall migration of wading species generally begins in early fall, and elevated wader observations in July and August may be related to wader migration from the north. The broad peak in observed wader numbers may include both the production of young in and around the survey areas, and the presence of southward migrants.

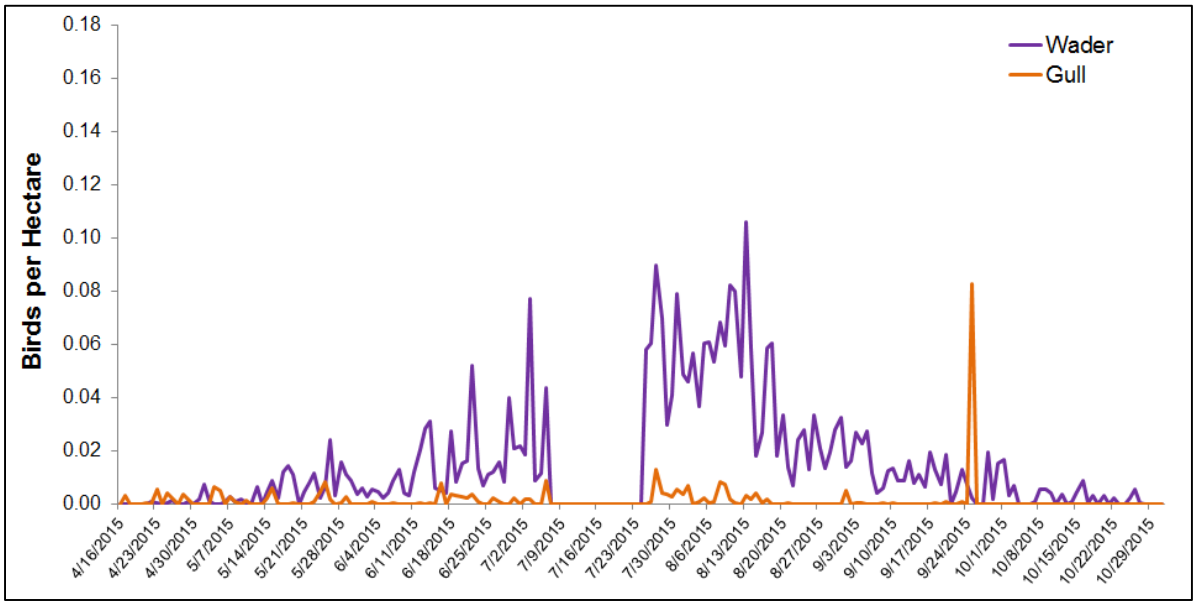

Figure 6: Number of landed wading and gull observations per hectare across all mine sites and bird survey stations in 2015

A low number of gull observations occurred through the season, except for a sharp peak on September 25 (Figure 6) resulting from the observation of 143 gulls at 45_Dump (Syncrude), a small (3.1-ha) survey area. Gulls gather and stopover in large numbers just prior to their southward migration. This was a very transient effect, with the gulls either moving out of the survey area or departing the area altogether.

3.3 Landed Bird-Habitat Associations

3.3.1 Survey Area Habitat

A primary intent of the habitat assessment component of the 2015 OSBCMP was to identify habitat types associated with higher numbers of bird landings and/or mortalities. Approximately every two weeks, the habitat composition (as percent cover) of each survey area was assessed. The frequency of assessment was based on the understanding of changes, particularly in water level and open water area coverage, within the LIFs included in the program. Survey area habitats at each site, as a mean, standard deviation and range, are presented in Table 7.

Table 7: Type and Extent (ha) of Habitats within Bird Survey Areas[1,2]

Habitat Type	Canadian Natural [11]	Imperial [9]	Shell [14]	Suncor [19]	Syncrude [29]
Open Water (OW)	18.9 ± 11.5 (1.4 - 39.1)	15.2 ± 15.2 (3.0 - 55.5)	22.73 ± 8.9 (9.5 - 45.3)	19.8 ± 10.5 (0 - 35.3)	17.5 ± 11.5 (0 - 62.2)
Bank – Vegetated (BV)	1.7 ± 1.7 (0 - 7.2)	0.3 ± 1.0 (0 - 6.2)	<0.1 ± 0.1 (0 - 0.5)	0.4 ± 0.9 (0 - 5.1)	0.7 ± 1.6 (0 - 10.7)
Emergent Vegetation (EV)	0.7 ± 0.9 (0 - 3.2)	0.6 ± 1.4 (0 - 6.7)	0	<0.1 ± 0.1 (0 - 1.5)	0.2 ± 0.9 (0 - 8.3)
Flat – Vegetated (FV)	0.3 ± 0.8 (0 - 4.1)	0.2 ± 0.9 (0 - 6.7)	0	0.3 ± 0.8 (0 - 5.1)	0.1 ± 0.6 (0 - 5.1)
Island – Vegetated (IV)	0.4 ± 0.6 (0 - 2.7)	0.1 ± 0.3 (0 - 1.7)	<0.1 ± 0.1 (0 - 1.8)	0.1 ± 0.3 (0 - 2.4)	<0.1 ± 0.2 (0 - 3.0)
Flat – Gravel/Sand/Mud (FGSM)	0.1 ± 0.3 (0 - 2.3)	8.7 ± 7.1 (0 - 20.1)	3.2 ± 3.5 (0 - 18.0)	1.8 ± 3.2 (0 - 34.2)	3.7 ± 5.6 (0 - 28.7)
Flat – Coke (FC)	0	<0.1 ± 0.4 (0 - 3.1)	0	0	0
Island – Non-vegetated (INV)	0.1 ± 0.3 (0 - 2.5)	0.5 ± 1.0 (0 - 6.7)	0.3 ± 0.6 (0 - 2.5)	<0.1 ± 0.1 (0 - 1.3)	0.2 ± 0.9 (0 - 10.1)
Bank – Non-vegetated (BNV)	1.0 ± 1.0 (0 - 4.6)	2.1 ± 3.0 (0 - 12.3)	1.0 ± 1.8 (0 - 5.2)	1.8 ± 1.8 (0 - 8.8)	2.4 ± 3.8 (0 - 22.6)
Bank – Artificial Materials (BAM)	0	0.2 ± 0.5 (0 - 1.7)	0	0.1 ± 0.3 (0 - 3.0)	0.1 ± 0.8 (0 - 13.8)
Artificial Structures (AS)	0.3 ± 0.4 (0 - 2.5)	0.5 ± 1.2 (0 - 6.2)	0.6 ± 1.0 (0 - 3.0)	0.8 ± 1.1 (0 - 6.0)	0.7 ± 1.4 (0 - 10.4)
Other	0.4 ± 0.9 (0 - 7.6)	0.1 ± 0.7 (0 - 4.9)	<0.1 ± 0.3 (0 - 5.2)	0	0.1 ± 0.7 (0 - 10.8)

Notes:

[1] The number of survey stations at each site is indicated in square brackets.

[2] The mean area ± standard deviation are indicated above the range (minimum and maximum area; in parentheses) for each habitat type within each site.

Vegetated habitats (emergent, island, flat and bank vegetation) were present in some survey areas at all sites. Open water cover and each of the other habitat types were present to some extent at each site, with a high degree of variability from survey area to area, LIF to LIF, and operator to operator.

Process-water LIFs, and tailings facilities are active systems, changing in the amount and type of fluid inputs through the year in response to operational requirements. Changes in open water coverage within survey areas can be categorized into three groups: stable, highly variable, and consistent direction of change (decrease or increase) during the period of monitoring (Figure 7).

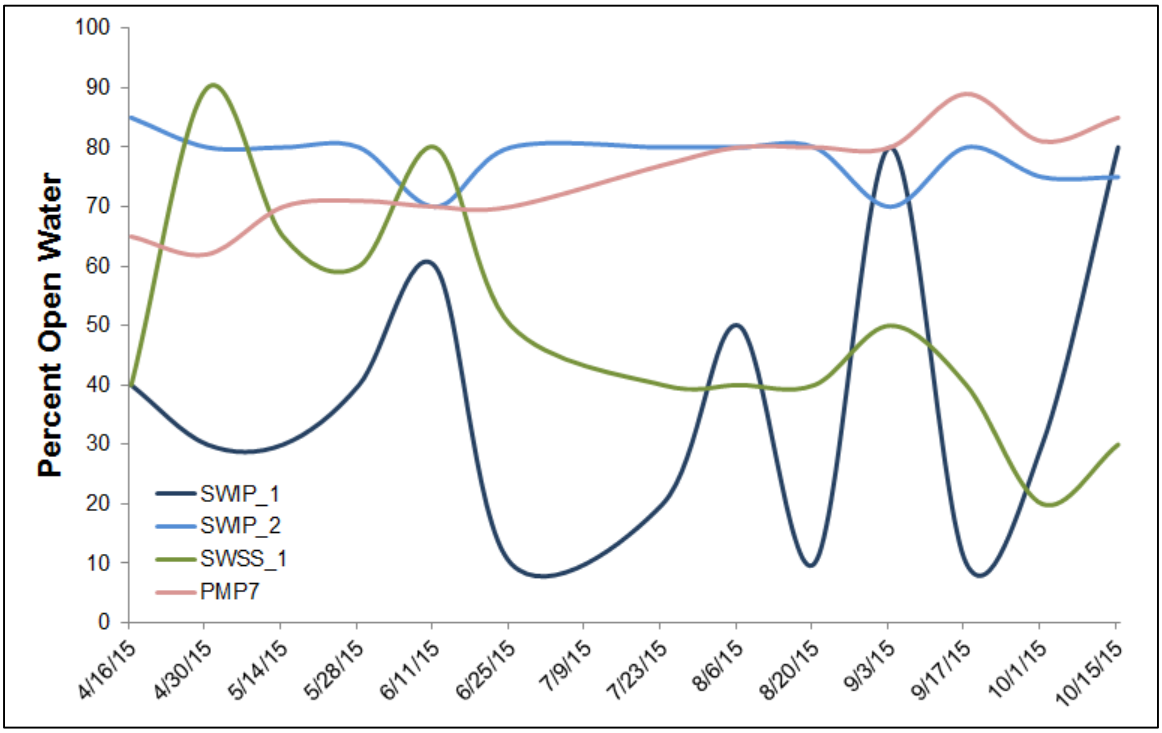

Figure 7: Open water area cover (as a percent of the survey area) at four survey stations on tailings LIFs through the 2015 OSBCMP season: SWIP_1 (highly variable), SWIP_2 (stable), SWSS_1 (consistent decrease) and PMP7 (consistent increase)

Open water cover in the SWIP_1 (Syncrude) survey area fluctuated dramatically through the season, from a low of 10% to a high of 80%, while at SWIP_2, open water cover remained relatively constant through the year, fluctuating between 70% and 85% cover within the survey area. Open water cover in the SWSS_1 survey area (Syncrude) was initially estimated to be 40% (likely underestimated as the LIF was partly frozen at this assessment) jumping to 90% in the next assessment, after which it steadily decreased through the season to a final cover of 30% of the survey area. In the PMP7 (Canadian Natural) survey area, open water cover increased relatively steadily through the year, from about 60% to 90% of the survey area. It is important to recognize that as open water cover increases or decreases, there would be a commensurate decrease or increase in one or more of other habitat types.

An observer variability of up to 20% associated with area cover assessments may be reasonably expected. As observer variability was not explicitly addressed in this program, the expected 20% contribution to the variability cannot be confirmed.

3.3.2 Bird Survey Observations and Habitat Associations

Landed bird observations, expressed as the number of observations per ha of habitat (by habitat type), are presented in Table 8 and Figure 8. As a general hypothesis based on knowledge of the habitat associations of species within the target guilds, dabblers are expected to be most associated with vegetated habitats, divers with open water, and waders with flats, primarily those composed of gravel, sand and/or mud. Gulls are habitat generalists, and would not be expected to be strongly associated with any particular habitat.

Dabbler observations, on an area-normalized basis, were highest in emergent vegetation (8.39 observations/ha), followed by the other vegetated habitats (islands, flats and banks, in decreasing order). Dabblers were observed in low numbers in open water (0.15 observations/ha) and gravel/sand/mud flats (0.07 observations/ha), again, an expected result. Observed diver numbers were also higher where emergent vegetation (0.69 observations/ha) was present, and on islands. Unexpectedly, observed diver numbers were not strongly associated with open water (0.18 observations/ha), no more so than dabblers (0.16 observations/ha). However, this may be a reflection of the study design and the inability to conduct sampling that includes adequate open water representation across the larger LIFs.

Higher numbers of waders (per ha) were observed in vegetated habitats: 1.13 observations/ha in vegetated bank to 4.88 observations/ha in vegetated island, although numbers were also proportionately higher in non-vegetated island habitat (3.01 observations/ha) than for the other guilds. Higher numbers on bank (artificial materials) and other (predominantly floating and beached logs) habitats were also observed for waders, reflecting their perching behaviour.

Gulls appear to prefer the isolation of islands, whether non-vegetated (0.86 observations/ha) or vegetated (0.36 observations/ha), and to a lesser extent, the open flat (gravel/sand/mud) habitat (0.07 observations/ha).

All guilds show a strong association with at least one of the vegetated habitats, with emergent vegetation being the strongest attractant. This indicates that vegetation removal may be an effective means of reducing the number of birds of target guilds that are attracted to mine LIFs.

The habitat definitions developed and implemented in the 2015 program appear to capture the majority of features within the LIFs at the five sites. However, habitats are not always distinct, and is recognized that individual surveyors may interpret the habitat definitions differently, resulting in variability in the habitat assessment data. It is recommended that the habitat definitions be examined and as appropriate revised in advance of the 2016 monitoring season, with consideration of elimination of the minor habitat types and broader categories be created to represent the primary habitats present.

Table 8: Landed Bird Observations by Habitat Type in 2015

Habitat Type[1]	Operator	Area Surveyed (ha)	Observations (#/ha) by Guild				Target v. Non-target		Migrant v. Resident		Overall Total
			Dabblers	Divers	Gulls	Waders	Target	Non-target	Migrant & Unknown	Resident & Stopover	
OW	Canadian Natural	2,252.2	0.63	0.84	0.01	0.13	1.62	0.00	0.95	0.38	1.63
	Imperial	1,107.3	0.91	0.69	0.04	0.18	1.87	0.00	1.36	0.49	1.87
	Shell	3,546.3	0.01	0.02	0.00	0.00	0.02	0.00	0.01	0.00	0.02
	Suncor	4,568.9	0.01	0.05	0.00	0.00	0.06	0.00	0.59	0.00	0.06
	Syncrude	5,914.6	0.04	0.04	0.00	0.00	0.09	0.00	0.04	0.39	0.09
	Total	*17,389.5*	*0.16*	*0.18*	*0.01*	*0.03*	*0.38*	*0.00*	*0.24*	*0.10*	*0.38*
BV	Canadian Natural	198.8	1.63	0.13	0.00	2.89	4.68	1.02	3.38	0.58	5.69
	Imperial	22.1	0.82	0.05	0.00	0.18	1.04	5.532	5.62	0.95	6.57
	Shell	4.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Suncor	82.0	0.02	0.00	0.00	0.11	0.13	0.00	0.13	0.00	0.13
	Syncrude	220.1	0.06	0.00	0.00	0.03	0.09	0.00	0.01	0.07	0.09
	Total	*527.2*	*0.68*	*0.05*	*0.00*	*1.13*	*1.87*	*0.61*	*1.53*	*0.29*	*2.48*
EV	Canadian Natural	78.1	18.16	1.36	0.00	1.47	21.48	0.82	17.15	1.90	22.30
	Imperial	43.7	0.27	0.25	0.02	2.33	2.88	0.00	2.06	0.71	2.88
	Shell	0.0	-	-	-	-	-	-	-	-	-
	Suncor	4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Syncrude	50.7	1.01	0.10	0.00	0.08	1.18	0.00	0.43	0.59	1.18
	Total	*176.6*	*8.39*	*0.69*	*0.01*	*1.25*	*10.55*	*0.36*	*8.22*	*1.18*	*10.91*
FV	Canadian Natural	37.6	3.35	0.51	0.00	5.31	9.35	0.74	6.19	1.62	10.10
	Imperial	13.6	2.13	0.00	0.00	0.96	3.09	0.07	1.40	1.69	3.16
	Shell	0.0	-	-	-	-	-	-	-	-	-
	Suncor	56.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Syncrude	36.3	0.66	0.00	0.00	0.08	0.75	0.00	0.66	0.08	0.75
	Total	*144.2*	*1.24*	*0.13*	*0.00*	*1.50*	*2.92*	*0.20*	*1.92*	*0.60*	*3.12*
IV	Canadian Natural	47.1	4.86	0.62	0.34	5.37	11.25	1.57	9.45	0.66	12.82
	Imperial	3.3	5.74	0.30	3.02	30.50	39.55	0.00	31.70	7.85	39.55
	Shell	1.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Suncor	12.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Syncrude	7.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	*72.5*	*3.42*	*0.41*	*0.36*	*10.14*	*9.12*	*1.02*	*7.59*	*0.79*	*4.88*

Habitat Type[1]	Operator	Area Surveyed (ha)	Observations (#/ha) by Guild				Target v. Non-target		Migrant v. Resident		Overall Total
			Dabblers	Divers	Gulls	Waders	Target	Non-target	Migrant & Unknown	Resident & Stopover	
FGSM	Canadian Natural	11.4	7.22	0.79	0.00	20.33	28.69	0.35	15.23	2.73	29.04
	Imperial	638.0	0.18	0.03	0.07	1.43	1.71	0.59	2.04	0.19	2.30
	Shell	503.1	0.00	0.00	0.01	0.05	0.06	0.02	0.03	0.01	0.08
	Suncor	408.2	0.01	0.00	0.00	0.01	0.02	0.00	0.02	0.00	0.03
	Syncrude	1,249.1	0.00	0.00	0.12	0.00	0.12	0.00	0.00	0.12	0.12
	Total	*2,809.8*	*0.07*	*0.01*	*0.07*	*0.42*	*0.57*	*0.14*	*0.53*	*0.11*	*0.71*
FC	Canadian Natural	0.0	-	-	-	-	-	-	-	-	-
	Imperial	3.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Shell	0.0	-	-	-	-	-	-	-	-	-
	Suncor	0.0	-	-	-	-	-	-	-	-	-
	Syncrude	0.0	-	-	-	-	-	-	-	-	-
	Total	*3.1*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
INV	Canadian Natural	5.6	1.25	1.07	1.07	6.45	9.85	1.43	5.73	0.54	11.29
	Imperial	33.1	1.27	1.21	3.38	12.78	18.64	0.00	17.40	1.21	18.64
	Shell	43.5	0.07	0.05	0.09	0.07	0.28	0.00	0.09	0.14	0.28
	Suncor	1.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Syncrude	69.6	0.00	0.03	0.14	0.00	0.17	0.00	0.07	0.07	0.17
	Total	*153.6*	*0.34*	*0.33*	*0.86*	*3.01*	*4.53*	*0.05*	*4.02*	*0.35*	*4.58*
BNV	Canadian Natural	113.1	0.34	0.06	0.05	2.26	2.73	0.56	1.81	0.30	3.29
	Imperial	152.6	0.10	0.00	0.00	0.21	0.31	0.59	0.44	0.46	0.90
	Shell	151.4	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.00	0.03
	Suncor	408.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Syncrude	825.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
	Total	*1,650.7*	*0.03*	*0.00*	*0.00*	*0.18*	*0.22*	*0.10*	*0.17*	*0.07*	*0.22*
BAM	Canadian Natural	0.0	-	-	-	-	-	-	-	-	-
	Imperial	16.7	0.48	0.12	0.00	12.18	12.77	0.06	6.84	5.28	12.84
	Shell	0.0	-	-	-	-	-	-	-	-	-
	Suncor	11.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Syncrude	30.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	*58.6*	*0.14*	*0.03*	*0.00*	*3.46*	*3.63*	*0.03*	*1.94*	*1.50*	*3.67*

Habitat Type[1]	Operator	Area Surveyed (ha)	Observations (#/ha) by Guild				Target v. Non-target		Migrant v. Resident		Overall Total
			Dabblers	Divers	Gulls	Waders	Target	Non-target	Migrant & Unknown	Resident & Stopover	
AS	Canadian Natural	30.0	0.00	0.00	0.00	0.03	0.03	0.83	0.80	0.03	0.87
	Imperial	34.0	0.00	0.00	0.00	0.00	0.00	0.09	0.06	0.00	0.09
	Shell	94.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Suncor	194.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Syncrude	225.8	0.02	0.00	0.01	0.00	0.03	0.00	0.00	0.03	0.03
	Total	*578.3*	*0.01*	*0.00*	*0.00*	*0.00*	*0.01*	*0.05*	*0.05*	*0.01*	*0.06*
Other[3]	Canadian Natural	51.4	0.66	0.12	0.00	3.38	4.30	0.60	3.48	0.23	4.90
	Imperial	10.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Shell	6.8	0.00	0.00	0.15	0.00	0.15	0.00	0.00	0.00	0.15
	Suncor	0.0	-	-	-	-	-	-	-	-	-
	Syncrude	21.1	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.09
	Total	*89.5*	*0.38*	*0.07*	*0.03*	*1.94*	*2.50*	*0.35*	*2.00*	*0.13*	*2.85*

Notes:
[1] See Table 7 for habitat type abbreviations.
[2] Many Common Ravens, one Northern Harrier and one American Kestrel.
[3] Habitats not defined in the 2015 Protocol.

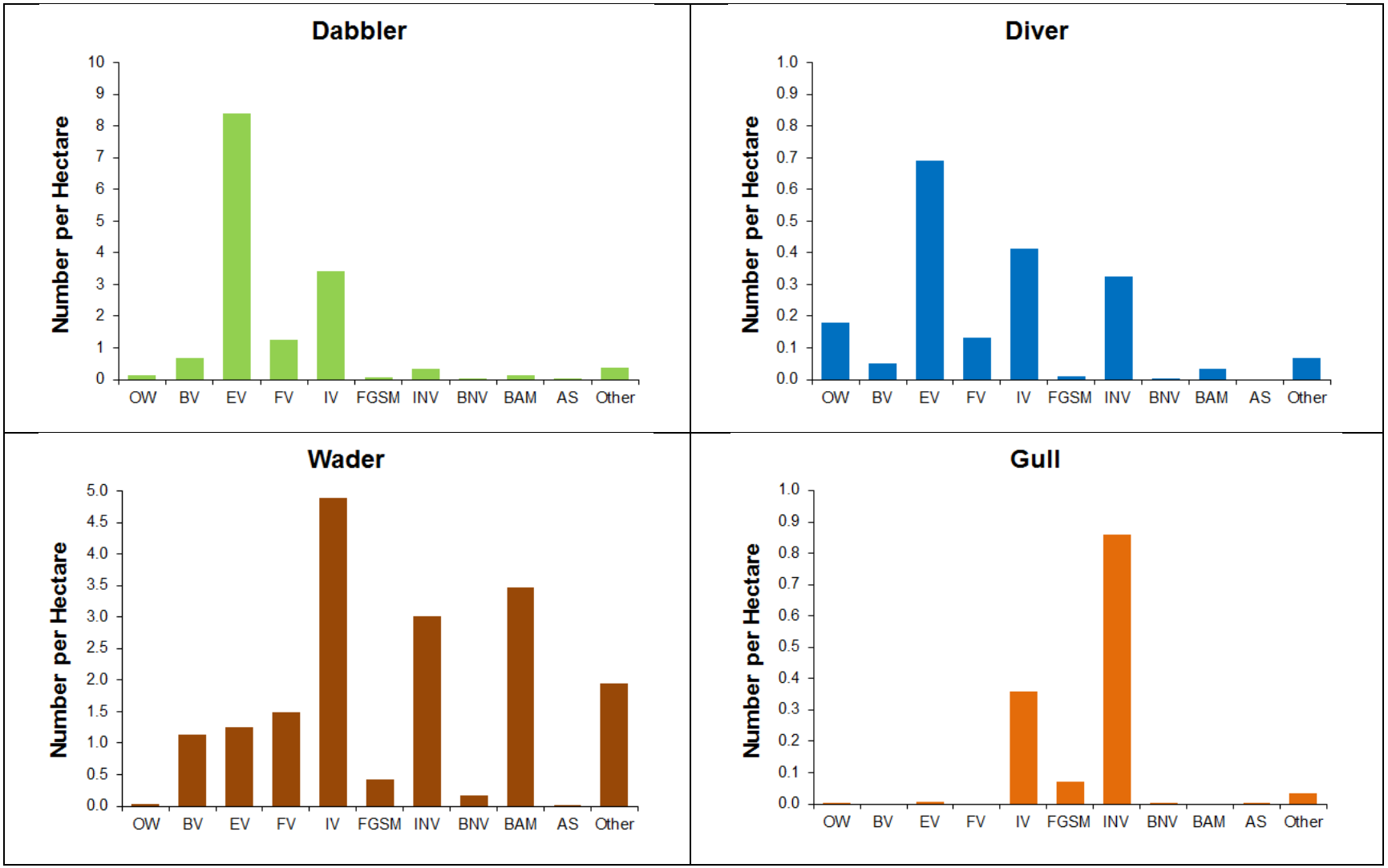

Figure 8: Target guild bird-habitat associations (bird survey data).
See Table 6 for habitat type abbreviations

3.4 Mortality Search

Mortality search bird oiling and mortality observations from each site are presented in Table 9 (data presented exclude oiled live or dead birds recorded during other surveys). Although attempts to capture oiled birds, regardless of oiling level, were made when safe to do so, many lightly and moderately oiled birds were sufficiently mobile and flight-capable so as to avoid capture. Birds that were heavily or completely oiled but not captured were presumed to have died.

Table 9: Bird Oiling Disposition of Oiled Birds Observed During Mortality Searches in the 2015 OSBCMP[1]

Operator	Total Oiled[2]	Disposition and Oiling Level								
		Alive, Not Recovered			Captured & Euthanized			Found Dead[3]		
		Light	Moderate	Heavy & Complete	Light	Moderate	Heavy & Complete	Light	Moderate	Heavy & Complete
Canadian Natural	21 (86)	51	8	4	5	18	18			3
Imperial	17 (19)	15	2	3			8		1	7
Shell	21 (22)	7	3	2	3	9	11	1	1	6
Suncor	3 (0)									3
Syncrude	1 (40)					3	8			30
Totals	**63 (167)**	**73**	**13**	**9**	**8**	**30**	**45**	**1**	**2**	**49**

Notes:
[1] Blank cells indicate that no birds ("0") were observed.
[2] Numbers in parentheses indicate oiled birds observed incidentally during mortality searches.
[3] Some birds found dead could not be recovered.

As in previous years, the number of dead, oiled birds discovered during mortality searches (15 birds) was very low in 2015 (Table 10), all of which were found on transect searches covering 75,277 ha (Table 11). Heavily and completely oiled birds, together with oiled birds of any oiling level that were captured and euthanized totaled 27, for a total of 42 mortalities associated with mortality searches in 2015. An additional 21 birds were observed as lightly or moderately oiled during transect, fixed-radius scan and small LIF searches, but these birds were too agile or flight-capable to be captured. On average, about 0.0008 oiled birds occurred per ha searched (1 oiled bird per 12 km^2). Mortalities (42 birds) occurred at a rate of about 0.0005 per ha (1 mortality per 18 km^2).

Table 10: Oiled Birds Detected during Transect, Fixed-radius Scan and Small LIF Procedures in 2015[1]

Mortality Search Procedure	Found Dead	Birds Heavily & Completely Oiled[2] and Captured & Euthanized[3]	Total Mortalities	Lightly & Moderately Oiled Live Birds[4]	Total Oiled Birds
Transect	15	27	42	17	59
Fixed-radius Scan				2	2
Small LIF				2	2
Total	**15**	**27**	**42**	**21**	**63**

Notes:
[1] Blank cells indicate that no birds ("0") were observed.
[2] Heavily and completely oiled birds that could not be recovered were presumed to have died.
[3] Captured and euthanized regardless of oiling level.
[4] Unable to capture.

Table 11: Effort-normalized Oiled Bird Detection at Operator Sites in 2015

Operator	Area Searched (ha)				Oiled Birds Detected During Mortality Searches				Oiled Birds per ha
	Transect	Fixed-radius Scan	Small LIF	Total	Transect	Fixed-radius Scan	Small LIF	Total	
Canadian Natural	6,982	30	271	7,283	21			21	0.0029
Imperial	1,821	164	299	2,284	13	2	2	17	0.0074
Shell	7,215	67		7,282	21			21	0.0029
Suncor	8,741	78	172	8,992	3			3	0.0003
Syncrude	48,698	226	512	49,436	1			1	0.0000
Total	**73,457**	**566**	**1,254**	**75,277**	**59**	**2**	**2**	**63**	**0.0008**

Notes:
[1] Blank cells indicate that no birds ("0") were observed.

By nature of the amount of area covered, and the ability to detect oiled birds, transect searches should remain the core mortality search method in the OSBCMP. Use of the fixed-radius scan and small LIF search methods at in areas in which transects cannot be conducted remains appropriate. Mortality search effort targets should be derived only for transect searches, with guidance provided on when fixed-radius scan and small LIF searches are appropriate.

3.5 Quick Scan

The purpose of the quick scan procedure was to provide data on bird landings and mortalities occurring at low risk LIFs, thereby providing data for a check on the performance of the model. Quick scan observations, on an area-normalized basis, are presented in Table 12. Through the spring and fall monitoring periods, a total of 2,866 quick scans were conducted across 59 LIFs, and 5,888 birds were observed landed.

To interpret the quick scan data in the context of whether or not the risk model performed as expected, it is necessary to convert from the units used in the 2015 risk model (landings per survey) to the units used in the 2015 program (landings per hectare). In Step 4 of the risk model, a value of 1.5 landings/survey was used as the separation between a moderate and high number of landings. Across all sites in 2015, survey areas averaged 25 ha (mode of 26 ha); using the average area together with the number of landings of target guild birds per survey (from 2014), a landing rate of 1.5 landings/survey is approximately equivalent to 0.06 landings of target guild birds/ha.

Bird observations at over half (30 of 58) of the LIFs at which quick scans were conducted exceeded 0.06 landings/ha averaged over the course of the 2015 season. Lightly to moderately oiled birds (71) were observed at 10 LIFs, all at LIFs where bird landings were equal to or greater than 0.06 landings/ha. One mortality, a bird that was oiled, was recorded during quick scans.

Table 12: Bird Landings and Oilings at Observed in the Quick Scan Component of the 2015 OSBCMP[1,2]

Operator	LIF	Area (ha)	No. Quick Scans	Bird Landings						Oiled Birds			
				Target Guild		Non-target Guild		Total		Lightly & Moderately Oiled	Heavily & Completely Oiled, Dead, or Euthanized	Total	
				No.	#/ha	No.	#/ha	No.	#/ha			No.	#/ha
Canadian Natural	Mine Dump Discharge	0.07	49		0.00		0.00		0.00			0	0.00
	OPP 4_5 East Retention	0.10	49	3	0.62	5	1.04	8	1.66			0	0.00
	OPP 4_5 Inpit Pond	0.57	49		0.00		0.00		0.00			0	0.00
	OPP 4_5 NW Retention[2]	n/a	7	-	-	-	-	-	-	-	-	-	-
	OPP 4_5 SW Retention	0.66	49	29	0.90		0.00	29	0.90	1		1	0.03
	OPP 7	0.03	49		0.00		0.00		0.00			0	0.00
	OPP 8	0.06	49		0.00		0.00		0.00			0	0.00
Imperial	KEP Extraction EDP	0.66	54		0.00		0.00		0.00			0	0.00
	KEP Froth Pond	0.88	56	10	0.20	1	0.02	11	0.22			0	0.00
	KEP Raw Water Pond	17.14	56	137	0.14	10	0.01	147	0.15			0	0.00
	KEP Stage 3 Rupture Disk	0.05	52		0.00	1	0.37	1	0.37			0	0.00
	KEP Stage 4/5 Rupture Disk	0.08	55	2	0.46		0.00	2	0.46			0	0.00
	KID Raw Water Pond	1.95	54	10	0.10	22	0.21	32	0.30			0	0.00
	NODA Runoff Pond	4.26	56	96	0.40	2	0.01	98	0.41	2		2	0.01
	OPP2 Crusher Sump	0.34	54		0.00		0.00		0.00			0	0.00
	OPP2 Drainage Pond	2.22	55	12	0.10		0.00	12	0.10	1		1	0.01
	OPP2 EDP	0.24	56		0.00		0.00		0.00			0	0.00
	Pond 4	1.75	58	9	0.90	2	0.02	11	0.11			0	0.00
	Pond 6	0.57	56		0.00		0.00		0.00			0	0.00
	Pond 7	2.77	56	84	0.54	9	0.06	93	0.60	3		3	0.02
	West ETA Debris Dyke	6.70	54	62	0.17	26	0.07	88	0.24	2		2	0.01
	West ETA Drainage 1A	1.01	58	21	0.36	4	0.07	25	0.43	1		1	0.02
	West ETA Drainage 2	1.66	56	380	4.09	61	0.66	441	4.75	8		8	0.09
Shell	JPM South Extraction	2.12	49	48	0.46	5	0.05	53	0.51	6		6	0.06
	Pond 1	2.15	48	20	0.19		0.00	20	0.19			0	0.00
	Sedimentation1	8.01	49	255	0.65	2	0.01	257	0.66	45	1	46	0.12
	Seepage Collection	8.34	46	4	0.01	1	0.00	5	0.01			0	0.00
Suncor	Cooling Water Pond	2.74	48	88	0.67		0.00	88	0.67			0	0.00
	Upper Wood Creek	0.82	48	2	0.05		0.00	2	0.05			0	0.00
	System 4	1.16	48		0.00		0.00		0.00			0	0.00
	System 5	0.57	47		0.00		0.00		0.00			0	0.00

Operator	LIF	Area (ha)	No. Quick Scans	Bird Landings						Oiled Birds			
				Target Guild		Non-target Guild		Total		Lightly & Moderately Oiled	Heavily & Completely Oiled, Dead, or Euthanized	Total	
				No.	#/ha	No.	#/ha	No.	#/ha			No.	#/ha
Suncor (cont'd)	System 8	6.77	48	20	0.06		0.00	20	0.06			0	0.00
	System 7 (New)	2.16	42	1,313	14.47	1	0.01	1,314	14.48			0	0.00
	System 7 (Old)	4.34	47	7	0.03	1	0.01	8	0.04			0	0.00
	EDP-7	0.59	48	2,620	92.51	4	0.14	2,624	92.66			0	0.00
	Extraction Decant E	0.57	46		0.00		0.00		0.00			0	0.00
	Extraction Emergency W	1.57	47	223	3.02	1	0.01	224	3.04			0	0.00
	(Weir #10	2.05	49	3	0.03		0.00	3	0.03			0	0.00
	Mine North Gate Sump	2.91	48		0.00		0.00		0.00			0	0.00
	PAW Pond	3.91	49		0.00		0.00		0.00			0	0.00
	Pond 4 G	8.62	48		0.00		0.00		0.00			0	0.00
	Pond 4 G2	16.86	48	1	0.00		0.00	1	0.00			0	0.00
	Pond A	1.23	50	4	0.07		0.00	4	0.07			0	0.00
	Pond A East	1.10	48	40	0.76		0.00	40	0.76			0	0.00
	Pond B	2.73	46	9	0.07		0.00	9	0.07			0	0.00
	Pond C	0.41	49		0.00		0.00		0.00			0	0.00
	Pond D	8.37	50		0.00		0.00		0.00			0	0.00
	Pond E	3.28	50		0.00		0.00		0.00			0	0.00
	Pond F	2.17	49	8	0.08		0.00	8	0.08			0	0.00
	Weir #1	5.71	49	43	0.15		0.00	43	0.15			0	0.00
	South Triangle Pond	3.92	49	215	1.12	12	0.06	227	1.18			0	0.00
Syncrude	4-84 (Fusion Yard)	0.80	44	53	1.51		0.00	53	1.51			0	0.00
	7-01 (FFT)	1.59	40	2	0.03		0.00	2	0.03			0	0.00
	7-02 (FFT)	0.31	42	51	3.94		0.00	51	3.94	2		2	0.15
	AN Emergency Dump	1.27	40		0.00		0.00		0.00			0	0.00
	ASB Seepage Sump MR	0.67	40		0.00		0.00		0.00			0	0.00
	Bechtel Sump	0.58	43		0.00		0.00		0.00			0	0.00
	MH-4 (BMD)	0.68	43	2	0.07		0.00	2	0.07			0	0.00
	PWCS	1.79	44	2	0.03		0.00	2	0.03			0	0.00
Total or *Average*		**156.6**	**2,866**	**5,888**	***2.17***	**170**	***0.05***	**6,058**	***2.26***	**71**	**1**	**72**	***0.01***

Notes:
[1] Blank cells indicate that no birds ("0") were observed.
[2] Orange shading indicates target guild observations of ≥0.06 birds/ha.

The habitats, by area, available across the LIFs included in the quick scan component are presented in Table 13. There are no apparent differences in habitat between the LIFs at which ≥0.06/ha landings of target guild species were observed and the LIFs with <0.06 landings/ha.

Table 13: Habitat Availability in LIFs included in the Quick Scan Component[1,2]

LIF Habitat Type	Target Guild Landings ≥0.06/ha [30 LIFs]		Target Guild Landings <0.06/ha [28 LIFs]	
	Mean	Range	Mean	Range
Total LIF Area (ha) and by habitat type:	2.9	0.1 - 17.1	2.5	<0.1 - 16.9
Open Water	2.1	0 - 15.4	1.7	0 - 9.3
Emergent Vegetation	<0.1	0 - 0.2	<0.1	0 - 0.5
Bank (Vegetated)	0.1	0 - 1.0	0.1	0 - 0.6
Island (Vegetated)	<0.1	0 - 0.6	0	-
Island (Non-vegetated)	0	-	<0.1	0 - 0.2
Flat (Vegetated)	0	-	<0.1	0 - 0.2
Flat (Gravel/Sand/Mud)	0.1	0 - 1.4	0.3	0 - 5.9
Flat (Coke)	0	-	<0.1	0 - 1.1
Bank (Non-Vegetated)	0.2	0 - 1.7	0.2	0 - 1.7
Bank (Artificial Materials)	0.1	0 - 0.9	<0.1	0 - 0.5
Artificial Structures	0.1	0 - 0.3	<0.1	0 - 0.2
Other	0	-	0.1	0 - <0.1

Notes:
[1] Based on habitat assessments completed in August and September 2015.
[2] The OPP 4_5 NW Retention (Canadian Natural) LIF was decommissioned prior to the completion of the habitat assessments, and data from this LIF are excluded from this table.

3.6 Bird Disposition and Oiling Level

Many lightly and moderately oiled birds remain flight-capable or otherwise agile to avoid capture and euthanization. Of the total 518 birds observed oiled across all monitoring procedures at all sites, 357 (69%) lightly and moderately oiled birds could not be captured (Table 14). If bitumen is not ingested, and the location and pattern of oiling on the body, depth of oil penetration, and timing of oiling does not seriously compromise thermoregulation or buoyancy, and feathers are moulted reasonably soon after oiling, it is possible that the bitumen exposure would not be lethal.

Table 14: Bird Disposition and Oiling Levels Across All OSBCMP Procedures in 2015

Disposition	Oiling Level				Total
	Light	Moderate	Heavy	Complete	
Not Captured or Recovered	303	55	14	11	383
Captured & Euthanized	8	30	6	39	83
Dead at Time of Observation & Recovered	1	2	4	45	52
Totals	**312**	**87**	**24**	**95**	**518**

With 69% of the oiled birds possibly falling into this category, opportunities for bird treatment and release appear to be available.

3.7 Species of Conservation Concern

Thirteen species listed as Sensitive in Alberta were observed during the 2015 OSBCMP (Table 15). The Rusty Blackbird is also designated as a species of Special Concern under the Canadian *Species at Risk Act*.

Table 15: Species of Conservation Concern Observed during Bird Surveys, Mortality Searches and Quick Scans, and as Incidental Observations[1]

Guild	Species	Totals		Disposition and Oiling Level							
				Not Recovered			Captured & Euthanized			Found Dead[4]	
		Landed[2]	Oiled[3]	Light	Moderate	Heavy & Complete	Light	Moderate	Heavy & Complete	Moderate	Heavy & Complete
Dabbler	American Green-winged Teal	1,286	14	10	2			1		1	
	Northern Pintail	279	2		2						
Diver	American White Pelican	1	1		1						
	Horned Grebe	98	5	1				2	2		
	Pied-billed Grebe	3	1				1				
	Lesser Scaup	485	20	18	1	1					
	White-winged Scoter	1	0								
Wader	Great Blue Heron	31	31						1		30
	Sandhill Crane	28	3		3						
Non-target	American Kestrel	6	0								
	Barn Swallow	56	1						1		
	Rusty Blackbird	2	0								
	Sharp-tailed Grouse	4	0								
	Northern Harrier	1	0								
Totals		**2,281**	**78**	**29**	**9**	**1**	**1**	**3**	**4**	**1**	**30**

Notes:
1 Blank cells indicate that no birds (“0”) were observed.
2 Total landed birds observed during bird surveys and quick scans.
3 Oiled birds include birds observed oiled during bird surveys, mortality searches, and quick scans; oiled bird numbers are included in the Landed Bird totals.
4 Some birds found dead could not be recovered.

During bird surveys and quick scans, 2,281 individuals of species of conservation concern were observed landed within the LIFs. Target guild species of conservation concern represented 97% of the total number of observed landings of species of concern, with American Green-winged Teal, Northern Pintail and Lesser Scaup, two dabblers and a diver, dominating the observations (89%).

3.8 Year-to-Year Comparisons

The bird survey observations and oiled bird/mortality observations from 2013, 2014 and 2015 are presented in Table 16. Landed bird observation data are presented in terms of landed bird numbers per survey and per hectare (estimated using the 2015 average survey area size of 25 ha).

Table 16: Comparison of 2013, 2014, and 2015 Bird Survey Observations of Landed Birds, and Oiling and Mortality Observations

Year	Site	Landed Bird Observations[1]			Oilings & Mortalities		
		Total	Per ha[2]	Per Survey	Lightly & Moderately Oiled[3]	Presumed[4] or Recovered Dead & Euthanized	Total
2013	Canadian Natural	7,551	0.044	1.10	n/a		24
	Imperial	5,258	0.046	1.15			27
	Shell	212	0.004	0.11			23
	Suncor	3,340	0.025	0.63			36
	Syncrude	1,800	0.015	0.38			47
	Total or *Average*	18,161	*0.031*	*0.78*			157
2014	Canadian Natural	6,945	0.075	1.88	138	31	169
	Imperial	2,067	0.038	0.96	119	43	162
	Shell	2,062	0.052	1.29	114	33	147
	Suncor	5,439	0.057	1.42	1	19	20
	Syncrude	2,052	0.023	0.59	59	47	106
	Total or *Average*	18,565	*0.050*	*1.26*	431	173	604
2015	Canadian Natural	8,568	0.261	6.14	172	48	220
	Imperial	4,958	0.224	6.46	85	32	117
	Shell	146	0.002	0.08	93	34	127
	Suncor	307	0.004	0.11	0	3	3
	Syncrude	818	0.009	0.20	10	41	51
	Total or *Average*	14,797	*0.056*	*1.37*	360	158	518

Notes:
1 Data from freshwater ponds (2013, 2014) are excluded.
2 Landed birds/ha are estimated for 2013 and 2014 using an assumed 25-ha average survey area.
3 Total of lightly and moderately oiled birds that could not be captured.
4 Included all birds heavily and completely oiled that could not be recovered but were presumed to have died, together with all birds of all oiling levels that were captured and euthanized.

There is a trend of increasing numbers of landed bird observations from 2013 to 2015, both on a per survey (from 0.78 in 2013 to 1.37 in 2015) and per hectare (0.031 to 0.056) basis. Protocol revisions and adaptations at the sites contribute to this trend, although it is not possible to estimate the magnitude of this contribution. The number and types of LIFs monitored in 2014 differed from those in 2013, including reduction of monitoring effort at smaller LIFs where fewer bird landings had typically been observed. Application of the inclusion and exclusion criteria and the risk model in 2015 focused the monitoring effort on locations with more attractive habitat, with greater numbers of landed bird observations than in previous years, and with greater risk

(bitumen presence) to birds. Also in 2015, removal of the quadrant requirement for the distribution of survey stations around tailings facilities resulted in some reconfiguration of survey stations around these larger LIFs to focus effort on areas with higher numbers of landed birds. These protocol revisions would each have the effect of elevating the numbers of birds observed per survey and per hectare. Therefore, the increase in landed bird observations at least in part is a consequence of the annual changes in the protocol.

Mortality observations (including those observed incidentally) were relatively consistent from year to year: 157 in 2013, 173 in 2014, and 158 in 2015. Total oiled bird observations decreased from 2014 (604) to 2015 (518). The increased emphasis in 2015 on identification of oiled birds during effort-based mortality search programs did not result in a commensurate increase in the detection of oiled birds during effort-based mortality searches, or a decrease in the number of oiled birds observed incidentally across the monitoring procedures. Of the 518 oiled birds reported across the five sites in 2015, 456 (88%) were recorded as incidental observations.

The number of birds (per ha) in 2015 was 10-fold or more higher at Canadian Natural Horizon and Imperial Kearl than at Shell, Suncor or Syncrude. A similar pattern was observed in 2013, although in 2014, landed bird observations on a per survey or hectare basis at Shell and Suncor were also elevated relative to those at Syncrude. Migration, stopover and residency are stochastic processes, predictable at broad levels but random or chaotic at site-specific, species-specific and yearly levels. However, the relatively consistent pattern of higher observed bird landings at two sites relative to the others may indicate that birds are choosing where to land on the basis of factors not incorporated into the monitoring program. As discussed above, these considerations are complicated by non-representative sampling, protocol changes across years, and changes in survey station locations from year-to-year within each of the sites.

3.9 Deterrent effectiveness

Deterrent activation and disturbances in and proximal (e.g., hazing, traffic) to the survey areas were noted during the bird surveys. Each habitat assessment included identification of the type and number of deterrents visible from the survey station. The purpose of including deterrent information in these procedures was to provide data upon which to conduct an initial exploration of potential effects of deterrents on observed bird landing numbers.

The types and number of deterrents recorded in the habitat assessments at each of the five sites are shown in Table 17. A wide range of deterrent types was deployed across the sites, with the predominant type varying by site and by LIF. Different deterrent types and numbers among sites may reflect different deterrent selection processes and decisions, or simply be an artifact of the selection of survey station locations, as no effort was made to sample deterrent deployment in a statistical manner.

Table 17: Deterrent Types and Numbers Recorded During Habitat Assessments in the OSBCMP in 2015[1]

Deterrent Type	Canadian Natural [11]	Imperial [9]	Shell [14]	Suncor [19]	Syncrude [29]
Human Effigy	10.0 ± 9.5 (1 - 53)	4.0 ± 2.4 (1 - 9)	1.0 ± 0 (1 - 1)	5.0 ± 3.9 (1 - 15)	3.8 ± 4.7 (1 - 26)
Cannon	11.7 ± 8.5 (3 - 51)	3.34 ± 1.6 (1 - 8)	1.20 ± 0.6 (1 - 4)	1.9 ± 1.6 (1 - 10)	2.4 ± 2.8 (1 - 23)
Acoustic Hailing Device	6.2 ± 2.8 (1 - 11)	1.50 ± 1.1 (1 - 5)	1.5 ± 0.5 (1 - 2)	1.0 ± 0 (1 - 1)	1.4 ± 1.0 (1 - 6)
Combinations[3]	6.44 ± 2.2 (2 - 11)	3.3 ± 1.8 (1 - 8)	1.92 ± 1.3 (1 - 8)	0	4.1 ± 3.6 (1 - 18)

Notes:
[1] Number is square brackets is the number of survey stations at each site.
[2] Data for each deterrent type are presented as the mean ± standard deviation above the range (in parentheses) for each site.
[3] Combination deterrents are defined as a deterrent system that includes two or more stimuli, regardless of stimulus types.

Deterrent numbers across the 2015 program were highly variable; this variability is illustrated by the number of human effigies (10 ± 9.5, range 1 to 53) and cannons (11.7 ± 8.5, range 3 to 51) recorded at Canadian Natural, and cannons (2.4 ± 2.8, range 1 to 23) and combination systems (4.1 ± 3.6, range 1 to 18) recorded at Syncrude. Reduced visibility during some habitat assessments also introduced variability, as compromised visibility (e.g., fog, forest fire smoke) was noted in some records as affecting the area and deterrents visible to observers.

Although deterrent data were collected with the intent of conducting preliminary analyses of effectiveness of deterrents within the survey areas, the substantial variation among sites in the deterrent types (singly and in combination) negated any opportunity to conduct a statistical exploration of the data. Changes to the protocol to attempt to reduce variability in the data, and/or to collect more information on deterrent systems and deterrent activation before and during a bird survey are not recommended. Properly constructed studies would be required to elucidate the efficacy of the various deterrent types, and how they are operated, on the birds interacting with the LIF habitats.

3.10 Searcher Efficiency Study

It is recognized that there is a limit to the distance at which a dead, oiled bird can be confidently identified, which for the 2015 program was assumed to be 50 m in a boat transect search or 100 m in a fixed-radius scan. Empirical data that support these assumptions have been lacking.

Using Dokken Deadfowl™ dog trainers[1] as surrogates of dead birds, a searcher efficiency study designed to answer the following questions was conducted:

1. What is the percent recovery of bird carcasses as represented by Blue-winged Teal, Mallard and Canada Goose replicas (Dokken Deadfowl™ trainers) as surrogates for dead, oiled birds?

[1] http://www.deadfowltrainer.com/

2. How many days are required to recover a known number of bird carcasses (rate of recovery)?
3. What is the distance to a bird carcass at which the carcass is first definitively identified, and how is this influenced by habitat?
4. How does search effort influence recovery of bird carcasses?

Two trials were conducted from August through October 2015 at each of the five mine sites. Details of the study and the results obtained are described in detail in OMEI (2016).

Trainer recovery was approximately 70%. Loss of trainers resulted from drift, scavenging (in one instance), and possibly sinking. Recovery of the smaller Blue-winged Teal trainer was less than that for each of the Mallard and Canada Goose trainers, an expected result. The true recovery of dead birds may be higher or lower than 70%, the magnitude of which would depend on the ability of the trainers to behave in a manner analogous to dead waterfowl. Most trainers were discovered within the first six days after deployment. This suggests that the maximum 10-day interval between mortality searches currently specified in the protocol is reasonable.

Given the distance at which trainers were observed, a watercraft transect search width of 50 m (25 m on each side of the boat) is appropriate. Transect searches on foot through vegetated habitat will remain limited to a narrower transect width, the actual width being dependent on vegetation density and complexity of the habitat. Few trainers were detected using the fixed-radius scan procedure (1%), due primarily to limitations associated with trainer deployment in areas searched using this method, and the small area that can be searched using this method.

4.0 EVALUATION OF THE LIF INCLUSION/EXCLUSION CRITERIA & RISK MODEL

The inclusion and exclusion criteria and the risk model were used to identify LIFs having a high risk to birds (in terms of oiling and mortality). These criteria and the model appear to have performed reasonably well in 2015. LIFs excluded from monitoring but at which higher than expected landed bird observations and/or oiled bird observations were recorded in 2015 will be re-assessed using the updated dataset, with the risk rating of many of these LIFs being revised as a result. This is the intended process, and without major justification for criteria and/or model revision, it is recommended that no major changes be made prior to initiation of the 2016 monitoring program.

4.1 Liquid Impoundment Facility (Tailings Facilities) Inclusion Criteria

Tailings facilities were the original target of the monitoring program, which arose as an outcome of the bird landing events in 2008 and 2010. The size of the tailings facilities and their contents (including bitumen) continues to justify the inclusion of these facilities in the OSBCMP monitoring programs.

4.2 Liquid Impoundment Facility Exclusion Criteria

In 2014, a set of criteria was derived to identify LIFs at which a lesser monitoring effort was to be applied (St. Clair et al. 2014), including a size criterion (1.5 ha) that reduced monitoring effort at small LIFs. This size criterion was retained in 2015, however, LIFs of 1.5 ha and smaller that also met the other four criteria were identified as being of low risk and could be excluded from monitoring in 2015 (Section 2.1.2). No revision of these criteria is recommended at this time.

4.3 Risk Model

In general, the risk model performed reasonably well in defining bird oiling risk associated with the LIFs, in 2015. While some data obtained in 2015 may support minor modifications in one or more steps in the model, the inter-annual variation in bird landings within and among operator sites suggests that retention of the current configuration of the model for another monitoring year would be beneficial. On the strength of data acquired over two years using a relatively unchanged protocol, a detailed examination of the individual elements and matrices in the model may be undertaken following the 2016 program year.

In 2015, observed landed bird numbers at some low risk LIFs that were in proximity to natural or reclaimed vegetated habitats (particularly wetlands) were sometimes higher than would be expected on the basis of the application of the risk model. Incorporation of this external influence into the risk model would be difficult due to the wide range of characteristics associated with these external influences. Should a LIF defined as being of low risk by application of the risk model be situated near a habitat reasonably be expected to influence bird numbers and/or bird oiling on the LIF, inclusion of this low-risk LIF in the quick scan procedure would be appropriate. These data would then be useful in the following year in better defining the bird mortality risk associated with the LIF.

5.0 RECOMMENDATIONS

The procedures applied in 2015 are in general judged to be appropriate, and only minor modifications to the protocol are recommended below. Changes to the protocol as a result of these recommendations would not affect the ability to compare landed bird observations, bird oiling numbers, or oiled bird mortalities across years.

5.1 Habitat Definitions

For simplification and to reduce the difficulties in discerning between habitats of generally similar composition, grouping habitats of similar types (e.g., vegetated bank and vegetated flat) should be considered. Habitats of very low coverage across the regional program, may be appropriately grouped into a single “other” category.

Opportunities for field personnel to provide comments via the tablet data entry forms should continue to be made available, as these often provide insight into habitat elements that are not appropriately defined as a discrete habitat type. This includes a mechanism for noting the presence of woody debris, which may appear in any habitat type, as floating or beached logs.

5.2 Habitat Assessment

Retention of the habitat assessment procedure, applied every two weeks at each LIF in the bird survey is recommended for 2016. Expansion of the habitat assessment procedure to include the LIFs within the quick scan monitoring component should be considered, although at a lesser frequency than for assessments of bird survey areas.

Collection of deterrent information within the habitat assessment procedure should be discontinued entirely. Deterrent types, deployment strategies, and operation vary widely across LIFs within a site and among sites, negating the ability to properly evaluate deterrent effectiveness based on data collected from the bird survey stations. Any further deterrent evaluations should be conducted as separate studies, outside of the formal monitoring procedures in the OSBCMP.

5.3 Bird Survey

5.3.1 Bird Survey Duration

An analysis of the 2014 data indicated that 85 to 90% of the birds observed during a survey were either landed at the time of arrival of the survey crew or landed within the first 5 minutes of the survey (OMEI 2015a). For this reason, the bird survey duration in 2015 was changed to a minimum 5-minute period, extended as required to count and identify landed birds or if birds were continuously landing in the survey area, to a maximum of 30 minutes.

Of the 14,797 landed birds observed during bird surveys, 13,899 (94%) were recorded as being landed at the start of the survey, with the remaining 898 (6%) of observed landed birds arriving during the survey. Crews spent an average of 13.4 minutes conducting surveys that included landed birds, and 18.3 minutes for surveys where no birds were present. It is unclear why surveys took longer in the absence of birds, however, both averages indicate that personnel were taking the time necessary to thoroughly scan the survey area, and identify and count landed birds. While a minimum survey duration does not appear to be necessary, it is recommended that the 5-minute minimum survey period be retained, emphasizing the importance of taking the time necessary to fully scan the survey area for landed birds.

5.3.2 Bird Survey Sampling Interval

Bird surveys were conducted six times per week, with attempts to complete missed surveys being made on the seventh day, the comparison day. In 2015, Shell and Imperial selected Wednesday as their comparison day, while Syncrude, Suncor and Canadian Natural chose Monday. This selection allowed for training and coordination meetings to be held on Mondays and Wednesdays. Monitoring activities did not completely cease on any comparison day, as at least two sites were actively monitoring. The concept of the comparison day embodies an understanding that monitoring need not occur every day of the week, which raises a question about the frequency of monitoring that would provide data that is sufficient to understand the numbers of bird landings on site LIFs, and whether these numbers are changing from year to year.

The data from the 2015 bird surveys, normalized on an area basis, were used to determine if a less labour-intensive program would provide data of a quality and quantity sufficient in terms of meeting program objectives. Data were extracted from the 2015 bird survey dataset to represent a sampling program of monitoring once per week (data collected on Fridays), twice per week (Tuesdays and Fridays), three times per week (Tuesdays, Thursdays and Saturdays), and four times per week (Tuesdays, Thursdays, Fridays and Saturdays), and plotted together with the data from the current 6-day per week monitoring schedule (Figure 9). Data collected on Mondays and Wednesdays (comparison days) were explicitly excluded, since data from these days would represent monitoring at only two or three of the sites, introducing a potential bias.

Monitoring frequencies of once per week (represented by data collected on Fridays) up to and including four times per week (represented by data collected on Tuesdays, Fridays, Saturdays and Sundays) all generally capture the general pattern of bird landings during the spring and fall migrations, with more frequent monitoring better capturing shorter-term, sharper peaks. Given that these approximations of reduced bird survey effort capture the general pattern of bird landings, efficiency in monitoring without significant loss of information may be gained by decreasing the frequency of bird surveys.

Decreasing monitoring frequency may raise a concern regarding detection of landing and oiling events, specifically, whether reduced frequency would cause a landing event to be missed. Experience in the program, and regionally prior to the initiation of the OSBCMP, suggests that landing events occur during specific weather conditions, and that these conditions themselves alert site personnel to the possibility of a landing event. Other activities on site, particularly those related to deterrent operation and maintenance, are positioned better than is the bird survey program to detect an unusually large number of landed birds.

5.4 Mortality Search

Retention of the current transect search procedure is recommended for the 2016 program. The method to derive target transect search distances, using a 50-m effective search width for boat-based transects, remains appropriate for the 2016 season.

While the fixed-radius scan and small LIF search procedures were less effective in detecting dead, oiled birds, these procedures should be retained in the 2016 protocol. However, they should be applied only where transect searches are not possible. Selection of the appropriate method would be dependent on the type and configuration of the LIF being searched.

5.5 Quick Scan

The majority of the birds observed landed during quick scans were at a few LIFs, suggesting that one or more characteristics of these LIFs were poorly understood, or factors external to the LIFs (e.g., a nearby natural wetland) are driving bird observations. Data obtained using the quick scan procedure in 2015 become inputs into the risk model in the evaluation of bird oiling risk associated with these LIFs.

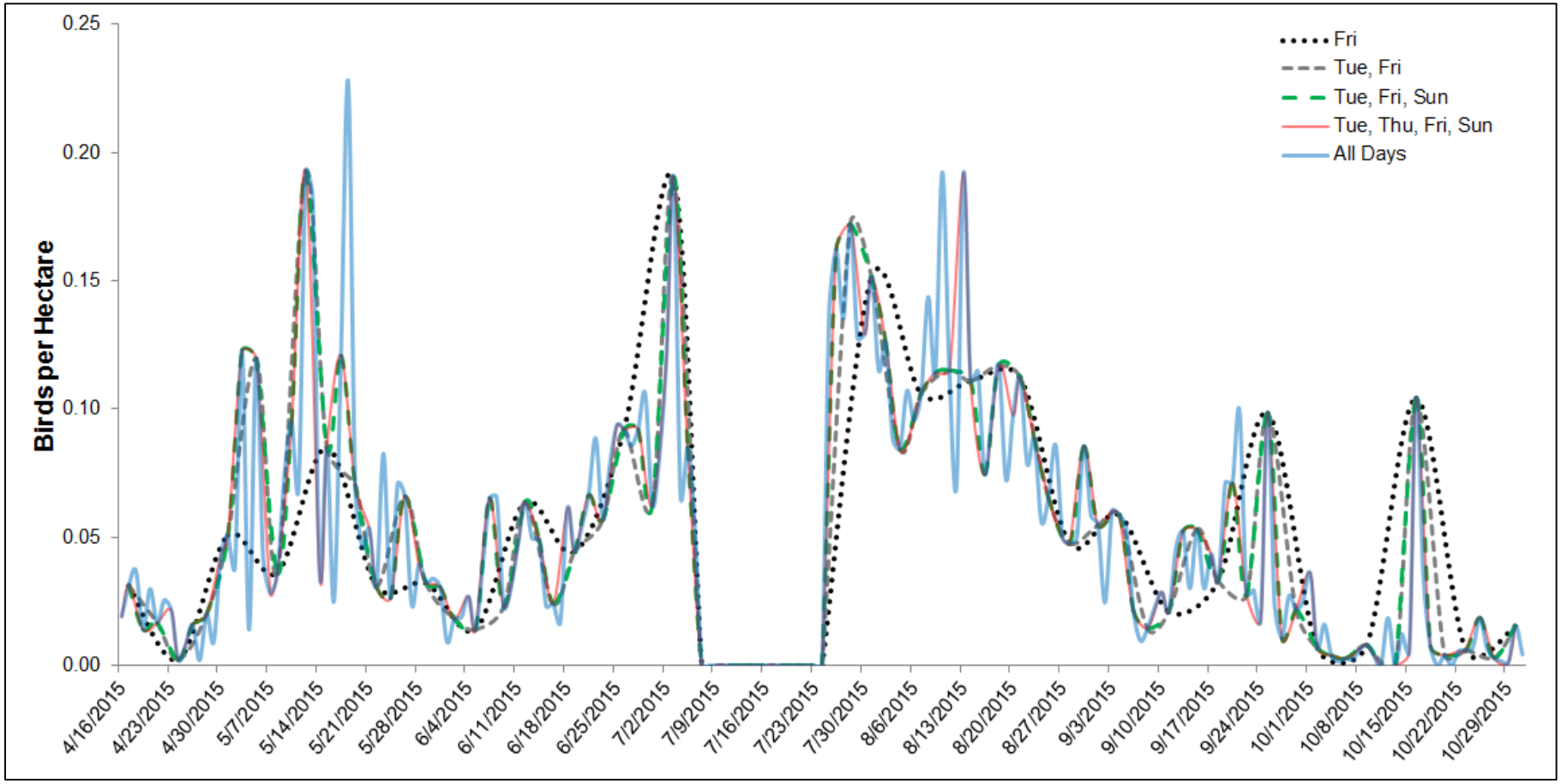

Figure 9: Effect of bird Survey monitoring interval on the pattern of bird landings observed in the 2015 OSBCMP

LIFs identified as having a low bird oiling risk and excluded from bird survey and mortality search monitoring, but which are situated in proximity to external influences that may elevate the numbers of birds at these LIFs would be candidates for inclusion in the quick scan procedure in 2016.

5.6 Oiled Bird Survivability

Lightly and moderately oiled birds outnumbered birds heavily or completely oiled, found dead (due to oiling) and captured and euthanized in both 2014 (431 of 604) and 2015 (360 of 521). Although these birds were reported to the appropriate site contacts and efforts are made to locate, capture and euthanize these birds, many remain sufficiently agile and flight capable so as to avoid capture. With 70% of the oiled birds observed in the past two years being lightly or moderately oiled and sufficiently mobile to avoid capture, an opportunity to examine the proportion of oiled birds that may be capable of surviving exposure to bitumen appears to be available. Examining the survivability of bitumen contact would require separate investigations, outside of the formal OSBCMP procedures.

6.0 REFERENCES

Owl Moon Environmental Inc. (OMEI) (2015a) Oil Sands Bird Contact Monitoring Program 2014 Annual Report. Prepared for the Alberta Energy Regulator and Alberta Environment and Sustainable Resource Development. 321 pp.

Owl Moon Environmental Inc. (OMEI) (2015b) Oil Sands Bird Contact Monitoring Program 2015 Protocol. Program Description and Rationale for Changes. Prepared for Canadian Natural Resources Limited, Imperial Oil Canada Limited, Shell Canada Energy, Suncor Energy Inc. and Syncrude Canada Limited. 75 pp.

Owl Moon Environmental Inc. (OMEI) (2016) Oil Sands Bird Contact Monitoring Program Searcher Efficiency Study. Prepared for Prepared for Canadian Natural Resources Limited, Imperial Oil Canada Limited, Shell Canada Energy, Suncor Energy Inc. and Syncrude Canada Limited. 15 pp.

St. Clair C.C., Loots S., McCallum C., Thayer D., Fontaine T., Gilhooly P. (2013) 2012 Report of the Regional Bird Monitoring Program for the Oil Sands. Research on Avian Protection Project, Department of Biological Sciences, University of Alberta, Edmonton; 60 pp.

OIL SANDS BIRD CONTACT MONITORING PROGRAM
2015 REGIONAL REPORT

APPENDIX A

CANADIAN NATURAL RESOURCES LIMITED – HORIZON OIL SANDS

Prepared for:

Canadian Natural Resources Limited

March 2016

324 Killdeer Way, Fort McMurray, Alberta T9K 0R3 kfoster@owlmoon.ca

March 31, 2016

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Terrance Ko
Manager, EPEA and Water
Mining Authorizations

Via email EPEA.Reports@aer.ca

Subject: **Horizon Oil Sands Processing Plant and Mine**
EPEA Approval No. 149968-00-04
Regional Oil Sands Bird Contact Monitoring Program Annual Report

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As required in Section 4.9 of the above mentioned approvals, Canadian Natural Resources Limited (Canadian Natural) herby submits the 2015 Regional Oil Sands Bird Contact Monitoring Program.

The following is the annual report requirements as described in section 4.9.2(b).

Should you have any questions, please contact the undersigned at (780) 824 - 2076.

Yours Truly,

Canadian Natural Resources Limited

Joanne Hogg

Joanne Hogg
Lead, Research (Wetlands & Aquatics)
Horizon Oil Sands

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A1.0 INTRODUCTION

The Horizon Oil Sands Mine (Horizon), operated by Canadian Natural Resources Limited (Canadian Natural), is located approximately 70 km north of Fort McMurray. In accordance with the Oil Sands Bird Contact Monitoring Program (OSBCMP) Protocol (OMEI 2015), bird surveys and mortality searches were conducted at six liquid impoundment facilities (LIFs) deemed of being high risk to birds, including the External Tailings Facility (ETF) and five smaller LIFs. Quick scans were conducted at seven small, low risk LIFs.

The Horizon Oil Sands Mine *Environmental Protection and Enhancement Act* (*EPEA*) Approval (No. 149968-00-01; Conditions 4.9.1 to 4.9.4) requires that Canadian Natural develop and implement a Waterbird Protection Plan. Canadian Natural's participation in the OSBCMP fulfills these requirements and submission of this report is in fulfillment of Condition 4.9.4: The approval holder shall submit to the Director the results of the avian mortality monitoring in the Annual Report."

Canadian Natural's Waterbird Protection Plan describes the planning and preventative measures for minimizing and managing hazards to birds at Horizon. The Waterbird Protection Plan focuses on deterring waterbirds from LIFs that have the potential to impact birds. Requirements of the plan include the deployment and maintenance of avian deterrents, monitoring of bird contacts (though standardized bird surveys, mortality searches and quick scans), assessment of avian attractants/habitat, and reporting of monitoring results. The plan also includes reporting procedures for species of conservation concern and injured or dead birds, a vegetation management plan, the installation of containment booms, routine hazing of birds, recovery of impacted birds, and creation of updated satellite imagery and digital maps of the Horizon site.

A2.0 LIQUID IMPOUNDMENT FACILITIES

A2.1 Risk Model and Liquid Impoundment Facilities Inclusion

All Horizon LIFs were evaluated for inclusion in the 2015 monitoring program using the procedures outlined in the OSBCMP Protocol (OMEI 2015). LIFs that did not satisfy the initial inclusion or exclusion criteria were assessed using the risk model. This model integrated LIF characteristics (contents, surface bitumen, size, setting, and avian attractants) with the number of bird landings and mortalities from 2013 and 2014 to derive a risk rating for birds at each LIF (Table A-1).

Based on risk model outcomes, 16 LIFs were deemed to be of low risk to birds. Their characteristics were deemed unattractive to birds, and for 11 of them standardized monitoring from the previous two years resulted in few (0 to 0.23) landed birds per survey and no mortalities found (the five others were not monitored or were nonexistent in previous years). The number of landed birds per survey in 2013 and 2014 at Coke Runoff initially suggested its inclusion in the bird survey and mortality search procedures. However, removal of perimeter vegetation in early 2015 reduced its attractiveness to birds, and coupled with the absence of bitumen and absence of observed bird mortalities through 2014, this LIF was defined as low risk in 2015.

Table A-1: High and Low Risk LIFs as Defined by the OSBCMP Risk Model

High Risk LIFs Bird Survey & Mortality Search	Low Risk LIFs	
	Quick Scan	Not Monitored
Basal Water Storage Dyke 10 Runoff Mine Dump Recycle Water Storm Water External Tailings Facility	Mine Dump Discharge OPP 4/5 East Retention OPP 4/5 Inpit OPP 4/5 Northwest Retention* OPP 4/5 Southwest Retention OPP 7 OPP 8	Coke Runoff** Emergency Dump Pond 1 Emergency Dump Pond 2 Emergency Dump Pond 3 Extraction Dump Froth Dump Mine Sump North Pump House Village*** OPP 4/5 Mine Sump*** Pond 2*** R1 Distributor R1 Emergency Dump R2 Basal Dump R2 Emergency Dump R15 Sump*** Storm Ditch*** Sulphur Runoff

Notes:
* Decommissioned on May 20, 2015.
** One mortality search on April 16, 2015, then removed from the monitoring program.
*** LIF not monitored or nonexistent in previous years.

Six LIFs, defined as high risk by application of the risk model, were included in the bird survey and mortality search procedures (Figure A-1). Of those, Basal Water Storage does not contain bitumen, but the LIF is highly attractive to birds and there is potential to observe birds that could have become oiled at the nearby ETF.

Seven low risk LIFs were included in the quick scan procedure, one of which (Ore Preparation Plant (OPP) 4/5 NW Retention) was decommissioned on May 20, at which time monitoring of this LIF ceased.

A2.2 Description of LIFs and Survey Areas

Avian habitat within bird survey areas (see Appendix AI for maps) was assessed every two weeks through the spring (April 16 to July 6, inclusive) and fall (July 25 to October 31, inclusive) monitoring seasons (Table A-2). The ETF is the largest LIF at Horizon (Figure A-1; 1,130 ha of fluid, 2015 data). Four bird survey stations were established at this LIF, located in the northwest section (PMP5), southeast (PMP6/9), southwest (PMP8/10), and central-west (PMP7). Its large size, potentially attractive habitats along the west side (vegetation, islands, flats, sinuous shoreline) and remoteness from industrial and human activity contribute to a high bird landing potential, while the presence of bitumen poses an oiling risk to birds.

Basal Water Storage also includes avian attractants along its west shoreline (flat islands, emergent and ground vegetation, sinuous shoreline on a gradual slope), however, this LIF is a saline water storage facility and does not contain bitumen.

Figure A-1:LIFs included in the 2015 Oil Sands Bird Contact Monitoring Program (OSBCMP) at Horizon

Note: Only one mortality search was conducted at Coke Runoff (on April 16), before the LIF was removed from the program.

Table A-2: Characteristics of Bird Survey Areas Monitored in 2015 at Horizon (ha; Mean ± Standard Deviation)

LIF	Survey Station	Total Area	Open Water	Island		Emergent Vegetation	Flat			Bank			Artificial Structure	Floating Logs or Ice Cover
				Vegetated	Non-vegetated		Gravel/ Sand/Mud	Vegetated	Coke	Vegetated	Non-vegetated	Artificial Material		
Basal Water Storage	TMP2*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TMP3 (spring)	23.3	16.8 ±1.0	0.9 ±0.4	0	1.9 ±0.5	0.6 ±0.2	1.2 ±0.8	0	1.6 ±0.6	1.4 ±0.6	0	0	0
	TMP3 (fall)	24.6	18.3 ±0.9	0.6 ±0.1	0.2 ± 0	1.3 ±0.6	0.3 ±0.1	0	0	1.7 ±0.2	2.3 ±0.5	0	0.2 ± 0	0
Dyke 10 Runoff	NMP1	11.1	8.3 ±0.5	0.1 ±0	0.1 ±0	0.3 ±0.1	0.3 ±0.2	0.2 ± 0	0	1.2 ±0.5	1.0 ±0.5	0	0.2 ±0.1	1.1 ±0
Mine Dump	KMP1	2.0	1.5 ±0.1	0	0	0	0.1 ±<0.1	0	0	0.2 ±0.1	0.3 ±0.1	0	0.1 ±<0.1	0
Recycle Water	AMP1	19.3	16.4 ±1.0	0	0	0	0	0	0	1.6 ±0.5	1.2 ±0.6	0	0.2 ±0	0
Storm Water	EMP1	10.8	8.4 ±0.6	0	0	0.1 ±0	0	0	0	0.3 ±0.2	2.0 ±0.5	0	0.2 ±0.2	0
ETF	PMP5 (spring)	43.4	36.3 ±2.2	0	0	1.6 ±0.5	0	0	0	3.7 ±1.7	1.4 ±0.5	0	0.6 ±0.3	1.4 ±0.7
	PMP5 (fall)	43.5	37.8 ±1.3	0.4 ±0	0	0.6 ±0.2	0	0	0	3.5 ±1.7	0.4 ±0	0	0	1.1 ±0.3
	PMP6	25.1	20.0 ±1.0	0	2.5 ±0	0	0	0	0	0	1.9 ±0.7	0	1.6 ±0.6	1.3 ±0
	PMP9 (replaced PMP6)	27.3	20.6 ±2.2	1.2 ±0.7	1.0 ±0.6	1.4 ±0.8	0.3 ±0	2.2 ±1.4	0	2.2 ±1.1	0.3 ±0	0	0.3 ±0	0.4 ±0.1
	PMP7	44.3	34.2 ±1.0	1.9 ±0.5	0	2.4 ±0.7	1.3 ±1.3	1.4 ±1.2	0	3.7 ±1.1	0	0	0.4 ±0	0.6 ±0.3
	PMP8 (spring)	48.8	37.8 ±0.7	1.3 ±1.0	0	1.8 ±0.6	0	1.8 ±0.6	0	4.9 ±0	0.5 ±0	0	0.5 ±0	0.8 ±0.3
	PMP8 (fall)	30.6	25.3 ±2.3	0.3 ±0	0	0.3 ±0	0.3 ±0	0	0	1.5 ±0	1.9 ±1.4	0	0.9 ±0.5	2.3 ±2.1
	PMP10 (replaced PMP8)	42.5	34.3 ±1.7	0.6 ±0.2	0	1.0 ±0.2	0	0.4 ±0	0	5.3 ±1.2	0.4 ±0	0	0.4 ±0	0.8 ±0.2

Note:

* TMP2 was replaced by TMP3 after one bird survey, to include more avian habitat within the survey area; no habitat assessment was conducted at TMP2.

The Dyke 10 Runoff LIF includes perimeter sand flats, which may be perceived by shorebirds as foraging habitat. Ground and emergent vegetation and an island are also present. A nearby wetland may draw birds into the area that would potentially interact with the Dyke 10 Runoff LIF.

Recycle Water is a rectangular LIF within the plant site, located near roads. The open water is surrounded by a strip of non-vegetated bank resembling a sand flat, which is surrounded by a grassy bank. The Storm Water LIF is also a rectangular LIF within the plant site. A non-vegetated bank resembling a sand flat surrounds the perimeter. The Mine Dump LIF is located within a highly industrialized area. There is a small sand flat to the south and two steep, partially vegetated banks to the north and east.

At the request of the OSBCMP Program Manager, a habitat assessment was conducted in late August at each LIF included in the quick scan component of the monitoring program (Table A-3). The habitat survey was not conducted at OPP 4/5 NW Retention, as it was decommissioned on May 20. Quick scan LIFs are small and generally contain no or minimal areas of attractive avian habitat (Table A-3, Appendix AI).

The LIFs at which bird surveys, mortality searches and quick scans were conducted are shown in the images presented in Appendix AI.

A3.0 DETERRENTS

Deterrents (Table A-4) were deployed at all LIFs that could pose a risk of avian oiling (Table A-5, Figure A-2). Deterrent deployment was initiated in mid-March 2015, with the radar detection system and most propane cannons installed and operational by April 1. Propane cannons were deployed to all LIFs by April 1, and additional cannons were deployed at the ETF as snow and ice melted, enabling safe access, and throughout the open water season. Deterrents were decommissioned between November 12 and December 5 for winter storage. Deterrents remain in place at areas expected to remain unfrozen (open water) at Recycle Water, Storm Water, R2 Basal Dump, Extraction Dump, and Pond 2.

At the ETF, combined audio-visual deterrents (Acoustic Hazing Devices (AHDs) and Floating Deterrent Units (FDUs)), were activated by a radar detection system (Merlin Detect and Deter™) customized for Horizon. Three surveillance radars, each capable of detecting birds in flight to a maximum distance of 2.8 km (DeTect 2014), triggered the appropriate deterrents through wireless signal when the software identified moving objects as birds. One horizontal radar provided coverage of the north section of the ETF and Basal Water Storage, another horizontal radar was located on the south shore of the ETF, and a radar with horizontal and vertical capability was located on the east shore of the ETF. In the eventuality of a malfunction of the on-demand radar activation system, the linked deterrents were programmed to revert to random activation. Radars and AHDs were each powered by two generators (a primary and a backup) and maintenance was performed as required, or at minimum every 250 hours. An automated notification system sent periodic system status emails, and immediate notification of any system failures, to Canadian Natural and deterrent system contractors. System alert messages were tracked 24/7 and resolved as soon as possible.

Table A-3: Characteristics of Quick Scan LIFs at Horizon in 2015 (ha)

LIF	Habitat Assessment Date (2015)	Total Area	Open Water	Island		Emergent Vegetation	Flat			Bank			Artificial Structure	Other
				Vegetated	Non-vegetated		Gravel/ Sand/Mud	Vegetated	Coke	Vegetated	Non-vegetated	Artificial Material		
Mine Dump Discharge	Aug 27	0.07	0.01	0	0	0	0.01	0	0	0	0.05	0	0	0
OPP 4/5 East Retention	Aug 30	0.10	0	0	0	0.07	0	0	0	0.02	0	0	0	0
OPP 4/5 Inpit	Aug 30	0.57	0.28	0	0	0	0	0	0	0.28	0	0	0	0
OPP 4/5 NW Retention*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OPP 4/5 SW Retention	Aug 30	0.66	0.46	0	0	0	0.03	0	0	0.16	0	0	0	0
OPP 7	Aug 27	0.03	0.01	0	0	0	<0.01	0	0	0	0.02	0	<0.01	0
OPP 8	Aug 27	0.06	0.04	0	0	<0.01	0	0	0	0	0.01	0	<0.01	0

Note:
* OPP 4/5 NW Retention was decommissioned on May 20.

Table A-4: Description and Number of Avian Deterrents Deployed at Horizon in 2015

Deterrent	Description	Stimuli	Sound Intensity at 1 m (dB)	Activation Control	Sub-strate	No.
AHD	Combines 3 to 6 AHD (Long-Range Acoustic Devices 100x or Hyperspike HS-18) facing different directions, and 2 eye-safe (Class 3) green lasers for night deterrence	Audio & Visual	152 to 156	Radar	Land	13
FDU	Combines a Robop robotic falcon effigy with internal speaker, Bird Gard Super Pro Amp, and Zon EL08 Electronic Propane Cannon. A 12-volt battery system is recharged via solar panel and wind generator. In the event of wireless disruption, all systems switch to random activation.	Audio & Visual	90 to 120	Radar	Water	14
Cannon	Zon LP propane bird scare cannons	Audio	120	Random	Land	196
Merlin Harrier System	A thermal surveillance cameras that detects birds immediately above the water surface and triggers a cannon near the bird (total = 10 cannons)	Audio	120	Motion Sensor	Land	10
Bird Gard	Distress call generator	Audio	110	Random	Land	3
Human Effigy	Human effigies dressed as workers	Visual	-	-	Land	152
Falcon Kite	Predatory bird kite attached by cable to a pole and that emulates the flight of a falcon	Visual	-	-	Land	3
Eagle Effigy	Plastic eagle	Visual	-	-	Land	3
Coyote Effigy	Coyote replica with furry tail	Visual	-	-	Land	3
Mylar Tape	Crackling reflective tape, attached to a horizontal string in strips of 30 to 60 cm in length	Visual	-	-	Over Flats	4

Table A-5: Type and Number of Deterrents at Horizon LIFs

LIF	Purpose	AHD	Cannon	FDU	Bird Gard	Falcon Kite	Human Effigy	Eagle Effigy	Coyote Effigy	Mylar Tape
Basal Water Storage	Saline water storage	1	7				7	1		
Coke Runoff	Site drainage		7				11			
Dyke 10 Runoff	Dyke drainage, storage for process upsets		12		1		7	1	1	2
EDP 1	Site drainage, storage for process upsets		1				1			
EDP 2	Site drainage, storage for process upsets		1				1			
EDP 3	Site drainage, storage for process upsets		2				2			
Extraction Dump	Site drainage, storage for process upsets		4				5			
Froth Dump*	Storage for process upsets						4			
Mine Dump Pond	Site drainage, storage for process upsets		3				5	1		
Mine Dump Discharge	Site drainage, storage for process upsets		1				1			
Mine Sump	Site drainage		2				2			
North PH Village	Site drainage, storage for process upsets		1				1			
OPP 4/5 East Retention	Site drainage		1				1			
OPP 4/5 Mine Sump	Site drainage		2				2			
OPP 4/5 NW Retention	Site drainage		2				2			
OPP 4/5 SW Retention	Site drainage		2				2			
OPP 7	Site drainage		1				1			
OPP 8	Site drainage		1				2			
Pond 2	Site drainage, storage for process upsets		2				2			
R1 Distributor	Site drainage, storage for process upsets		1				1			
R1 Emergency Dump	Site drainage, storage for process upsets		1				1			
R15 Sump	Site drainage, storage for process upsets		1							
R2 Basal Dump	Site drainage, storage for process upsets		4		1		4			1
R2 Emergency Dump	Site drainage, storage for process upsets		2				2			
Recycle Water**	Recycle water from Tailings for plant operations		10				10			
Storm Ditch***	Site drainage		3							
Storm Water	Site drainage, storage for process upsets		11		1		8			1
Sulphur Runoff	Site drainage		2							
ETF	Tailings drainage	12	116	14		3	70		2	

Notes:
* Cannons were not deployed at Froth Dump due to the potential presence of flammable gas.
** The 10 cannons at Recycle Water pond are linked to a Merlin Harrier System.
*** Cannons at Storm Ditch were moved to Storm Water on August 15, as no water remained in the ditch.

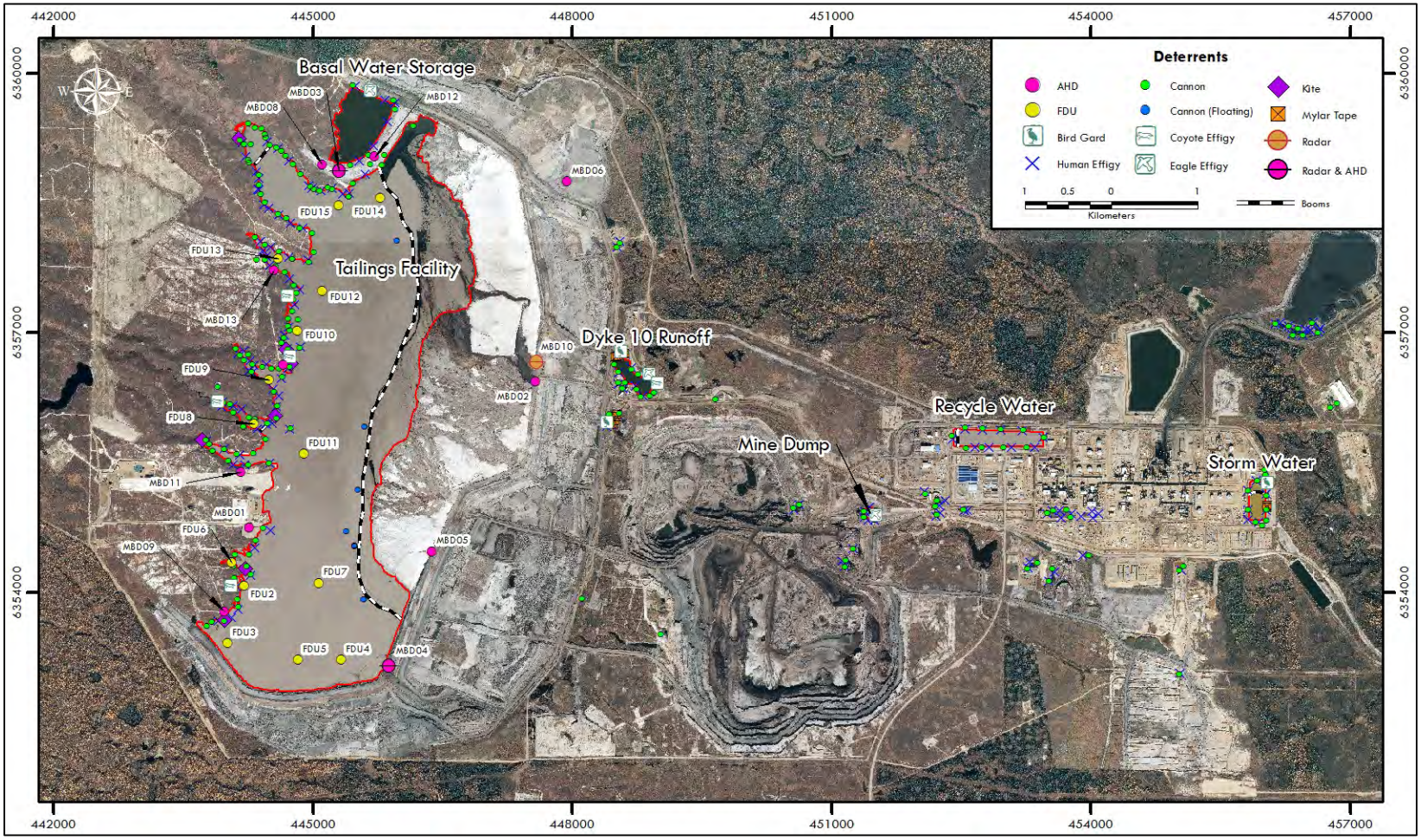

Figure A-2: Deterrent System Deployment at Horizon in 2015

The AHDs were mounted as 12 separate units (11 at the ETF and one at Basal Water Storage), comprising in total 42 long-range acoustic devices (LRADs) and 23 Hyperspike speakers. AHD files included 255 sound tracks: 85 warning sounds (e.g., dogs barking), 85 scare sounds (e.g., bird distress calls), and 85 significant hazing sounds (e.g., gunshots). When radar software detected a target within the guard zone and identified it as a bird, an AHD near the bird was triggered to play a sound file. Sounds were selected from the library of recordings with the lowest threat level played first, escalating to those in the intermediate threat level category, and then to the highest threat level if the bird(s) remained in the area. To minimize bird habituation, the recording within each threat level was randomly selected by computer algorithm and the escalating sequence restarted and continued looping until the target was no longer detected. Radar MBD10 was moved northward on June 15 and AHD MBD05 was moved northward on October 8. Two lasers were coupled with each AHD unit to serve as visual deterrents during nighttime. AHDs were decommissioned on November 19 and 20.

Bird Gards were deployed at the Dyke 10 Runoff, Storm Water, and R2 Basal Dump LIFs.

FDUs include a bird distress call generator with an omni-directional speaker, a scare cannon, and either a robotic falcon with a rotating head and flapping wings emitting Peregrine Falcon calls, or a green laser. The units were inspected every two weeks to check propane supply and to verify correct operation of the electronic components, cannon, and falcon decoy. Six FDUs were deployed by April 5, four new units on April 30, and four on May 3. High winds caused one FDU to flip on September 27, and it was out of service for the remainder of the season.

Two falcon kites were deployed on the west side of the ETF and relocated periodically to reduce the potential for bird habituation, and a third at the Dyke 10 Runoff LIF. Kites were decommissioned on November 12.

Cannons were placed at all LIFs at a distance of 150 to 200 m apart, except at Froth Dump where flammable gas may be present. Cannons were inspected and refueled every two weeks and the solar panels cleaned of snow or dust as needed. At the North Pump House Village LIF, cannons were turned off from June 13 to June 30 for emergency work during which the LIF was drained. At Storm Ditch, cannons were moved on August 15 to accommodate excavation work and no water was present after the work was completed. At R2 Basal, the cannons and Bird Gard on the west side were moved to other locations around the LIF on August 29 to allow for road construction. At Basal Water Storage, cannons and effigies on the north side were dispersed around the LIF on September 13 for building up the berm.

At Recycle Water, 10 cannons are linked to an on-demand system (Merlin Harrier, DeTect) that detects movement (birds) immediately above the water surface through infrared cameras with motion sensors, which when triggered causes firing of the cannon nearest to the bird. Each camera covers a different section of the LIF, and sensors can be masked to eliminate detection of movement in areas subject to human activity (roads) or wind-blown vegetation, preventing unnecessary cannon firing. The system is primarily powered by a solar panel array, and has a diesel generator for backup. The system is active and maintained all year, as a portion of the

LIF remains free of ice through the winter months. Maintenance includes maintaining the fuel level of the backup generator and cleaning of camera lenses. Cannons also remain active at Storm Water, Pond 2, Extraction Dump, and R2 Basal Dump, where operational activities cause open water to remain through the winter. Propane tanks are refuelled and solar panels maintained regularly.

Human effigies are installed year-round at all LIFs except Sulphur Runoff, and are maintained or replaced as needed. Eagle effigies were located at Dyke 10 Runoff, Basal Water Storage, and Mine Dump. Two coyote effigies were placed at the ETF, and one at Dyke 10 Runoff.

Strings of Mylar tape were placed over flats at the Dyke 10 Runoff, R2 Basal Dump and Storm Water LIFs.

A4.0 AVIAN RISK MANAGEMENT PROGRAMS

A4.1 Removal and Control of Habitat Attractants

Vegetation on the west side of the ETF was aerially sprayed in August 2014 with a mixture of Navius™, Vision Max®, Hasten™, herbicides, with an Onsite VM additive. The area was assessed in June 2015 for efficacy of the treatment, and was re-sprayed with the same mixture in September 2015.

Vegetation was mechanically removed at the Dyke 10 Runoff LIF in September 2014. To prevent regrowth, a herbicide mixture of Banvel® and Payload® was applied for broadleaf and grass vegetation control to an area of approximately 7 ha surrounding the LIF in spring 2015. In summer 2015, the amount of vegetation around the LIF was substantially reduced. However, some regrowth was apparent and some emergent vegetation remained within the LIF. The 7-ha area was re-sprayed in the fall with a mixture of Karmex®, Vision Max® and Onsite VM.

The vegetation surrounding Coke Runoff was mechanically removed in January 2015. To prevent regrowth, approximately 2 ha surrounding the LIF were sprayed using a mixture of Karmex®, VisionMax®, Banvel®, and OnSite® for control of all vegetation types. As of July 2015, the area around the LIF was devoid of vegetation, but emergent vegetation (cattail) was present along the shorelines of the east facility. The 2-ha area was re-sprayed in the fall with a mixture of Karmex®, Vision Max® and Onsite VM.

At Mine Dump, the vegetation on the north and east banks was mechanically removed in March 2015. Approximately 0.8 ha was sprayed with a mixture of Banvel® and Payload®, for broadleaf and grass vegetation control in April to prevent regrowth. As of July 2015, minimal vegetation was present and was composed primarily of short, sparse grasses along the east and north banks. The area was re-sprayed with Vision Max®, Karmex® and Onsite VM in the fall.

A4.2 Containment Booms

A bitumen containment boom enclosing all active discharge points into the ETF was maintained through the open water season and left in place during winter. A debris boom was installed around the siphon line intake in the southern section of the ETF and additional booms were

deployed throughout the season along the west side to exclude surface bitumen from potential avian habitats as a means of reducing the risk of bird oiling. These booms were removed prior to winter. A boom of fused 10-inch plastic pipes was installed in the Tar River Valley (west ETA) in November, and will remain in place over the winter.

Bitumen containment booms remain installed all year at the Recycle Water, Storm Water, and Dyke 10 Runoff LIFs.

A4.3 Hazing Procedures

Hazing activities were conducted to encourage birds to leave, prevent them from habituating to the area and attracting more birds, and minimize bird contact with LIFs. A hazing team focused 12 hours per day on actively hazing birds on the ETF, and a separate land-based crew patrolled the west side of the ETF daily. Hazing was also conducted concurrently with deterrent maintenance and mortality searches, and when birds were reported to the Regulatory and Environment department by bird survey, quick scan, Canadian Natural or on-site contractor personnel.

Hazing equipment included short-range hazing pistols firing pyrotechnic scare cartridges (bangers, screamers and whistlers), a longer-range CAPA launcher producing a loud detonation, and air horns. Hazing was conducted from an airboat, outboard boat, Mud Buddy, amphibious all-terrain vehicles (Argo and Hagglunds), or on foot, depending on location and weather. The airboat also functioned as a hazing device in itself. On stormy days (heavy wind, heavy rain or lightning) and other days when boats could not be used, the ETF boat hazing crew used an Argo to patrol the west perimeter of the ETF. Boat and land crews carried a net for bird capture and cages for holding oiled birds.

Bird survey personnel hazed birds using a short-range hazing pistol after the completion of a survey, depending on safety considerations, permitting, timing restrictions, and accessibility by foot or truck. Bird survey personnel systematically communicated the location of landed birds to the nearest hazing crew for additional hazing effort when required. This approach aimed to haze birds more promptly.

Hazing strategies were selected on a case-by-case basis, taking into account the bird guild, relative risk posed to birds at different LIFs, and potential for pushing birds into more hazardous areas. Birds with flight-incapable chicks or unable to fly due to moulting or oiling/injury were not hazed.

A5.0 MONITORING METHODS

A5.1 Habitat Assessment

Bird survey area habitat assessments were completed every two weeks. At the request of the OSBCMP Program Manager, one habitat assessment was conducted in the fall (August) at each LIF in the quick scan procedure. Data were entered into forms on electronic tablets and submitted to the OSBCMP program manager.

A5.2 Bird Survey

A specialized team conducted bird surveys using the procedures described in the OSBCMP Protocol (OMEI 2015). Surveys at ETF survey stations were conducted first in the day to enable the use of an amphibious all-terrain vehicle (Hagglunds BV206D) needed to access stations on the west side. Starting on June 10, a change in site permitting procedures enabled bird survey personnel to begin surveys earlier in the morning, when birds were more likely to be present. The bird survey and hazing crews communicated and coordinated their schedules to avoid survey interruptions and maximize the amount of time between the end of hazing and the beginning of a survey.

Survey station TMP2 was replaced by TMP3 after the first survey in order to include more avian habitat within the survey area. PMP6 was replaced by PMP9 on June 2 to avoid an active construction zone, ensure the safety of personnel, and increase survey area visibility by using a more elevated viewpoint. Due to rising water levels affecting the southwest survey station at the ETF, PMP4 was replaced by PMP8 prior to the beginning of the season, and PMP8 was replaced by PMP10 on August 27.

The use of an amphibious all-terrain vehicle (Hagglunds BV206D) in 2015 improved access to the west side of the ETF compared to previous years. Enhanced access enabled replacing the east-central survey station (PMP2) by a west-central station (PMP7) to monitor bird activity where birds were more likely to occur. The two stations on the west side of the ETF in 2015 (PMP7 and PMP8/10) were surveyed with a 100% completion rate, compared to 79% of surveys completed at the only west station in 2014 (PMP4). In total, there were 1,395 bird surveys conducted at Horizon in 2015 (Table A-6), representing 100% of the bird survey effort guidance in the protocol.

Table A-6: Bird Survey Effort at Horizon in 2015

LIF	Station	Dates Operated	# Surveys		Protocol Guidance (%)
			Station	LIF	
Basal Water Storage	TMP2	Apr 16	1	155	100
	TMP3	Apr 17 to Oct 31	154		
Dyke 10 Runoff	NMP1	Apr 16 to Oct 31		155	100
Mine Dump Pond	KMP1	Apr 17 to Oct 31		155	100
Recycle Water	AMP1	Apr 17 to Oct 31		155	100
Storm Water	EMP1	Apr 17 to Oct 31		155	100
ETF	PMP5	Apr 16 to Oct 31	155	620	100
	PMP6	Apr 16 to May 31	40		
	PMP9	Jun 2 to Oct 31	115		
	PMP7	Apr 16 to Oct 31	155		
	PMP8	Apr 16 to Aug 26	98		
	PMP10	Aug 27 to Oct 31	57		

Oiled birds observed outside of the bird surveys were recorded in the bird survey data form as incidental observations. Oiled birds were reported to the mortality search team for recovery, and to the site Regulatory & Environment on-call phone.

A5.3 Mortality Search

Mortality searches were conducted by a specialized team from April 16 to October 31 (inclusive) according to the procedures in the protocol. Searchers targeted areas where bird mortalities were more likely to be found. Mortality searches were conducted as designated activities, and during deterrent maintenance, bird hazing, and bird capture attempts when search effort (hectares searched) could be recorded. At the ETF, the majority of activities conducted by boat were recorded as mortality searches. Fixed-radius scans were completed at every second cannon inspected, and mortality searches were completed from an amphibious all-terrain vehicle (Argo) when weather conditions did not allow use of boats. At the ETF, 186 (80%) mortality search transects were conducted by boat, 78 (17%) by walking, and 3 (1%) by amphibious all-terrain vehicle (Argo). All transects at the other LIFs were conducted by walking.

Mortality search effort totalled of 3,455 km of search transects, 968 fixed-radius scans, and 44 small LIF searches (Table A-7). Transect searches and fixed-radius scans at the ETF each exceeded protocol guidance by more than a factor of five.

Table A-7: Mortality Search Effort at Horizon in 2015

LIF	Transect (m)		Fixed-radius Scan (No.)		Small LIF (No.)
	Guidance	Actual	Guidance	Actual	Actual
Basal Water Storage	–	3,540	–	37	0
Coke Runoff	–	1,160	–	0	0
Dyke 10 Runoff	–	32,440	–	0	3
Mine Dump Pond	–	537	–	1	19
Recycle Water	–	34,804	–	1	4
Storm Water	–	2,710	–	3	18
ETF	606,950	3,380,150	179	926	0
Totals	**605,000**	**3,455,341**	**179**	**968**	**44**

Oiled birds observed outside of mortality search procedures were recorded as incidental observations, and reported to the mortality search team for recovery, and to the to the site Regulatory & Environment on-call phone.

A5.4 Quick Scan

Bird survey personnel conducted quick scans twice per week through the spring and fall monitoring seasons. In August, at the request of the OSBCMP Program Manager, one habitat assessment was conducted at each LIF in the quick scan procedure.

Two quick scans per LIF (and three quick scans at the OPP 4/5 NW Retention LIF) were missed (Table A-8) due to difficulties encountered early in the season. These difficulties were addressed by mid-May, resulting in 100% of quick scans being completed during the remainder of the spring and fall seasons. The OPP 4/5 NW Retention LIF was decommissioned on May 20, at which time quick scans at this LIF ceased.

Table A-8: Quick Scan Effort at Horizon in 2015

LIF	# Scans	Protocol Guidance (%)
Mine Dump Discharge	49	96
OPP 4/5 East Retention	49	96
OPP 4/5 Inpit	49	96
OPP 4/5 NW Retention*	7	72
OPP 4/5 SW Retention	49	96
OPP 7	49	96
OPP 8	49	96
Total	**301**	**92**

Note:
* OPP 4/5 NW Retention was decommissioned on May 19.

A6.0 RESULTS AND DISCUSSION

In 2015, there were 8,568 landed bird observations during bird surveys, 8,069 (94%) from target guilds (Table A-9). Most of these observations were recorded at Basal Water Storage (4,364 observations), Dyke 10 Runoff (2,084), and the central-west and southwest ETF survey stations (1,830). In 301 quick scans at seven low risk LIFs, 37 birds were observed landed, of which 31 were of target guild species (Table A-10). Non-target species (499 observations in bird surveys, 6 in quick scans) observed during bird surveys and quick scans were primarily of passerine species, including 185 sparrows, buntings and longspurs, 119 blackbirds, grackles and cowbirds, 46 ravens, 44 swallows, and fewer than 35 individuals of other species. These data indicate a reasonable performance of the risk model as applied to the LIFs at Horizon, with relatively few observations of landed birds at the low risk LIFs in the quick scan component of the program.

Table A-9: Bird Survey Observations at Horizon in 2015

LIF (% of Surveys with Surface Bitumen Observed)	Station	Dabblers	Divers	Unknown Waterfowl	Waders	Gulls	Non-target	Total
Basal Water Storage (0%)	TMP2	0	0	0	0	0	0	0
	TMP3	2,102	1,192	20	830	44	176	4,364
Dyke 10 Runoff (0%)	NMP1	466	884	39	626	0	69	2,084
Mine Dump Pond (100%)	KMP1	0	0	0	0	0	14	14
Recycle Water (80%)	AMP1	7	9	0	34	0	37	87
Storm Water (80%)	EMP1	4	2	0	3	0	24	33
ETF (95%)	PMP5	12	3	0	9	0	31	55
	PMP6	0	0	0	0	0	0	0
	PMP9	0	0	0	25	0	20	45
	PMP7	975	3	61	445	1	61	1,546
	PMP8	93	1	0	151	1	38	284
	PMP10	9	0	0	18	0	29	56
Total		**3,668**	**2,094**	**120**	**2,141**	**46**	**499**	**8,568**

Table A-10: Quick Scan Observations at Horizon in 2015

LIF (% of Scans with Surface Bitumen Observed)	Dabblers	Divers	Waders	Gulls	Non-target	Total
Mine Dump Discharge (71%)	0	0	0	0	0	0
OPP 4/5 East Retention (0%)	0	0	3	0	5	8
OPP 4/5 Inpit (12%)	0	0	0	0	0	0
OPP 4/5 NW Retention (0%)	0	0	0	0	0	0
OPP 4/5 SW Retention (6%)	19	1	9	0	0	29
OPP 7 (69%)	0	0	0	0	0	0
OPP 8 (2%)	0	0	0	0	0	0
Total	**19**	**1**	**12**	**0**	**6**	**37**

Repeated observations of resident and stopover target guild birds through the season is illustrated by the data presented in Table A-11; these observations suggest that over 1,300 (16%) of the 8,069 of the landed bird observations during bird surveys are observations of birds recorded on one or more previous days. The presence of broods at some of the LIFs (e.g., American Green-winged Teal and Killdeer at the ETF) may indicate the availability of suitable nesting habitat nearby. The presence of broods (e.g., Mallard, Common Goldeneye, Canada Goose, American Coot, Scaup species) at Dyke 10 Runoff is also indicative of the availability of nesting habitat near this LIF, including the reclaimed wetland to the northeast (Reclamation Area 1). Ducks and waders may nest away from a waterbody and walk their young to the water after hatching, including Green-winged Teal (within 200 m of water; Johnson 1995), Gadwall (within 150 m of water, occasionally as far as 2.4 km; Leschack et al. 1997), Lesser Scaup (within 150 m of water; Anteau et al. 2014) and Lesser Yellowlegs (up to 850 m from water; Tibbits et al. 2014). Balancing the competing interests of removal of attractive habitat in and near LIFs to reduce bird oiling potential against the creation of attractive habitat in nearby reclaimed areas is a challenge requiring case-by-case risk evaluation.

Twenty-one birds were observed oiled during mortality searches (Table A-12), 13 of which were heavily oiled, discovered dead (due to oiling) or were captured and euthanized regardless of oiling level. Across all procedures, there were 220 observations of oiled birds in 2015 (Tables A-13 and 14; Appendix AII), 99 (45%) during bird surveys, 21 (10%) during mortality searches, one (<1%) during the quick scan procedure, and the remaining 99 (45%) as incidental observations. Some oiled birds observed but not captured on one day were observed and recorded as separate observations on a later date, however, quantifying repeated observations with certainty is not possible. In spite of efforts in 2015 to increase the recording of search effort to reduce the number of incidental observations (non-effort-based data), a large proportion of the oiled birds continued to be observed and recorded incidentally.

Table A-11: Observations of Resident and Stopover Birds (Target Guilds) at Horizon in 2015

LIF	Guild	Species	Adult	Young	Oiled*
Basal Water Storage	Dabbles	American Green-winged Teal	5	12	0
		American Wigeon	2	7	0
		Canada Goose	5	0	0
		Gadwall	2	18	0
		Mallard	7	26	0
		Northern Pintail	6	0	0
		Unk. Dabbling Duck	2	1	0
	Dives	Common Goldeneye	77	13	0
	Unknown Duck		0	2	0
	Wades	Killdeer	7	0	0
		Spotted Sandpiper	6	0	0
		Wilson's Phalarope	168	0	0
Dyke 10 Runoff	Dabbles	Canada Goose	17	43	0
		Mallard	26	136	0
		Northern Pintail	1	2	0
		Northern Shoveler	3	3	0
	Dives	American Coot	5	30 (2)	4 (2)
		Bufflehead	125	0	0
		Common Goldeneye	54	83	0
		Eared Grebe	1	2	0
		Lesser Scaup	21	8	0
		Ring-necked Duck	1	2	0
		Unk. Diver	20	41	0
	Unknown Duck		10	15	0
	Wades	Killdeer	5	0	0
		Spotted Sandpiper	2	0	0
Mine Dump Pond			0	0	0
Recycle Water	Dives	Common Goldeneye	1	2	0
	Wades	Killdeer	1	0	0
		Spotted Sandpiper	26	0	2
Storm Water			0	0	0
ETF	Dabbles	American Green-winged Teal	3	16	0
		Canada Goose	13	0	7
		Mallard	30	12	0
		Northern Pintail	1	4	0
		Northern Shoveler	1	2	0
	Unknown Duck		0	1	0
	Wades	Hudsonian Godwit	1	0	1
		Killdeer	22	14	11
		Sandhill Crane	4	0	0
		Spotted Sandpiper	30	1	0
		Totals	**804**	**494 (2)**	**25 (2)**

Notes:
* Oiled bird observations are included in the total numbers of adults and/or young.
Numbers in parentheses are incidental observations.
Individual live birds, including young, may be observed on multiple days and thus recorded more than once.
Olive shading indicates species listed as Sensitive, May be at Risk, or At Risk by Alberta Environment and Sustainable Resource Development (2010).

Table A-12: Oiled Bird Observations during Mortality Searches at Horizon in 2015

LIF	Lightly Oiled	Moderately Oiled	Heavily Oiled, Dead, and Captured and Euthanized	Total
Basal Water Storage	0	0	0	0
Coke Runoff	0	0	0	0
Dyke 10 Runoff	0	0	0	0
Mine Dump Pond	0	0	0	0
Recycle Water	0	0	0	0
Storm Water	0	0	1	1
ETF	5	3	12	20
Total	**5**	**3**	**13**	**21**

Table A-13: Oiled Bird Observations at Horizon in 2015 by Monitoring Activity

Guild	Oiling Level										Total
	Lightly or Moderately Oiled					Heavily Oiled, Dead, and Captured and Euthanized					
	Bird Survey	Mortality Search	Quick Scan	Incidental Observations*	Total	Bird Survey	Mortality Search	Quick Scan	Incidental Observations*	Total	
Dabbler	9	0	0	20	29	0	0	0	5	5	34
Diver	9	3	0	17	29	0	11	0	21	32	61
Unknown Waterfowl	0	0	0	0	0	0	0	0	1	1	1
Wader	80	4	1	24	109	0	1	0	6	7	116
Gull	1	1	0	3	5	0	0	0	0	0	5
Non-target	0	0	0	0	0	0	1	0	2	3	3
Total	**99**	**8**	**1**	**64**	**172**	**0**	**13**	**0**	**35**	**48**	**220**

Table A-14: Disposition and Oiling Level of Bird Observations at Horizon

LIF	Not Captured or Collected				Captured, Cleaned and Released	Euthanized				Dead at Time of Observation & Collected	Total
	Light	Moderate	Heavy	Complete	Light	Light	Moderate	Heavy	Complete	Heavy	
Basal Water Storage	6	0	0	0	0	0	0	0	0	0	6
Coke Runoff	0	0	0	0	0	0	1	0	0	0	1
Dyke 10 Runoff	23	1	0	0	0	0	0	0	0	0	24
ETF	116	16	4	0	1	4	16	13	3	2	176
Mine Dump	0	0	0	0	0	0	0	0	0	0	0
Mine Dump Discharge	0	0	0	0	0	0	0	0	0	0	0
OPP 4/5 East Retention	0	0	0	0	0	0	0	0	0	0	0
OPP 4/5 Inpit	0	0	0	0	0	0	0	0	0	0	0
OPP 4/5 NW Retention	0	0	0	0	0	0	0	0	0	0	0
OPP 4/5 SW Retention	1	0	0	0	0	0	0	0	0	0	1
OPP 7	0	0	0	0	0	0	0	0	0	0	0
OPP 8	0	0	0	0	0	0	0	0	0	0	0
Recycle Water	5	1	0	0	0	1	1	0	0	0	8
Storm Water	2	0	0	0	0	0	0	1	1	1	7
Total	**175**				**1**	**41**				**3**	**220**

Attempts were made to locate and capture all birds reported oiled, resulting in 41 oiled birds being captured and euthanized (Table A-14). Three birds were dead when discovered, and four heavily oiled birds could not be captured but are presumed to have died. The locations of these 48 bird mortalities are shown in Figures A-3 to A-5. One bird was captured, cleaned and released.

Most birds observed as being lightly or moderately oiled could not be captured (Table A-14; 171 of 220 observations; 78%) either because they had moved a sufficient distance from the point of observation that they could not be located by search personnel, or capture attempts were unsuccessful. Most observations of lightly and moderately oiled birds were of waders that were able to fly and avoid capture (Table A-13). Some birds may have been observed one or more times, recorded each time as part of a survey, morality search, quick scan, or as an incidental observation.

Twelve species of conservation concerns were recorded during OSBCMP procedures at Horizon (Table A-15), eight provincially-sensitive species within the target guilds, three provincially-sensitive non-target guild species, and the provincially and federally listed Rusty Blackbird (non-target guild). Species of conservation concern (all guilds) represented 12% of landed bird observations, and 6% of the observed oiled birds (13 of 222).

A7.0 SITE-LEVEL RECOMMENDATIONS FOR 2016

The exclusion criteria and risk model performed well in defining the risk to birds associated with Horizon site LIFs. The majority of landed birds were observed from survey stations established on LIFs defined as being of high risk, while in general, few landings were observed at the low risk LIFs included in the quick scan procedure. The bird landings at the OPP 4/5 Southwest Retention LIF, which included observation of one lightly oiled Greater Yellowlegs, will be examined through the risk evaluation procedure in advance of the 2016 monitoring season. Bitumen presence at this LIF was relatively infrequent, being present in 6% of the quick scan observations and not on the day of observation, suggesting that oiling of this bird may have occurred elsewhere.

Efforts to reduce bird landings and oiling, including deterrence, hazing, habitat management, and bitumen control, will continue. Booms will continue to be used along the west side of the ETF, as will containment booms at the ETF, Storm Water, Dyke 10 Runoff, and Recycle Water LIFs, to help minimize bird oiling risk. On the west side of the ETA, high points that would become islands due to raising water levels are being flattened over the 2015-2016 winter. Vegetation around the OPP 4/5 East Retention and the Coke Runoff LIFs was mechanically removed in winter 2015-2016. Efforts to remove or reduce vegetated areas in and around LIFs will continue at Horizon to reduce habitat that attracts and encourages residency and nesting of target guild species.

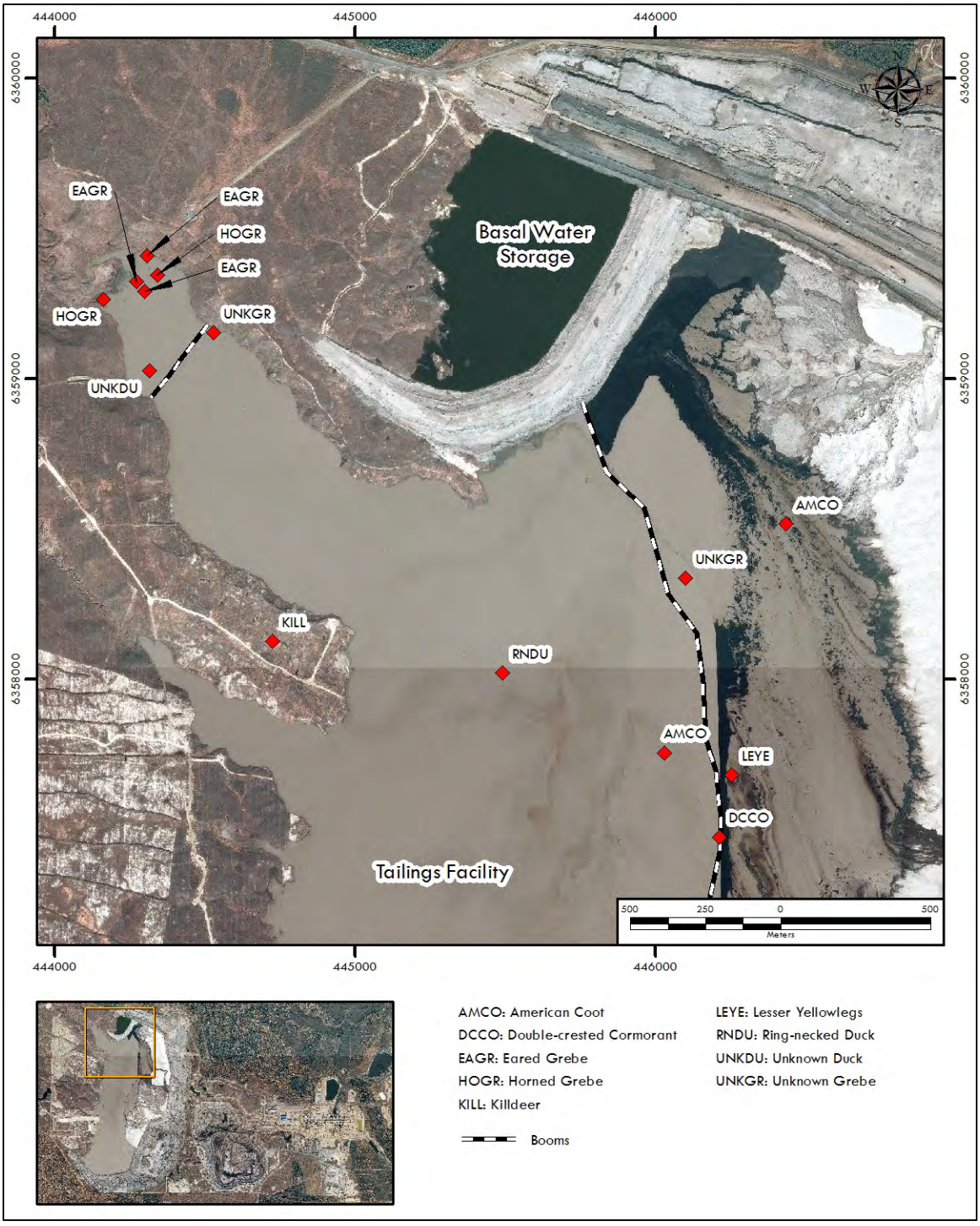

Figure A-3: Heavily oiled, dead, and captured and euthanized birds (north ETF)

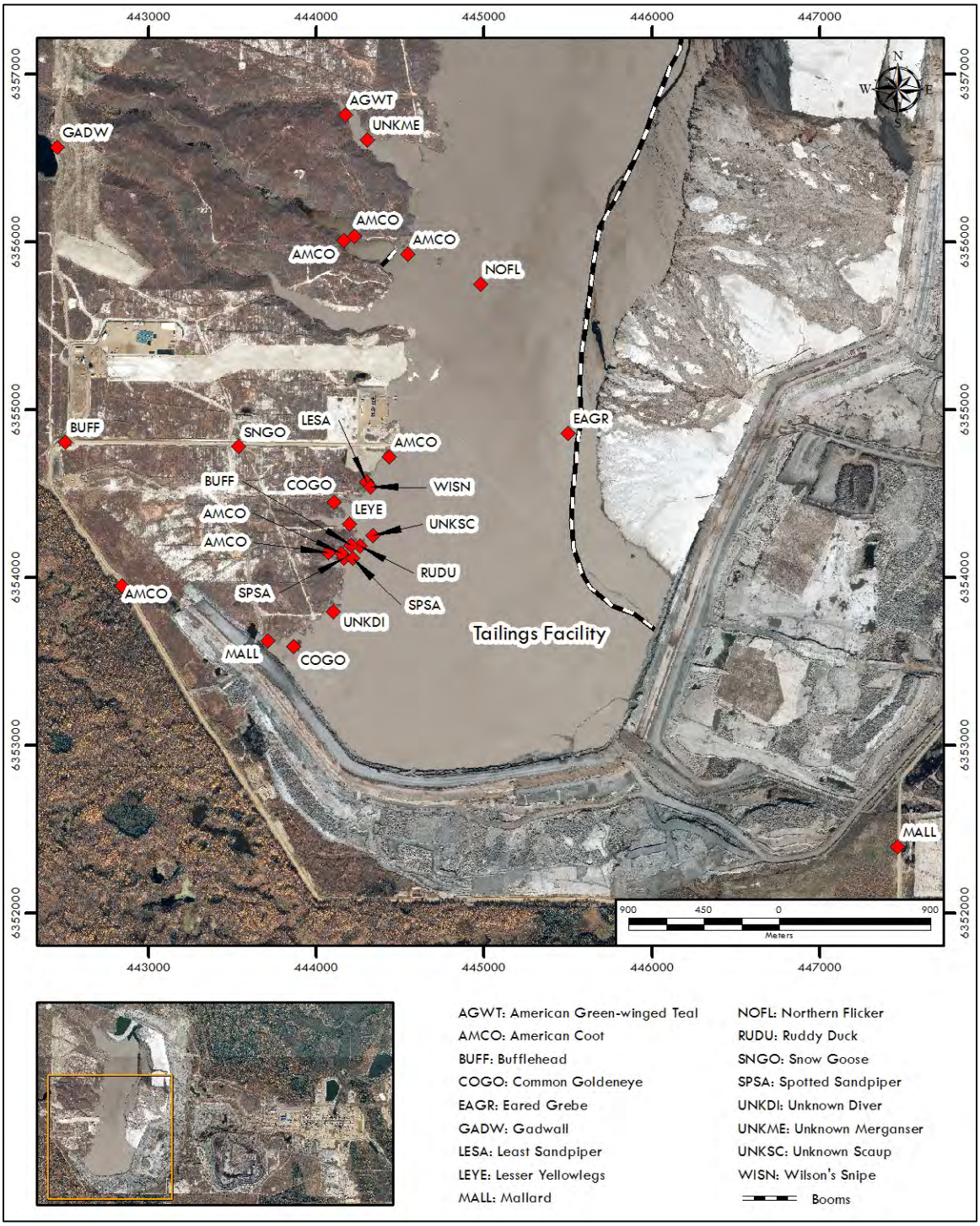

Figure A-4: Heavily oiled, dead and captured and euthanized birds (south ETF)

Figure A-5: Heavily oiled, dead and captured and euthanized birds (plant site)

Table A-15: Bird Species Observations Across all OSBCMP Procedures at Horizon in 2015

Guild	Species	Conservation Status	Number Landed*	Number Oiled**
Dabbles	American Green-winged Teal	Sensitive	665	4
	American Wigeon		205	0
	Blue-winged Teal		7	1
	Canada Goose		313	11
	Gadwall		60	3
	Mallard		1,441	4
	Northern Pintail	Sensitive	188	0
	Northern Shoveler		688	0
	Snow Goose		11	11
	Unknown Dabbler		2	0
	Unknown Dabbling Duck		117	0
	Unknown Teal		15	0
Dives	American Coot		81	18
	American White Pelican	Sensitive	1	1
	Bufflehead		306	2
	Canvasback		20	0
	Common Goldeneye		586	4
	Common Loon		3	0
	Double-crested Cormorant		1	1
	Eared Grebe		154	7
	Greater Scaup		19	0
	Horned Grebe	Sensitive	20	4
	Lesser Scaup	Sensitive	65	2
	Long-tailed Duck		6	0
	Pied-billed Grebe	Sensitive	1	0
	Red-breasted Merganser		1	1
	Red-necked Grebe		5	0
	Redhead		11	0
	Ring-necked Duck		65	8
	Ruddy Duck		18	3
	Surf Scoter		19	0
	Unknown Diver		5	2
	Unknown Diving Duck		12	0
	Unknown Grebe		3	2
	Unknown Merganser		1	1
	Unknown Scaup		742	5
	White-winged Scoter	Sensitive	1	0
Unknown Waterfowl	Unknown Duck		121	0

Guild	Species	Conservation Status	Number Landed*	Number Oiled**
Wades	American Avocet		23	0
	American Golden-Plover		70	6
	Baird's Sandpiper		162	12
	Black-bellied Plover		23	8
	Greater Yellowlegs		34	4
	Hudsonian Godwit		4	4
	Killdeer		413	12
	Least Sandpiper		19	1
	Lesser Yellowlegs		381	30
	Pectoral Sandpiper		12	0
	Red-necked Phalarope		1	0
	Sanderling		1	0
	Sandhill Crane	Sensitive	11	0
	Semipalmated Plover		2	0
	Semipalmated Sandpiper		67	4
	Short-billed Dowitcher		38	0
	Solitary Sandpiper		1	0
	Spotted Sandpiper		305	28
	Stilt Sandpiper		5	0
	Unknown Calidris Sandpiper		188	1
	Unknown Dowitcher		32	3
	Unknown Plover		9	1
	Unknown Sandpiper		25	0
	Unknown Shorebird		19	1
	Unknown Yellowlegs		47	0
	Wilson's Phalarope		294	0
	Wilson's Snipe		2	1
Gull	Bonaparte's Gull		8	0
	Franklin's Gull		27	1
	Herring Gull		7	0
	Unknown Black-headed Gull		1	0
	Unknown Gull		3	3
	Unknown White-headed Gull		4	1
Non-target	American Kestrel	Sensitive	5	0
	American Pipit		35	0
	American Robin		2	0
	Barn Swallow	Sensitive	41	1
	Black-billed Magpie		4	0
	Brown-headed Cowbird		4	0
	Clay-colored Sparrow		1	0
	Cliff Swallow		3	0

Guild	Species	Conservation Status	Number Landed*	Number Oiled**
Non-target (cont'd)	Common Grackle		37	0
	Common Raven		46	0
	Horned Lark		46	0
	Lapland Longspur		10	0
	Lincoln's Sparrow		1	0
	Marsh wren		1	1
	Northern Flicker		1	1
	Red-winged Blackbird		71	0
	Rusty Blackbird	Special Concern	2	0
	Savannah Sparrow		38	0
	Sharp-tailed Grouse	Sensitive	4	0
	Snow Bunting		37	0
	Song sparrow		21	0
	Tree Swallow		1	0
	Unknown Blackbird		3	0
	Unknown Passerine		7	0
	Unknown Songbird		6	0
	Unknown Sparrow		77	0
	Yellow-headed Blackbird		2	0
		Total	**8,724**	**220**

Notes:

* Total of all observations, across all OSBCMP procedures.

** Oiled bird numbers across all observations, across all OSBCMP procedures. Oiled bird numbers are included in the total number landed.

Pink shading indicates species listed under the *Species at Risk Act* (Government of Canada 2015).

Olive shading indicates species listed as Sensitive, May be at Risk, or At Risk by Alberta Environment and Sustainable Resource Development (2010). Species shaded in Pink are also included in the Alberta Environment and Sustainable Resource Development listing.

A8.0 DOCUMENTS CITED

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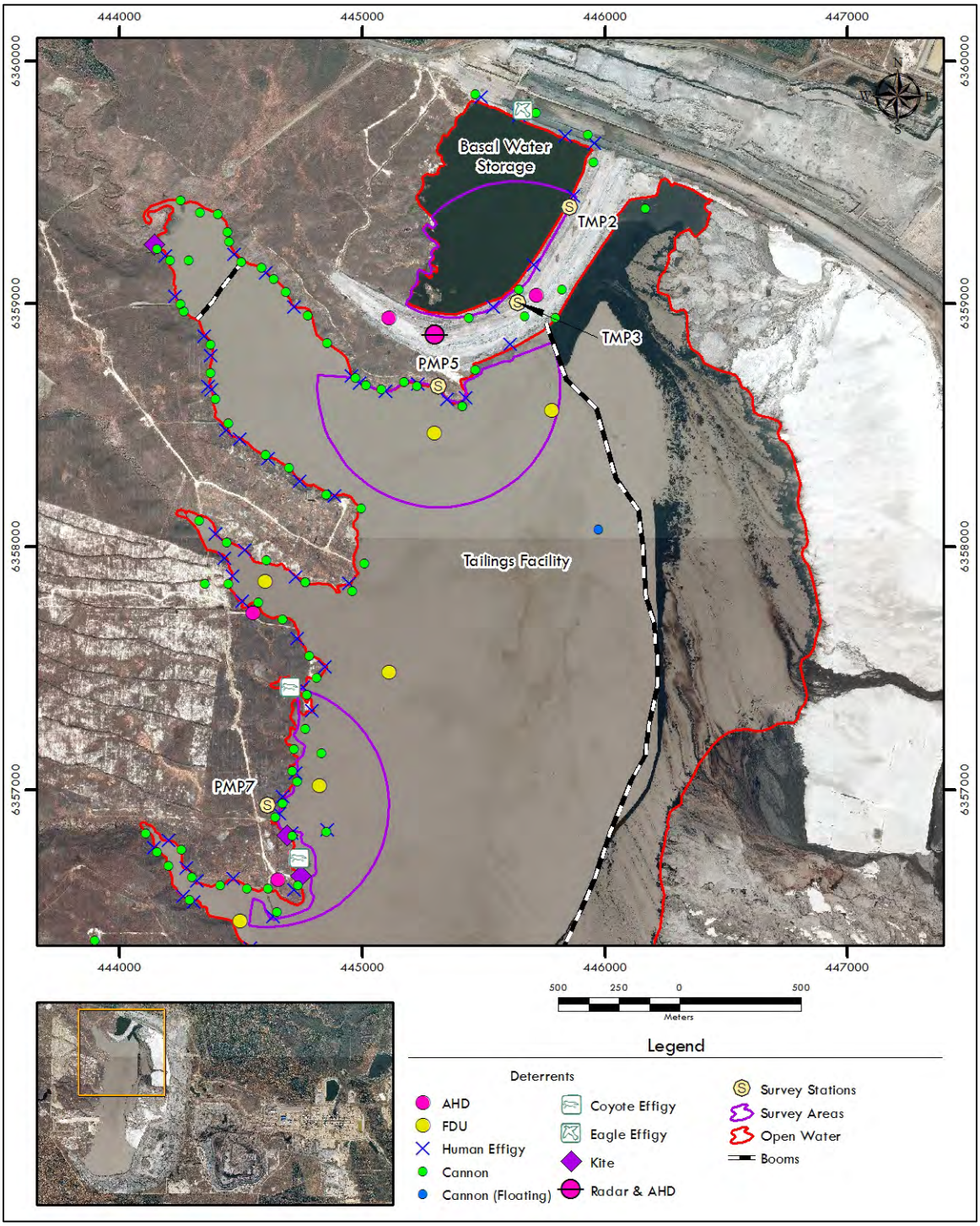
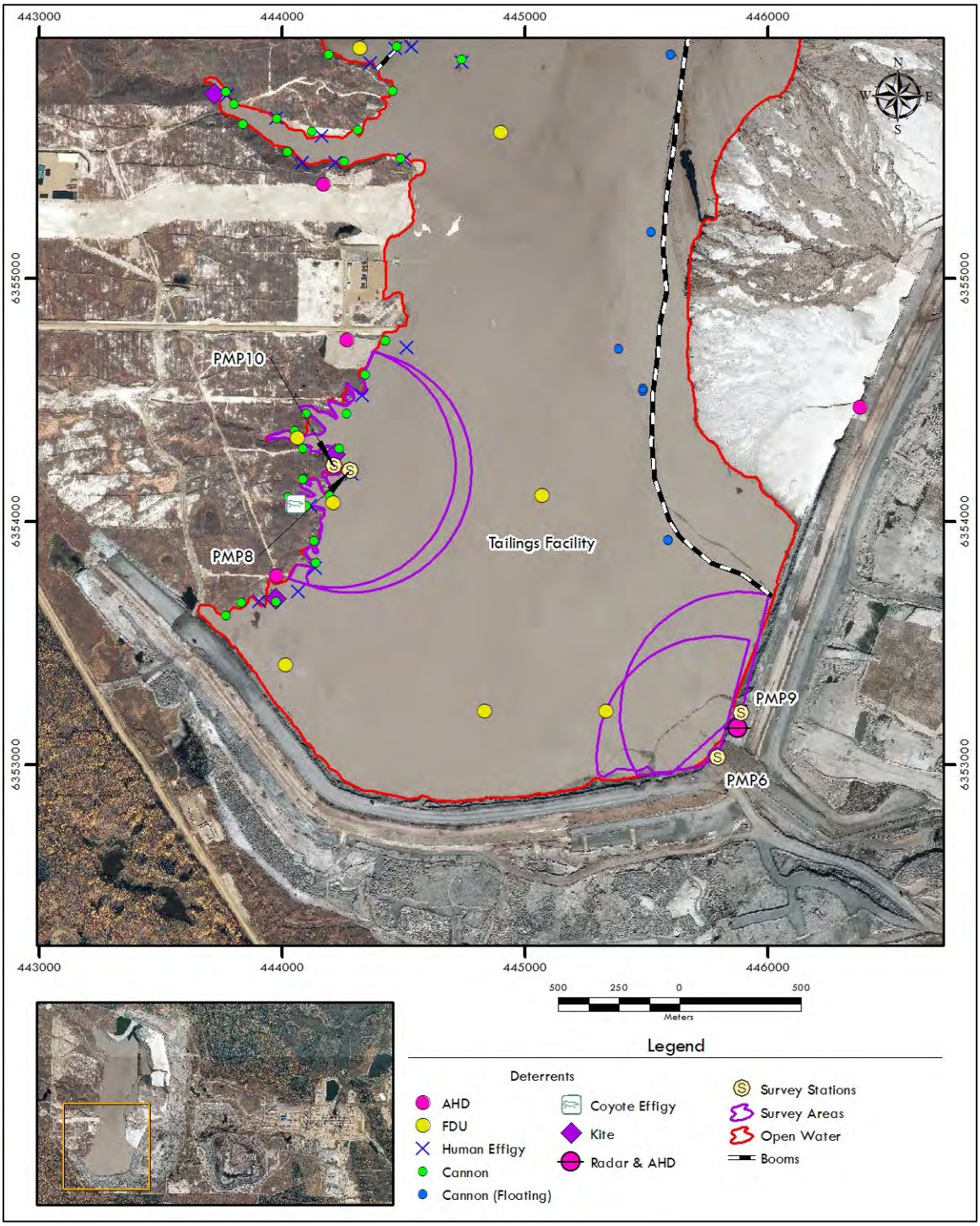
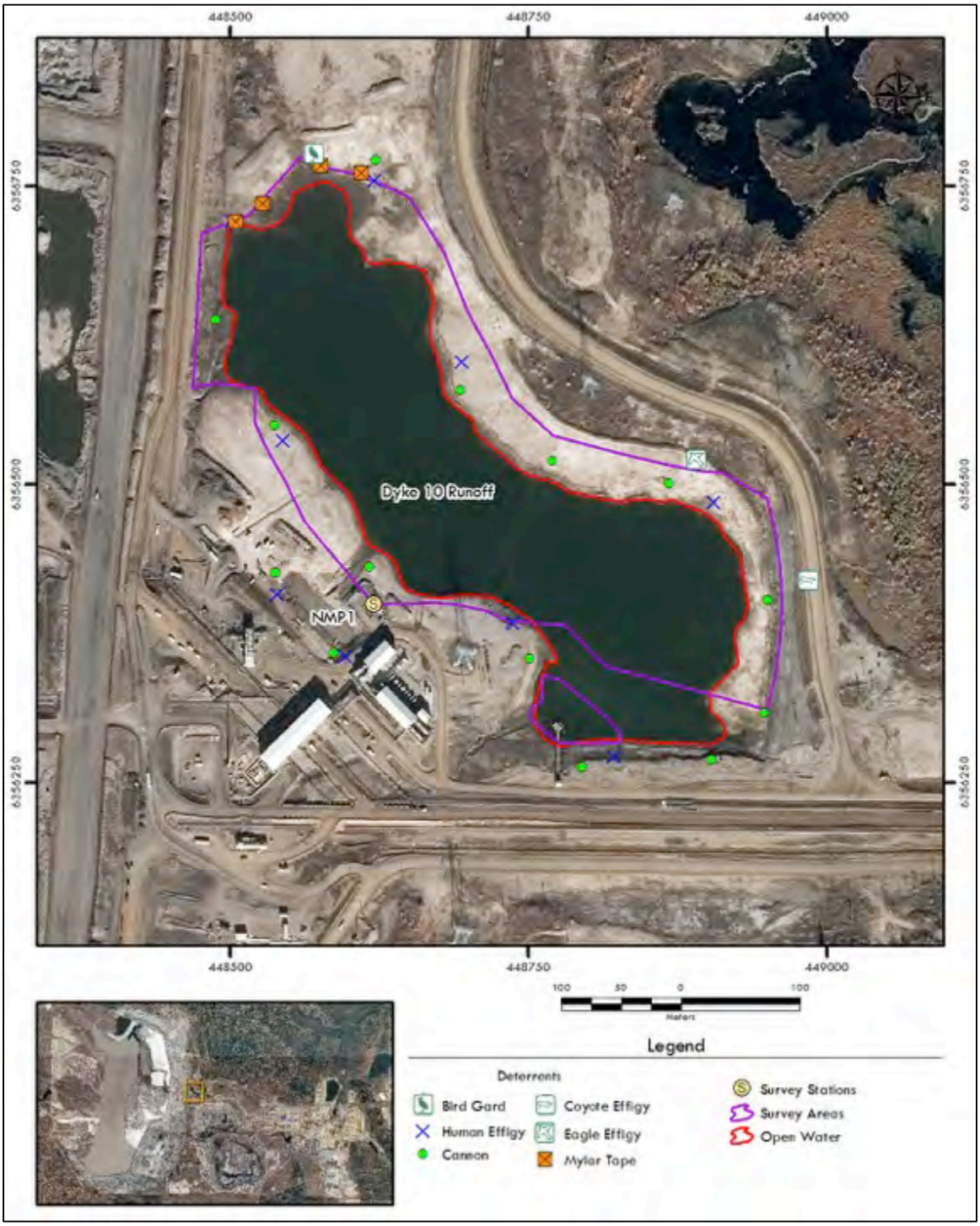
Appendix AI:
Bird Survey Stations and Survey Areas



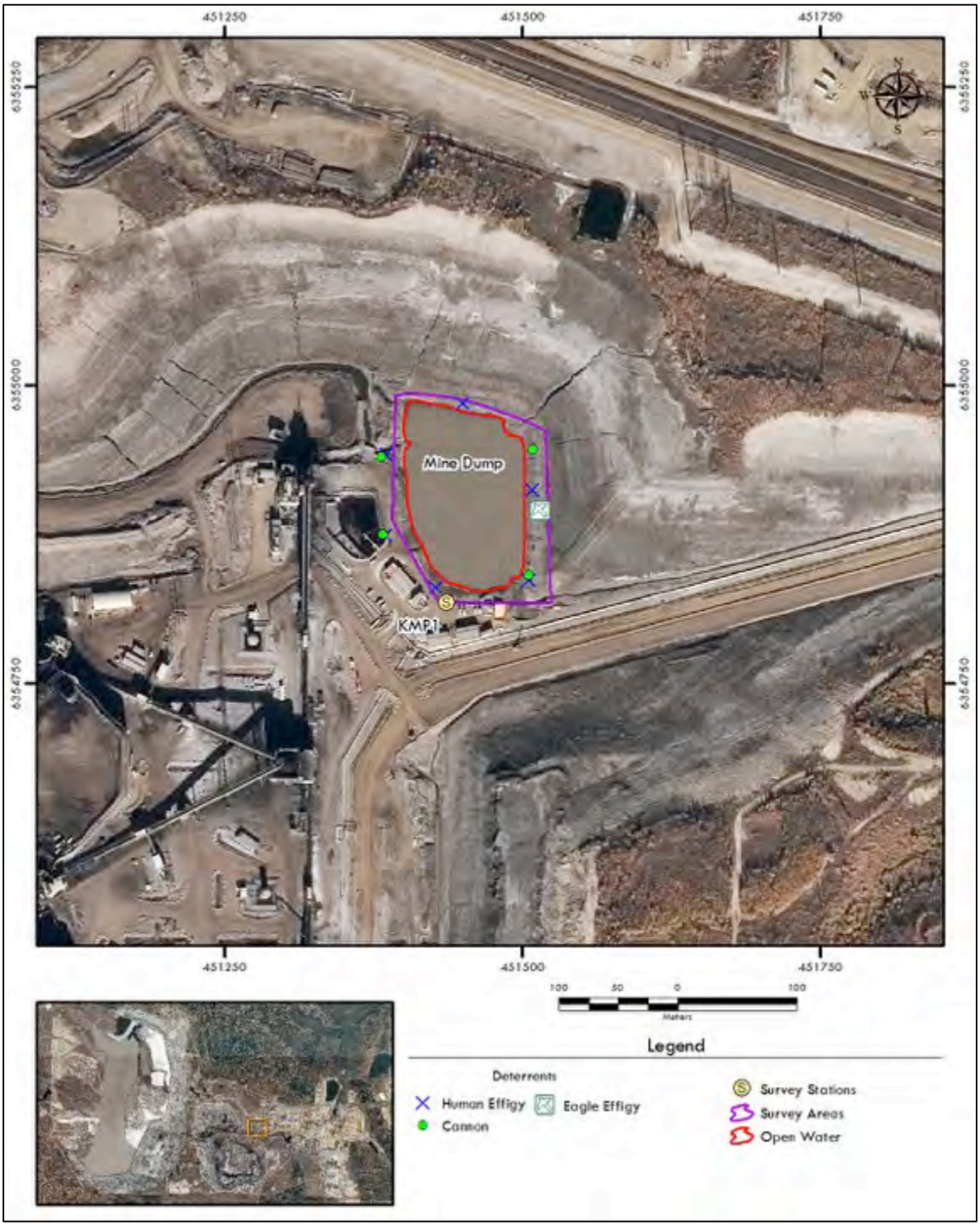
Basal Water Storage (TMP bird survey stations) and
External Tailings Facility (north section, PMP bird survey stations)



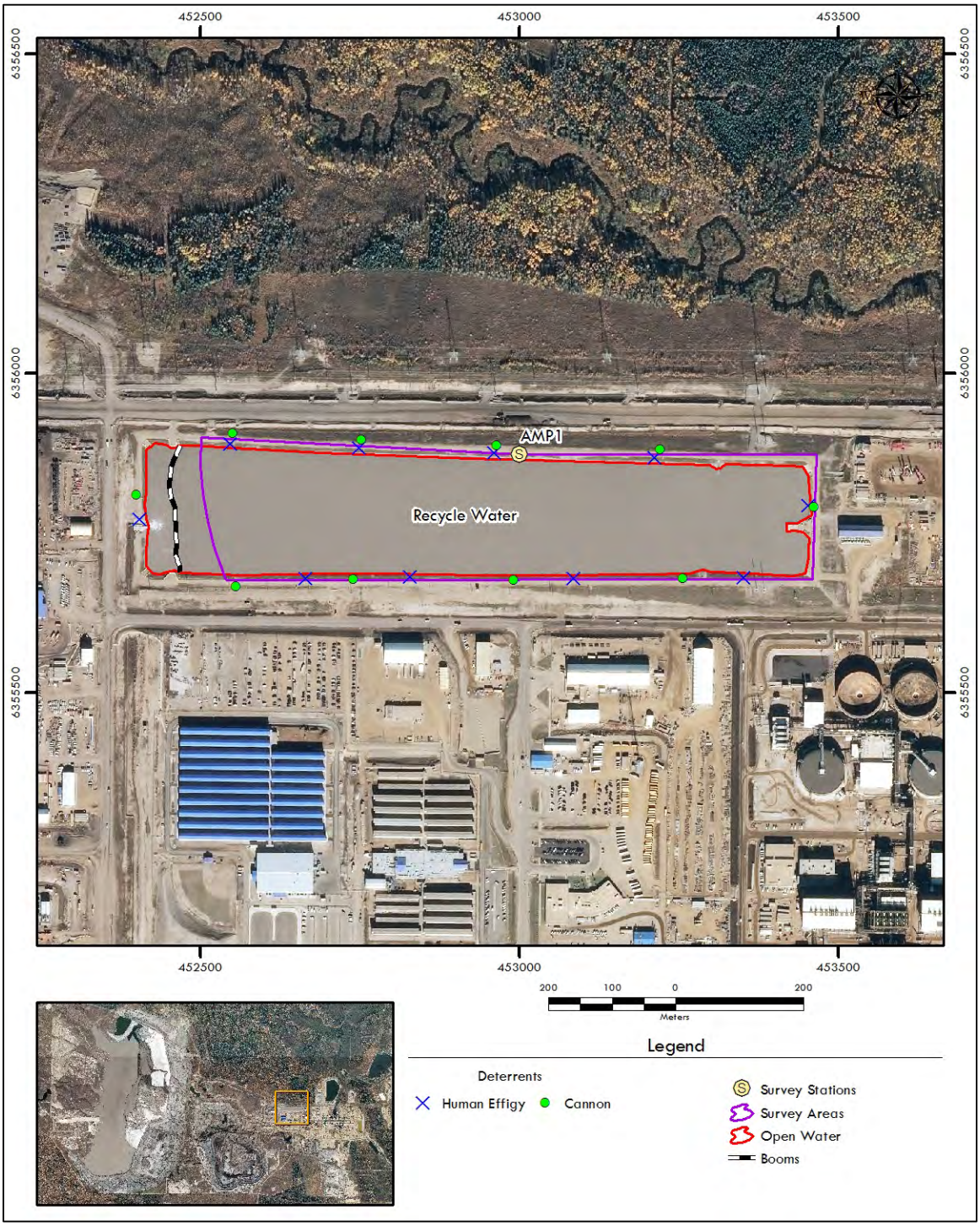
External Tailings Facility (south section, PMP bird survey stations)



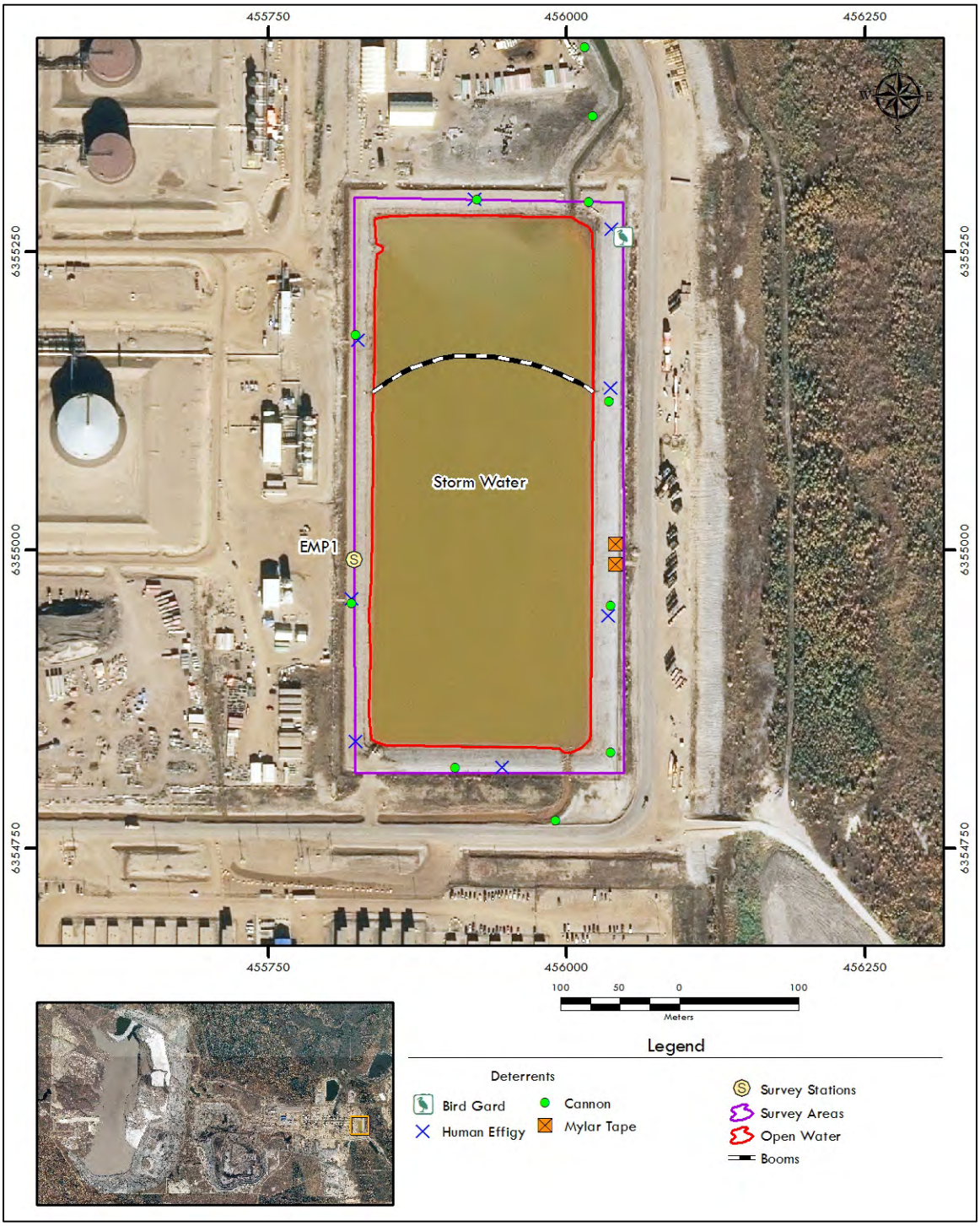
Dyke 10 Runoff (NMP bird survey station)



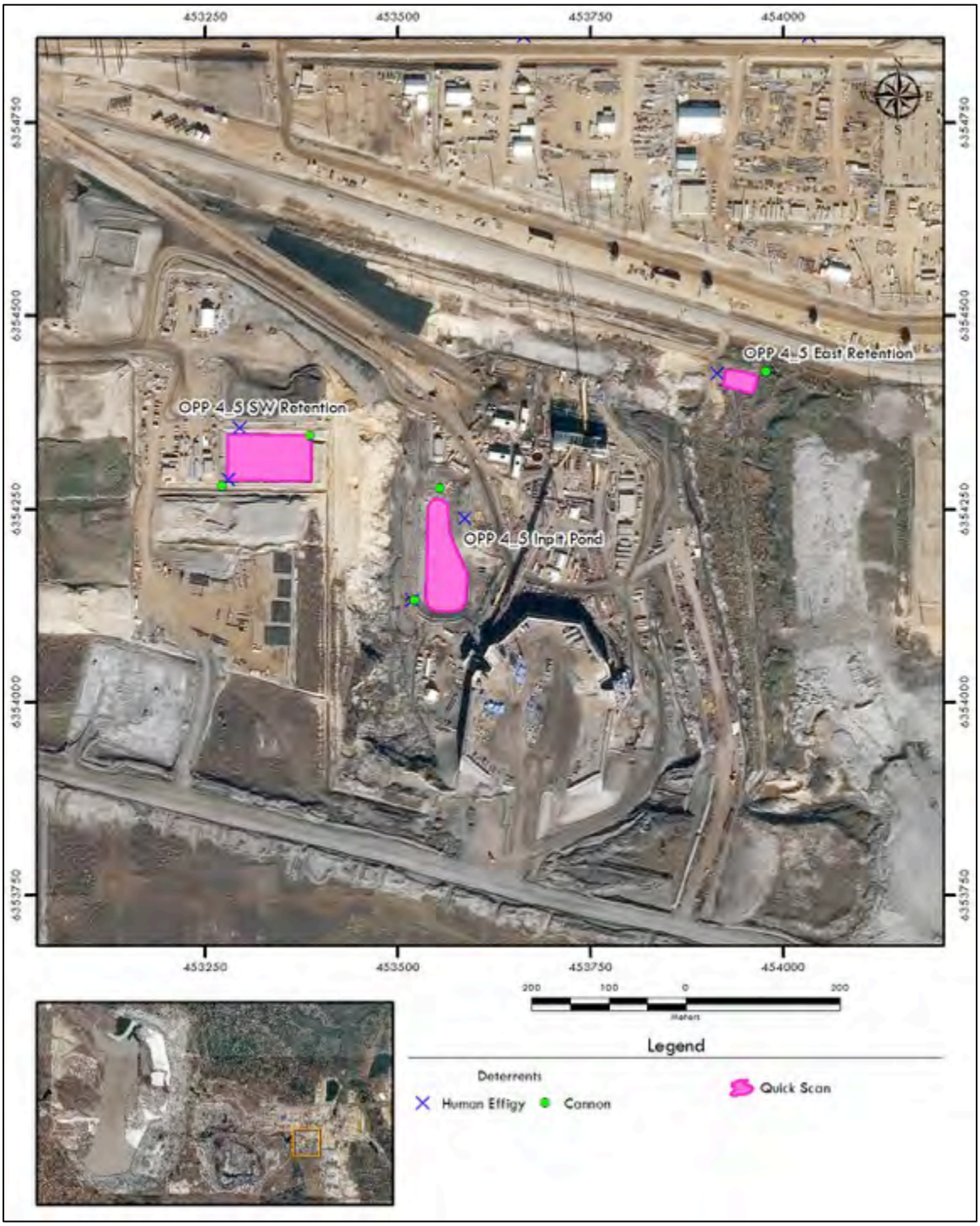
Mine Dump (KMP bird survey station)



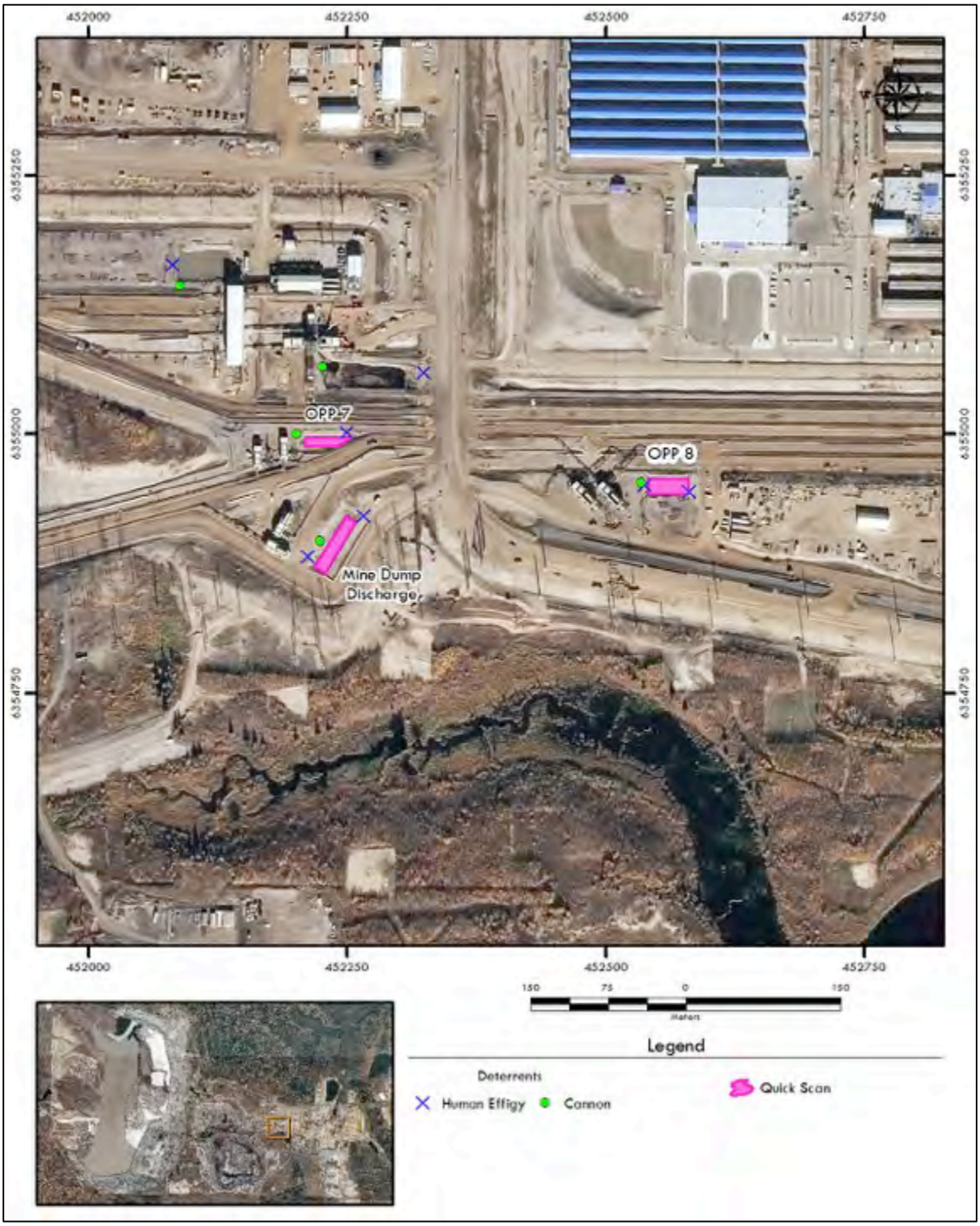
Recycle Water (AMP bird survey station)



Storm Water (EMP bird survey station)



OPP 4/5 LIFs (quick scan procedure)



OPP 7, OPP 8 and Mine Dump Discharge (quick scan procedure)

Appendix AII:
Bird Oiling and Mortality Observations at Horizon Between April 16 and October 31, 2015*

Date	Location	Species	Monitoring Method**	#	Substrate Where Found	State When Found	Oiling Level	End State
Apr 26	ETF - PMP7	Canada Goose	BS	1	Island, non-vegetated	Alive	Light	Alive, not captured
Apr 27	Storm Water	Red-breasted Merganser	MS - Walking Transect	1	Bank, non-vegetated	Dead	Heavy	Dead, collected
Apr 27	ETF	Horned Grebe	MS Inc. Obs. - Hazing	1	Open water	Alive	Light	Alive, not captured
Apr 28	Storm Water	Common Goldeneye	MS Inc. Obs.	1	Bank, non-vegetated	Alive	Heavy	Euthanized
Apr 28	ETF	Mallard	MS Inc. Obs. - Maintenance	1	Emergent vegetation	Alive	Heavy	Euthanized
Apr 29	ETF - PMP7	Canada Goose	BS	1	Island, vegetated	Alive	Light	Alive, not captured
Apr 30	Basal Water Storage - TMP3	Unknown Scaup	BS Inc. Obs.	1	Open water	Alive	Light	Alive, not captured
Apr 30	ETF - PMP7	Canada Goose	BS	1	Island, vegetated	Alive	Light	Alive, not captured
May 01	ETF	American Coot	MS Inc. Obs.	1	Artificial structure	Alive	Moderate	Euthanized
May 01	ETF - PMP7	Canada Goose	BS	1	Island, vegetated	Alive	Light	Alive, not captured
May 02	ETF - PMP7	Canada Goose	BS	1	Island, vegetated	Alive	Light	Alive, not captured
May 03	Roadside Ditch	Mallard	MS Inc. Obs. - Driving	1	Bank, vegetated	Alive	Moderate	Euthanized
May 03	ETF - PMP7	Canada Goose	BS	1	Island, vegetated	Alive	Light	Alive, not captured
May 05	ETF - PMP7	Canada Goose	BS	1		Alive	Light	Alive, not captured
May 06	ETF - PMP7	Canada Goose	BS	1		Alive	Light	Alive, not captured
May 07	ETF	Northern Flicker	MS - Boat Transect	1	Bitumen mat	Dead	Heavy	Dead, collected
May 08	ETF	American Coot	MS - Boat Transect	1	Emergent vegetation	Alive	Moderate	Euthanized
May 10	ETF	American Coot	MS Inc. Obs. - Hazing	1	Open water	Alive	Light	Alive, not captured
May 13	ETF	American Coot	MS Inc. Obs. - Hazing	1	Open water	Alive	Heavy	Euthanized
May 15	ETF	Horned Grebe	MS Inc. Obs. - Hazing	1	Open water	Alive	Moderate	Euthanized
May 17	ETF	Eared Grebe	MS - Boat Transect/Hazing	1	Open water	Alive	Moderate	Euthanized
May 18	ETF	Eared Grebe	MS - Boat Transect/Hazing	1	Open water	Alive	Moderate	Alive, not captured
May 18	ETF	Eared Grebe	MS - Boat Transect/Hazing	1	Open water	Alive	Moderate	Euthanized
May 20	Storm Water	Barn Swallow	MS Inc. Obs.	1	Bank, non-vegetated	Alive	Complete	Euthanized
May 21	ETF	American Coot	MS - Boat Transect	1	Emergent vegetation	Alive	Moderate	Euthanized
May 25	ETF	Eared Grebe	MS Inc. Obs. - Maintenance	1	Bank, vegetated	Alive	Moderate	Euthanized

Date	Location	Species	Monitoring Method**	#	Substrate Where Found	State When Found	Oiling Level	End State
May 28	ETF	Unknown Merganser	MS Inc. Obs.	1	Bank, vegetated	Dead	Heavy	Dead, collected
Jun 03	ETF	American Coot	MS - Boat Transect/Hazing	1	Artificial structure	Alive	Moderate	Alive, not captured
Jun 06	ETF	American Green-winged Teal	MS Inc. Obs. - Hazing	1	Open water	Alive	Moderate	Alive, not captured
Jun 07	ETF	American Green-winged Teal	MS Inc. Obs. - Maintenance	1	Emergent vegetation	Alive	Moderate	Euthanized
Jun 25	ETF	Ruddy Duck	MS Inc. Obs. - Maintenance	1	Open water	Alive	Moderate	Alive, not captured
Jun 25	ETF	Ruddy Duck	MS Inc. Obs. - Hazing	1	Open water	Alive	Moderate	Alive, not captured
Jun 25	ETF - PMP5	Unknown White-headed Gull	BS Inc. Obs.	1	Bank, non-vegetated	Alive	Moderate	Alive, not captured
Jul 04	ETF - PMP8	American White Pelican	BS	1	Open water	Alive	Moderate	Alive, not captured
Jul 18	ETF	Lesser Yellowlegs	MS Inc. Obs. - Hazing	1	Bank, non-vegetated	Alive	Light	Euthanized
Jul 21	ETF	Unknown Duck	MS Inc. Obs. - Hazing	1	Open water	Alive	Heavy	Alive, not captured
Jul 23	ETF	Unknown Gull	MS Inc. Obs. - Hazing	2	Open water	Alive	Light	Alive, not captured
Jul 24	Recycle Water	Eared Grebe	MS Inc. Obs.	1	Bank, vegetated	Alive	Light	Euthanized
Jul 25	Recycle Water - AMP1	Eared Grebe	BS	1	Bank, vegetated	Alive	Moderate	Alive, not captured
Jul 26	ETF	Least Sandpiper	MS Inc. Obs. - Maintenance	1	Emergent vegetation	Alive	Moderate	Euthanized
Jul 26	ETF - PMP7	Lesser Yellowlegs	BS	1		Alive	Light	Alive, not captured
Jul 28	ETF - PMP7	Spotted Sandpiper	BS	1		Alive	Light	Alive, not captured
Jul 29	ETF - PMP8	Franklin's Gull	BS	1	Open water	Alive	Moderate	Alive, not captured
Jul 30	ETF	Unk. Gull	MS - Boat Transect/Hazing	1	Floating woody debris	Alive	Light	Alive, not captured
Jul 30	ETF - PMP7	Spotted Sandpiper	BS	2		Alive	Light	Alive, not captured
Jul 31	Recycle Water	Spotted Sandpiper	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Jul 31	Recycle Water - AMP1	Spotted Sandpiper	BS	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Jul 31	ETF - PMP8	Killdeer	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 01	Dyke 10 Runoff - NMP1	Lesser Yellowlegs	BS	1		Alive	Light	Alive, not captured
Aug 01	Dyke 10 Runoff - NMP1	Semipalmated Sandpiper	BS	2	Flat, non-vegetated	Alive	Light	Alive, not captured
Aug 01	ETF	Unk. Shorebird	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 01	ETF - PMP7	Lesser Yellowlegs	BS	1		Alive	Light	Alive, not captured
Aug 01	ETF - PMP7	Spotted Sandpiper	BS	2		Alive	Light	Alive, not captured

Date	Location	Species	Monitoring Method**	#	Substrate Where Found	State When Found	Oiling Level	End State
Aug 02	Dyke 10 Runoff - NMP1	Lesser Yellowlegs	BS	2		Alive	Light	Alive, not captured
Aug 02	ETF	Lesser Yellowlegs	MS - Boat Transect/Hazing	2	Bank, non-vegetated	Alive	Light	Alive, not captured
Aug 02	ETF	Lesser Yellowlegs	MS Inc. Obs. - Hazing	4	Floating woody debris	Alive	Light	Alive, not captured
Aug 02	ETF - PMP8	Killdeer	BS	2	Bank, vegetated	Alive	Light	Alive, not captured
Aug 03	ETF	Killdeer	MS Inc. Obs. - Maintenance	1	Bitumen	Alive	Moderate	Euthanized
Aug 04	ETF	Unknown Grebe	MS Inc. Obs. - Hazing	1	Open water	Alive	Heavy	Euthanized
Aug 04	ETF - PMP7	Spotted Sandpiper	BS	1	Other	Alive	Light	Alive, not captured
Aug 04	ETF - PMP8	Killdeer	BS	2	Bank, vegetated	Alive	Light	Alive, not captured
Aug 04	Top of Dyke 10	Baird's Sandpiper	BS Inc. Obs.	1	Flat, non-vegetated	Alive	Light	Alive, not captured
Aug 05	Dyke 10 Runoff - NMP1	Lesser Yellowlegs	BS	2		Alive	Light	Alive, not captured
Aug 05	ETF	Eared Grebe	MS - Boat Transect	1	Emergent vegetation	Alive	Heavy	Euthanized
Aug 05	ETF - PMP7	Hudsonian Godwit	BS	1	Flat, vegetated	Alive	Light	Alive, not captured
Aug 05	ETF - PMP7	Lesser Yellowlegs	BS	1	Other	Alive	Light	Alive, not captured
Aug 05	ETF - PMP7	Unknown Dowitcher	BS	2		Alive	Light	Alive, not captured
Aug 05	ETF - PMP8	Killdeer	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 06	ETF	Common Goldeneye	MS - Argo Transect/Hazing	1	Open water	Alive	Heavy	Alive, not captured
Aug 06	ETF	Lesser Yellowlegs	MS Inc. Obs. - Hazing	1	Floating woody debris near shore	Alive	Light	Alive, not captured
Aug 06	ETF	Spotted Sandpiper	MS Inc. Obs. - Hazing	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Aug 06	ETF	Spotted Sandpiper	MS Inc. Obs. - Hazing	1	Bank, non-vegetated	Alive	Light	Euthanized
Aug 06	ETF	Unknown Diver	MS Inc. Obs. - Hazing	1	Floating woody debris	Alive	Heavy	Alive, not captured
Aug 06	ETF	Unknown Diver	MS Inc. Obs. - Hazing	1	Open water	Alive	Light	Alive, not captured
Aug 06	ETF - PMP7	Hudsonian Godwit	BS	1	Emergent vegetation	Alive	Light	Alive, not captured
Aug 06	ETF - PMP7	Lesser Yellowlegs	BS	2		Alive	Light	Alive, not captured
Aug 06	ETF - PMP7	Spotted Sandpiper	BS	2	Other - Floating logs	Alive	Light	Alive, not captured
Aug 06	ETF - PMP7	Unknown Dowitcher	BS	2	Other - Floating logs	Alive	Light	Alive, not captured
Aug 06	ETF - PMP8	Killdeer	BS	2	Flat, vegetated	Alive	Light	Alive, not captured
Aug 06	ETF - PMP8	Spotted Sandpiper	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 07	ETF	Spotted Sandpiper	MS Inc. Obs. - Hazing	1	Flat, vegetated	Alive	Moderate	Euthanized
Aug 07	ETF - PMP7	Lesser Yellowlegs	BS	2	Other	Alive	Light	Alive, not captured

Date	Location	Species	Monitoring Method**	#	Substrate Where Found	State When Found	Oiling Level	End State
Aug 07	ETF - PMP8	Killdeer	BS	1		Alive	Light	Alive, not captured
Aug 08	ETF	Hudsonian Godwit	MS - Boat Transect	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 08	ETF - PMP7	Baird's Sandpiper	BS	1	Other - Floating logs	Alive	Light	Alive, not captured
Aug 08	ETF - PMP7	Hudsonian Godwit	BS	2	Other - Floating logs	Alive	Light	Alive, not captured
Aug 08	ETF - PMP7	Spotted Sandpiper	BS	1	Other - Floating logs	Alive	Light	Alive, not captured
Aug 08	ETF - PMP8	Killdeer	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 09	ETF	Lesser Yellowlegs	MS - Boat Transect	1	Floating muskeg near boom	Alive	Heavy	Euthanized
Aug 09	ETF - PMP7	Spotted Sandpiper	BS	1	Other	Alive	Light	Alive, not captured
Aug 10	ETF	Lesser Yellowlegs	MS Inc. Obs. - Maintenance	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Aug 11	ETF - PMP7	Baird's Sandpiper	BS	1	Other - Floating logs	Alive	Light	Alive, not captured
Aug 12	Coke Runoff	Horned Grebe	MS Inc. Obs. - Maintenance	1	Emergent vegetation	Alive	Moderate	Euthanized
Aug 13	ETF - PMP7	Semipalmated Sandpiper	BS	1	Other - Floating logs	Alive	Light	Alive, not captured
Aug 13	ETF - PMP7	Spotted Sandpiper	BS	2		Alive	Light	Alive, not captured
Aug 14	Dyke 10 Runoff - NMP1	Unk. Calidris Sandpiper	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 14	ETF - PMP7	Baird's Sandpiper	BS	1	Flat, vegetated	Alive	Light	Alive, not captured
Aug 14	ETF - PMP7	Lesser Yellowlegs	BS	1	Bank, vegetated	Alive	Moderate	Alive, not captured
Aug 15	Basal Water Storage - TMP3	Baird's Sandpiper	BS	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Aug 18	Recycle Water - AMP1	Canada Goose	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 18	ETF	Ruddy Duck	MS Inc. Obs. - Hazing	1	Floating logs	Alive	Heavy	Euthanized
Aug 19	Dyke 10 Runoff - NMP1	Lesser Yellowlegs	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 19	ETF	Horned Grebe	MS Inc. Obs. - Maintenance	1	Emergent vegetation	Alive	Heavy	Euthanized
Aug 19	ETF	Lesser Yellowlegs	MS Inc. Obs. - Hazing	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Aug 20	OPP 4/5 SW Retention	Greater Yellowlegs	QS	1	Flat, non-vegetated	Alive	Light	Alive, not captured
Aug 21	ETF - PMP7	Spotted Sandpiper	BS	1	Other - Floating logs	Alive	Light	Alive, not captured
Aug 23	Recycle Water - AMP1	Spotted Sandpiper	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 23	ETF - PMP7	Spotted Sandpiper	BS	1	Island, vegetated	Alive	Light	Alive, not captured
Aug 24	Dyke 10 Runoff - NMP1	American Coot	BS Inc. Obs.	2	Open water	Alive	Light	Alive, not captured
Aug 24	Dyke 10 Runoff - NMP1	Unk. Scaup	BS Inc. Obs.	1	Bank, vegetated	Alive	Light	Alive, not captured

Date	Location	Species	Monitoring Method**	#	Substrate Where Found	State When Found	Oiling Level	End State
Aug 24	ETF	Common Goldeneye	MS Inc. Obs. - Hazing	2	Open water	Alive	Heavy	Euthanized
Aug 24	ETF	Lesser Yellowlegs	MS Inc. Obs. - Hazing	1	Floating woody debris	Alive	Light	Alive, not captured
Aug 25	Dyke 10 Runoff	Lesser Scaup	MS Inc. Obs. - Hazing	1	Open water	Alive	Light	Alive, not captured
Aug 25	Dyke 10 Runoff - NMP1	American Coot	BS	1	Open water	Alive	Light	Alive, not captured
Aug 25	Dyke 10 Runoff - NMP1	Unknown Scaup	BS	1		Alive	Moderate	Alive, not captured
Aug 25	ETF	Double-crested Cormorant	MS Inc. Obs. - Hazing	1	Open water	Alive	Complete	Euthanized
Aug 25	ETF	Greater Yellowlegs	MS Inc. Obs. - Hazing	1	Emergent vegetation	Alive	Light	Alive, not captured
Aug 25	ETF	Ring-necked Duck	MS Inc. Obs. - Hazing	1	Open water	Alive	Heavy	Euthanized
Aug 26	Basal Water Storage - TMP3	Spotted Sandpiper	BS	1	Island, non-vegetated	Alive	Light	Alive, not captured
Aug 26	Dyke 10 Runoff - NMP1	American Coot	BS	2		Alive	Light	Alive, not captured
Aug 26	ETF	American Coot	MS - Boat Transect/Maintenance	1	Open water	Alive	Moderate	Alive, not captured
Aug 26	ETF - PMP7	Lesser Yellowlegs	BS	1		Alive	Light	Alive, not captured
Aug 27	Dyke 10 Runoff - NMP1	American Coot	BS	1	Open water	Alive	Light	Alive, not captured
Aug 27	Dyke 10 Runoff - NMP1	Ring-necked Duck	BS	1	Open water	Alive	Light	Alive, not captured
Aug 27	ETF - PMP7	Spotted Sandpiper	BS	1	Other	Alive	Light	Alive, not captured
Aug 28	ETF - PMP7	Lesser Yellowlegs	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 29	ETF	Wilson's Snipe	MS Inc. Obs. - Maintenance	1	Flat, vegetated	Alive	Moderate	Euthanized
Aug 29	ETF - PMP7	Lesser Yellowlegs	BS	1	Emergent vegetation	Alive	Light	Alive, not captured
Aug 30	Recycle Water - AMP1	Spotted Sandpiper	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 30	ETF	Black-bellied Plover	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Aug 30	ETF - PMP7	Greater Yellowlegs	BS	1	Island, vegetated	Alive	Light	Alive, not captured
Aug 30	ETF - PMP7	Spotted Sandpiper	BS	1	Other	Alive	Light	Alive, not captured
Aug 31	Recycle Water	Marsh wren	MS Inc. Obs.	1	Bank, vegetated	Alive	Moderate	Euthanized
Aug 31	ETF	Black-bellied Plover	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 01	Basal Water Storage - TMP3	Baird's Sandpiper	BS	1	Island, vegetated	Alive	Light	Alive, not captured
Sep 01	Basal Water Storage - TMP3	Lesser Yellowlegs	BS	1	Island, vegetated	Alive	Light	Alive, not captured

Date	Location	Species	Monitoring Method**	#	Substrate Where Found	State When Found	Oiling Level	End State
Sep 01	ETF	Lesser Yellowlegs	MS Inc. Obs. - Hazing	2	Emergent vegetation	Alive	Light	Alive, not captured
Sep 01	ETF	Spotted Sandpiper	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 01	ETF - PMP7	Greater Yellowlegs	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 01	ETF - PMP7	Spotted Sandpiper	BS	1	Other - Floating logs	Alive	Light	Alive, not captured
Sep 02	ETF	American Green-winged Teal	MS Inc. Obs. - Hazing	1	Open water	Alive	Light	Alive, not captured
Sep 03	ETF	American Coot	MS Inc. Obs. - Hazing	1	Open water	Alive	Light	Euthanized
Sep 03	ETF	Canada Goose	MS Inc. Obs.	1	Berm around Tailings	Alive	Moderate	Alive, not captured
Sep 04	ETF	American Green-winged Teal	MS Inc. Obs. - Hazing	1	Open water	Alive	Light	Alive, not captured
Sep 04	ETF	Bufflehead	MS Inc. Obs. - Hazing	1	Open water	Alive	Complete	Euthanized
Sep 05	Dyke 10 Runoff - NMP1	Baird's Sandpiper	BS	1	Flat, non-vegetated	Alive	Light	Alive, not captured
Sep 06	Dyke 10 Runoff - NMP1	Baird's Sandpiper	BS	1	Flat, non-vegetated	Alive	Light	Alive, not captured
Sep 06	ETF	Spotted Sandpiper	MS Inc. Obs. - Hazing	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Sep 08	Freshwater Pond West of Tailings	Mallard	MS Inc. Obs. - Hazing	1	Bank, non-vegetated	Alive	Moderate	Alive, not captured
Sep 09	Dyke 10 Runoff - NMP1	Baird's Sandpiper	BS	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Sep 10	Dyke 10 Runoff - NMP1	Baird's Sandpiper	BS	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Sep 10	Freshwater pond near PMP7	Gadwall	BS Inc. Obs.	1	Bank, vegetated	Alive	Moderate	Alive, not captured
Sep 10	ETF	American Coot	MS Inc. Obs. - Hazing	1	Island, vegetated	Alive	Heavy	Euthanized
Sep 12	ETF	American Coot	MS – Boat Transect/Hazing	1	Bitumen mat	Alive	Heavy	Alive, not captured
Sep 12	ETF - PMP7	Black-bellied Plover	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 13	ETF	American Coot	MS - Boat Transect/Hazing	2	Other	Alive	Heavy	Euthanized
Sep 13	Dyke 10 Runoff	Baird's Sandpiper	MS Inc. Obs. - Hazing	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Sep 13	Dyke 10 Runoff - NMP1	Baird's Sandpiper	BS	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Sep 13	Freshwater pond near PMP7	Gadwall	BS Inc. Obs.	1	Open water	Alive	Moderate	Alive, not captured
Sep 13	ETF	Gadwall	MS Inc. Obs.	1	Emergent vegetation	Alive	Moderate	Euthanized
Sep 15	Basal Water Storage - TMP3	Black-bellied Plover	BS	1	Bank, non-vegetated	Alive	Light	Alive, not captured

Date	Location	Species	Monitoring Method**	#	Substrate Where Found	State When Found	Oiling Level	End State
Sep 15	ETF - PMP7	Unknown Plover	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 16	ETF - PMP7	Black-bellied Plover	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 17	ETF	Blue-winged Teal	MS Inc. Obs. - Hazing	1	Open water	Alive	Light	Alive, not captured
Sep 17	ETF - PMP7	Black-bellied Plover	BS	1	Other	Alive	Light	Alive, not captured
Sep 18	ETF	Black-bellied Plover	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 18	ETF - PMP7	Black-bellied Plover	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 20	ETF - PMP7	American Golden-plover	BS	1	Bank, vegetated	Alive	Light	Alive, not captured
Sep 23	ETF	American Golden-Plover	MS - Boat Transect/Hazing	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Sep 23	ETF - PMP7	American Golden-plover	BS	1		Alive	Light	Alive, not captured
Sep 28	ETF	American Golden-Plover	MS Inc. Obs. - Hazing	3	Bank, non-vegetated	Alive	Light	Alive, not captured
Sep 29	ETF	Snow Goose	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, cleaned and released
Oct 06	Freshwater Pond West of the ETF	Ring-necked Duck	MS Inc. Obs.	1	Open water	Alive	Light	Alive, not captured
Oct 09	ETF	Snow Goose	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Oct 10	ETF	Snow Goose	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Oct 11	ETF	Snow Goose	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Alive, not captured
Oct 16	ETF	Snow Goose	MS Inc. Obs. - Hazing	6	Bank, vegetated	Alive	Light	Alive, not captured
Oct 16	ETF	Snow Goose	MS Inc. Obs. - Hazing	1	Bank, vegetated	Alive	Light	Euthanized
Oct 25	ETF	Unknown Grebe	MS - Boat Transect	1	Bitumen mat near boom	Alive	Complete	Euthanized
Oct 28	ETF	Unknown Scaup	MS - Boat Transect	1	Open water	Alive	Moderate	Euthanized
Oct 29	Storm Water	Lesser Scaup	MS Inc. Obs.	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Oct 29	Storm Water - EMP1	Unknown Scaup	BS	1	Bank, non-vegetated	Alive	Light	Alive, not captured
Oct 30	ETF	Bufflehead	MS - Boat Transect	1	Emergent vegetation	Alive	Moderate	Euthanized

Notes:

* It is possible that birds observed on one day were observed subsequently, and if so, duplicate entries of the same bird are included in this table. However, confirmation of any of these possibilities is difficult and therefore, no attempt to cross-reference between apparent or possible duplicate entries has been made.

** Monitoring methods: MS = mortality search personnel; BS = bird survey personnel; QS = quick scan personnel; Inc. Obs. = incidental observation; Maintenance = deterrent maintenance.

Purple shading indicates a dead/euthanized or heavily oiled bird.

March 2016

KEARL OIL SANDS SITE

2015 Imperial OSBCMP Summary Report

Submitted to:
Rhiannon Davies
Kearl Wildlife, Wetlands and Fish Advisor
Imperial

REPORT

Report Number: 1640058

Golder Associates

Amanda Schiaroli, B.Sc., P.Biol.
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29 March 2016

Terence Ko
Alberta Energy Regulator
111 Twin Atria Building
4999 – 98 Avenue
Edmonton, Alberta, T6B 2X3

ATTN: Terence Ko

RE: 2015 OSBCMP Report

Please find the Imperial Oil section enclosed as part of the regional 2015 Annual Bird Monitoring Report, in accordance with the requirements of the Oil Sands Bird Contact Monitoring Plan for 2015 (required by AESRD in fulfillment of clauses 6.1.77 (b) and 6.1.78 of Environmental Protection and Enhancement Act (EPEA) Approval 46586-00-00).

Kearl production continued in 2015 and ponds were monitored regularly during 2015. Bird deterrents and monitoring continued at process affected ponds throughout the bird monitoring season.

If you have any questions, please contact Rhiannon Davies at (587) 476-4274.

Sincerely,

Amanda Schiaroli, B.Sc. P.Biol.
Kearl Environment and Regulatory Team Lead

cc:
Kearl Oil Sands Document Control (Imperial)
Rhiannon Davies (Imperial)
Marie Nietfield (AER)
Kenneth Yap (AER)
Joann Skilnick (AEP)
Andrea McGregor (AEP)
Richard Wiacek (Environment Canada)

Attachments:
2015 OSBCMP Report

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TABLES

FIGURES

B1.0 INTRODUCTION

The northern extent of the oil sands lies 150 km south of the Peace – Athabasca Delta, one of the world's largest deltas and a particularly important breeding site for waterfowl (Hennan and Munson 1979). The oil sands region is also at the confluence of all four continental flyways, which leads to considerable migratory bird traffic near or directly above oil sands developments. This puts a large number of migrating birds in close proximity to water bodies on oil sands leases, including tailings and other ponds that contain the by-products of oil extraction, including bitumen or process-affected (PA) water (Golder 2000). Weather conditions can quickly deteriorate during periods of migration, forcing large numbers of waterfowl to seek refuge wherever available. Without adequate detection and deterrent systems in place, the risk of birds visiting a PA pond, including mass landings, may be heightened during adverse weather conditions. To implement a more effective bird detection and deterrent system (BDDS), data on the presence and behavior of birds have been collected at ponds on or near the Imperial Oil Resources Limited (Imperial) Kearl Oil Sands (Kearl) site since 2011.

The Imperial Kearl site is located in the oil sands region, roughly 75 km north of Fort McMurray, Alberta. There are 19 ponds at Kearl that were evaluated using the Liquid Impoundment Facility (LIF) Risk Model (see Section 3.0) and incorporated into the 2015 Oil Sands Bird Monitoring Program (OSBCMP).

B2.0 APPROVAL AND WATERFOWL PROTECTION PLAN-RELATED REQUIREMENTS AND ACTIVITIES

This report was completed as a requirement for Imperial to participate in regional monitoring programs, as outlined in Imperial's Waterfowl Protection Plan (WPP). The WPP in turn is a requirement of Imperial's EPEA Approval Conditions (EPEA Approval No. 46586-00-00; clauses 6.1.76, 6.1.77, and 6.1.78).

B3.0 LIQUID IMPOUNDMENT FACILITY RISK MODEL

B3.1 Inclusion List

The LIFs at the Kearl site were evaluated using the inclusion and exclusion criteria in the 2015 OSBCMP Protocol. Following these evaluations, three LIFs (East ETA, West ETA, Pond 5; see Table 1) were identified as carrying a higher risk for bird mortalities and selected for bird surveys and mortality searches during the 2015 OSBCMP at Kearl. A further 16 LIFs were selected for quick scans based on risk matrix criteria.

Table 1: Liquid Impoundment Facilities Evaluated and Survey Selections Made at Imperial Kearl in 2015

Liquid Impoundment Facility	Station (if applicable)	Station Survey Area [ha]	Survey Selection
East ETA	East ETA - NE	33.6	Bird Survey, Mortality Search
	East ETA – NE_2	32.7	Bird Survey, Mortality Search
	East ETA - NW	24.2	Bird Survey, Mortality Search
	East ETA – NW_2	11.8	Bird Survey, Mortality Search
Pond 5	Pond 5	6.7	Bird Survey, Mortality Search
West ETA	West ETA – NE_A	40.6	Bird Survey, Mortality Search
	West ETA – NE_B	61.6	Bird Survey, Mortality Search
	West ETA – NW_1	28.3	Bird Survey, Mortality Search
	West ETA – NW_2	26.4	Bird Survey, Mortality Search
KEP Extraction EDP		0.66	Quick Scan, Mortality Search
KEP Froth Pond		0.88	Quick Scan, Mortality Search
KEP Raw Water Pond		17.14	Quick Scan, Mortality Search
KEP 3 Rupture Disk		0.05	Quick Scan, Mortality Search
KEP 4/5 Rupture Disk		0.08	Quick Scan, Mortality Search
KID Raw Water Pond		1.95	Quick Scan, Mortality Search
NODA Runoff Pond		4.26	Quick Scan, Mortality Search
OPP2 Crusher Sump		0.34	Quick Scan, Mortality Search
OPP2 Drainage Pond		2.22	Quick Scan, Mortality Search
OPP2 EDP		0.24	Quick Scan, Mortality Search
Pond 4		1.75	Quick Scan, Mortality Search
Pond 6		0.57	Quick Scan, Mortality Search
Pond 7		2.77	Quick Scan, Mortality Search
West ETA Debris Dyke		6.70	Quick Scan, Mortality Search
West ETA Drainage 1A		1.01	Quick Scan, Mortality Search
West ETA Drainage 2		1.66	Quick Scan, Mortality Search

B3.2 Liquid Impoundment Facility Descriptions

B3.2.1 Liquid Impoundment Facilities Evaluated with Bird Surveys

The West ETA and East ETA are the two largest LIFs at the Kearl site by surface area. The West ETA contained PA water throughout 2015, while the East ETA began receiving PA water in September. Both LIFs carried high landing potential, and evaluation through the six-step LIF risk model (OMEI 2015) indicated that both water bodies should be monitored through bird surveys and mortality searches.

Pond 5 contains fresh water and has a surface area of 6.7 ha, but is in close proximity to the East ETA and complex nesting habitat. Following the six-step LIF risk model evaluation, Pond 5 was selected for bird surveys and mortality searches.

B3.2.2 Liquid Impoundment Facilities Evaluated with Quick Scans

Of the 16 LIFs ultimately selected for quick scans, only West ETA Drainage 2 contained both emergent and perimeter-based vegetation as potential bird attractants. Evaluation through the LIF risk model established all 16 LIFs as carrying a low risk for bird mortalities, rendering them eligible for monitoring through quick scans or incidental observations. Imperial elected to pursue quick scans as an observation technique.

B4.0 DETERRENTS

The bird deterrent and detection system (BDDS) at the Kearl site utilizes both radar-linked and random-fire components. Deployment of the BDDS in 2015 began on March 1st, and the system remained deployed until November 20th following signoff through the seasonal decommissioning approval process. Deterrents remained in approximately the same location throughout the 2015 season.

The West ETA, as the largest PA pond at the Kearl site in 2015, featured the most comprehensive BDDS. A DeTect MERLIN Avian Radar unit was linked to four land-based long range acoustic devices (LRADs). These LRADs were stationed on the West ETA's northwest, northeast, southwest and southeast shores. Following the detection of an incoming object by the radar unit, the nearest LRAD would activate and emit noises designed to deter any birds approaching the pond. These noises increase in intensity and biological significance (e.g., bird distress calls) if the detected bird continued on a path over the ETA. This radar-linked approach is designed to reduce the likelihood that incoming birds would become habituated to deterring noises; if a noise is not clearly associated with danger, birds may cease to be deterred by it. The West ETA also featured floating effigies, radar-linked propane cannons and lasers, as well as land-based random-fire propane cannons and Eagle kites. Imperial, with support from DeTect Inc. and SGS Canada Inc. (SGS), was responsible for the set-up and decommissioning of the radar system, while daily maintenance of the radar system and downloading of captured radar images was conducted by SGS.

The large size of the West ETA facilitated the use of watercraft as mobile deterrents. Two motorized 4.5 m boats and an air boat allowed personnel to approach and deter birds that had landed on the water throughout the 2015 season. The rapid speed, loud noise and considerable air disturbance generated by the air boat appears to make it a more effective deterrent than the motorized boats.

A second radar station and set of five LRADs operated at the East ETA in 2015.

Bird deterrents on the majority of PA water ponds, excluding the West ETA and East ETA described above, were exclusively random-fire propane cannons, omni directional speakers and land-based visual deterrents.

The migratory patterns of birds were taken into consideration when decommissioning bird deterrents. The majority of waterfowl and shorebirds migrate primarily at night and may land abruptly during inclement weather. Beginning in early October, overnight radar scans over the West ETA and East ETA ponds were analyzed for signs of migratory activity and were used to dictate when deterrents would be dismantled and removed from the area. Daytime observations of on-site bird activities were also assessed as indicators of the autumn migration's progress, as were prevailing weather conditions. Using this technique, the migration season was established as having concluded in mid-November, with deterrents being removed the following week. No deterrents were intentionally left on PA ponds over the winter.

B5.0 VEGETATION/HABITAT MANAGEMENT

Booms were deployed on the West ETA pond in order to minimize the spread of bitumen over the pond's surface. The booms were deployed as the pond surface cleared of ice in the spring (March/April), and decommissioned in November following the effective end of the autumn migration.

Vegetation along the northern and eastern shores of the West ETA was completely removed between May and August to minimize the potential for its use as forage habitat for cranes and geese or breeding habitat for

shorebirds. Vegetation was also removed from the western and northern shores of the East ETA over the same period. Following the end of the bird breeding season, small ponds of standing water were removed from the northern section of the West ETA in order to reduce the risk of birds breeding nearby in subsequent years. Coarse Sand Tailings (CST) were distributed throughout some of the lower lying areas in the East ETA through the Fall months which significantly covered / plated areas of noted vegetation and free standing water bodies during the 2015 bird season.

Imperial employees and contractors were regularly reminded to reduce food waste as much as possible in order to prevent attracting wildlife into hazardous areas. All workers on site were also instructed to report on-site bird sightings, particularly when these birds were observed above, near, or on ponds containing PA water.

B6.0 SITE-LEVEL ADJUSTMENTS AND DEVIATIONS

No adjustments were made to the 2015 OSBCMP protocol at the site level.

B7.0 OBSERVATIONS AT THE SITE LEVEL

B7.1 Bird Surveys

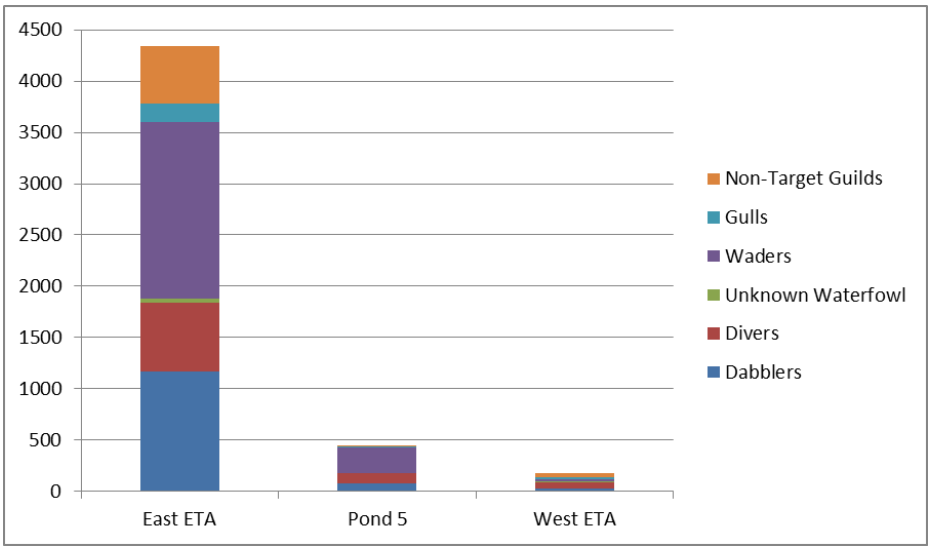
Bird surveys at the West ETA, East ETA, and Pond 5 commenced on April 16th and continued until October 31st. The open water surface areas of both the East ETA and West ETA necessitated two survey stations for each LIF, as per the 2015 OSBCMP Protocol. The open water surface area of Pond 5 was established as 6.7 ha and required one survey station. Each survey station was visited six days per week. Observed birds, when they could be positively identified, were categorized as being dabblers, divers, waders, gulls, or members of non-target guilds.

At the East ETA, a survey station was established at both the northwest and northeast quadrant of the LIF. At the northeast quadrant, station ‘East ETA – NE’ was visited from April 17th to September 15th, when it was replaced by station ‘East ETA – NE_2’; the new station was utilized from September 17th to the end of the program on October 31st. At the northwest quadrant, station ‘East ETA – NW’ was used from April 16th to September 26th. Station ‘East ETA – NW_2’ was visited from September 27th to October 31st.

Two survey sites were established at the northeast and northwest quadrants of the West ETA. In the northeast quadrant, site ‘West ETA – NE_A’ was utilized from April 16th to June 4th, when it was replaced by site ‘West ETA – NE_B’ for the remainder of the program. In the northwest quadrant, station ‘West ETA – NW_1’ was visited from April 17th to May 14th. On May 15th, station ‘West ETA – NW_1A’ was utilized, but for the remainder of the program the survey site ‘West ETA – NW_2’ was used.

A total of 4,958 birds were observed during surveys at Kearl in 2015 (Figure 1). Of these 4,958 birds, 4,338 (87.5%) were observed at the East ETA, 441 (8.9%) were observed at Pond 5 and 179 (3.6%) were observed at the West ETA. Notably, the number of landed birds observed at the West ETA in 2015 was an 82.4% reduction from the previous year; 1,016 landed birds were observed there in 2014.

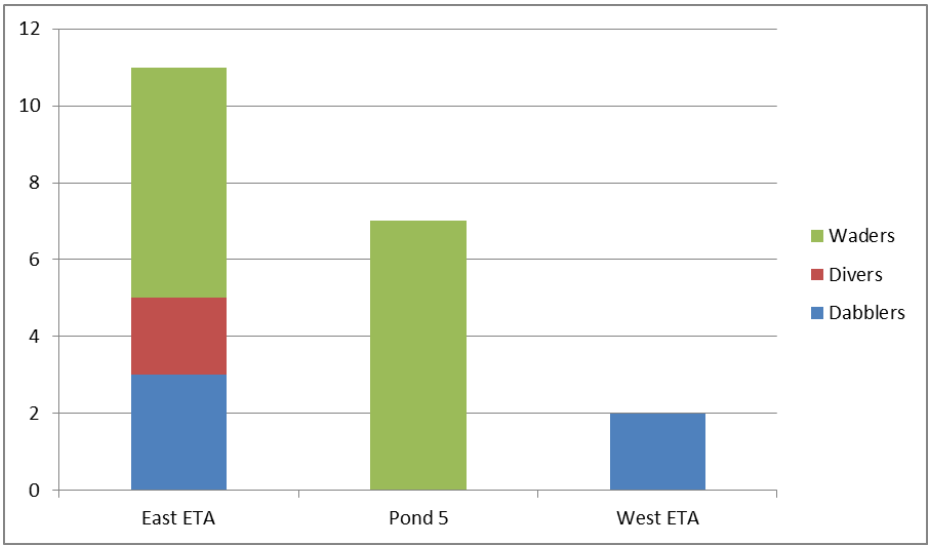
Figure B1: Number of birds, by guild, recorded at surveyed LIFs at Kearl in 2015



Across the three LIFs selected for bird surveys in 2015, 1,989 waders were observed (40.1% of all observed birds). Other guilds recorded included 1,267 dabblers (25.6%), 841 divers (17%), 214 gulls (4.3%) and 52 unknown waterfowl (1%). Non-target guilds accounted for 595 (12%) birds.

Twenty birds were identified as being oiled during bird surveys (Figure 2). Of the identified birds, 17 were lightly oiled, two moderately oiled, and one completely oiled bird was found deceased and was recovered. Thirteen of these oiled birds were identified as waders, five were dabblers, and two were divers. No oiled gulls or members of non-target guilds were observed during surveys.

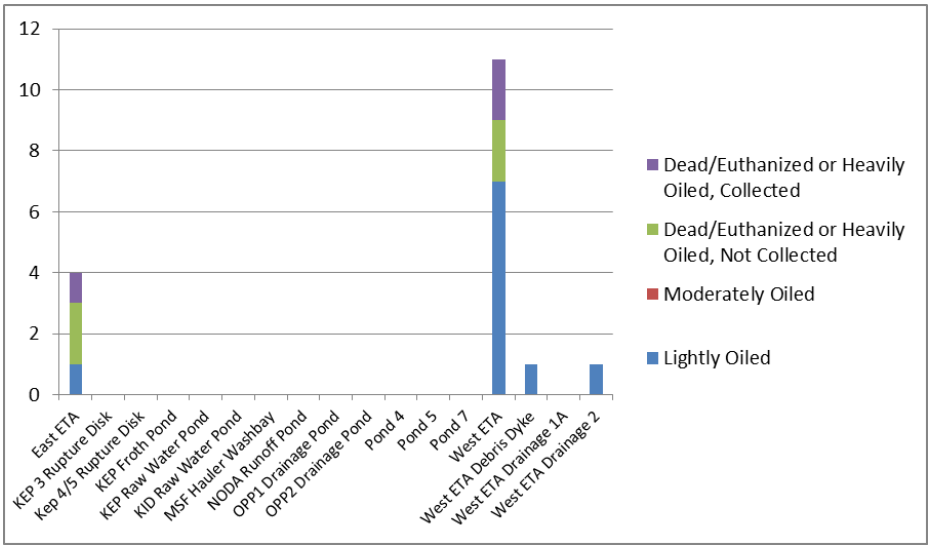
Figure B2: Number of oiled birds, by guild, recorded at surveyed LIFs at Kearl in 2015



B7.2 Mortalities

Mortality searches were conducted at 19 LIFs at the Kearl site in 2015 (Table1, Figure 3). Seventeen birds were observed during mortality searches; while a further 19 birds were observed incidentally (see Incidental Sightings below). Of the 17 birds observed during mortality searches, 10 were recorded as lightly oiled. The remaining seven birds were recorded in the dead/euthanized or heavily oiled category. Six of these birds were heavily and completely oiled, and one was found moderately oiled but deceased. Three out of the seven birds in the dead/euthanized or heavily oiled category were found deceased, and one was recovered and euthanized.

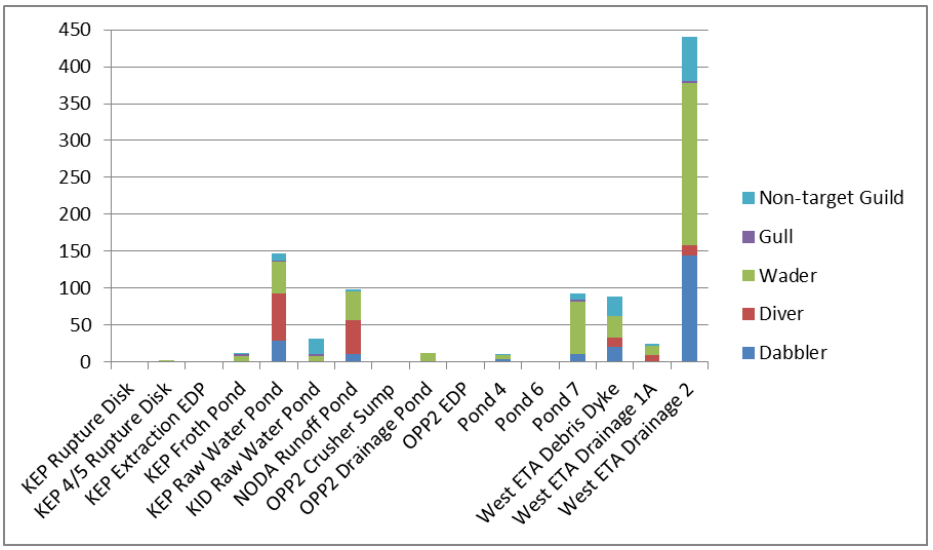
Figure B3: Oiling status of birds recorded during mortality searches at LIFs at Kearl in 2015



B7.3 Quick Scans

Quick scans were conducted at 14 LIFs resulting in observations of 961 birds of which 823 were members of target guilds, and a further 138 were non-target birds (Figure 4). Of the 961 birds observed during quick scans, 441 (45.9%) were at the West ETA Drainage 2 LIF. Quick scans at the KEP Raw Water Pond recorded 147 birds (15.3% of total). The NODA Runoff Pond (98), Pond 7 (93) and West ETA Debris Dyke (88) each approached 100 quick scan observations, while no other LIFs exceeded 50 observations. Three LIFs (KEP Extraction EDP, OPP2 Crusher Sump and Pond 6) did not feature any quick scan observations in 2015.

Figure B4: Birds recorded during quick scans at Kearl in 2015



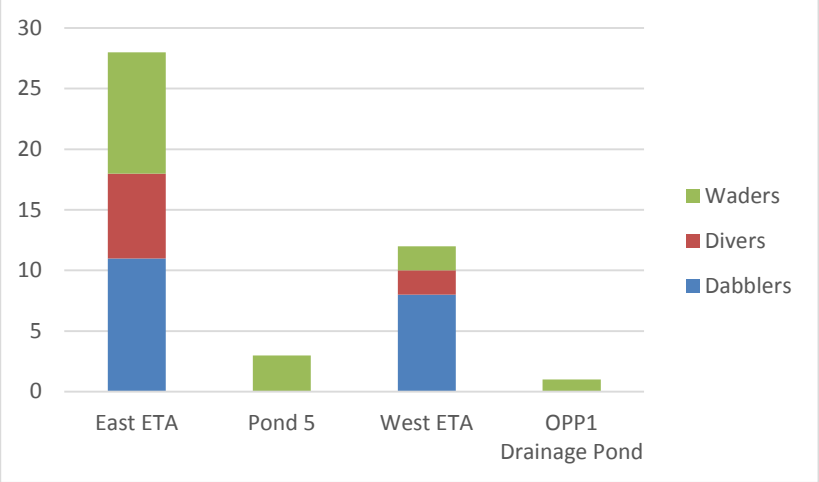
Of the 823 members of target guilds identified during quick scans, 447 (54.3%) were waders, 217 were dabblers, 149 were divers and the remaining 10 were gulls. A total of 17 oiled birds were identified during quick scans, 16 of which were recorded as being lightly oiled. The remaining bird was moderately oiled. Fifteen of the 17 oiled birds were waders and two were lightly oiled dabblers.

B7.4 Incidental Sightings

Over the course of the program, a total of 63 landed birds were recorded as incidental observations. All but one of these birds were members of target guilds. Forty-four of the 62 incidental sightings of target guild birds were made by bird survey personnel, while the remaining 18 were made during mortality searches. Of the 18 birds observed during mortality searches, five were lightly oiled, two moderately oiled, seven heavily oiled and four completely oiled. Seven birds in total were found dead including; all four completely oiled birds, one heavily oiled bird and two additional birds found that showed no evidence of oiling. The remaining six heavily oiled birds were euthanized. The five remaining oiled birds were alive and not recovered. The non-target incidental observation that of a house wren was made during a mortality search at the MSF Hauler Wash Bay, which was not one of the LIFs included in the 2015 OSBCMP.

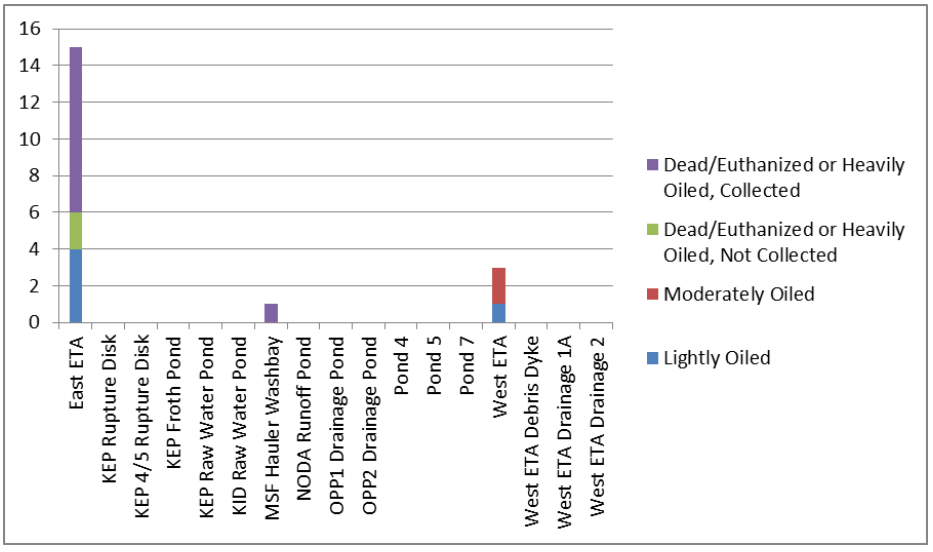
All of the 44 target guild birds observed incidentally by bird survey personnel were oiled (Figure 5). Twenty eight observations were made at the East ETA, 12 at the West ETA, and three at Pond 5. One oiled wader, a greater yellowlegs, was identified at the OPP1 Drainage Pond. In total, 16 waders, 19 dabblers and nine divers were observed incidentally by bird survey personnel. Twenty of these birds were lightly oiled, 12 moderately oiled, two completely oiled, and 10 were observed heavy oiled or dead/euthanized.

Figure B5: Incidental observations of target guild birds by bird survey personnel at Kearl in 2015



Fifteen of the 18 target guild birds observed incidentally during mortality searches were at the East ETA. The remaining three birds were at the West ETA (see Figure 6). In total, eight divers, five waders, three dabblers and two unknown ducks were identified as incidental sightings during mortality searches.

Figure B6: Incidental observations during mortality searches at Kearl in 2015



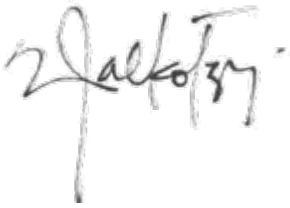
B8.0 SITE-LEVEL RECOMMENDATIONS FOR 2016

No site-level recommendations were made for inclusion in this report.

B9.0 CLOSURE

We trust that this report meets your needs. If you have any questions or concerns, please contact the undersigned.

GOLDER ASSOCIATES LTD.



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B10.0 REFERENCES

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Hatfield
CONSULTANTS

2015 Oil Sands Bird Contact Monitoring Program Report

March 2016

Prepared for:

Shell Canada Energy
Fort McMurray, Alberta

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March 31, 2016

Terence Ko
Mining Authorizations Manager
Alberta Energy Regulator
111 Twin Atria Bldg.
4999 - 98 Avenue
Edmonton, AB T6B 2X3

RE: Shell Albian Sands Oil Sands Bird Monitoring Program 2015 Annual Report
JPM: Approval #153125-00-00 (as amended), MRM: Approval #20809-01-00 (as amended)

Dear Mr. Ko;

Shell Canada Energy (Shell) is pleased to provide Alberta Energy Regulator (AER) with the 2015 annual report for the Shell Albian Sands Oil Sands Bird Contact Monitoring Program (OSBCMP). This report is included in the regional report that the OSBCMP Program Manager, Owl Moon Environmental Inc., is submitting by March 31, 2016.

If you require further information please feel free to contact Paul Knaga (Environmental Specialist – Wildlife and Biodiversity) at 780-713-4507 (paul.knaga@shell.com).

Yours truly,

SHELL CANADA ENERGY.

Paul Knaga
Environment Specialist – Wildlife and Biodiversity

cc:
Marie Nietfeld, Alberta Energy Regulator
Kenneth Yap, Alberta Energy Regulator
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Richard Wiacek, Environment Canada
Shell Environment Regulatory Files

2015 OIL SANDS BIRD CONTACT MONITORING PROGRAM REPORT

Prepared for:

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Prepared by:

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CANADA V7P 0A3

MARCH 2016

SHELL7167
VERSION 2

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AMENDMENT RECORD

This report has been issued and amended as follows:

Issue	Description	Date	Approved by	
1	First draft of 2015 Oil Sands Bird Contact Monitoring Program Report	20160203		
2	Second draft of 2015 Oil Sands Bird Contact Monitoring Program Report – updating numbering format	20130324		
			Peter McNamee Project Director	Felicia Juelfs Project Manager

C1.0 SUMMARY

C1.1 BIRD CONTACTS AND MORTALITIES AT LIQUID IMPOUNDMENT FACILITIES

Liquid impoundment facilities (LIFs) operated by Shell Canada Energy (Shell) were monitored for bird contacts and mortalities from April 16 to October 31, 2015. Eight (8) LIFs were monitored on a daily basis (daily surveys) and four LIFs were monitored twice weekly via quick scan surveys (quick scans). The level of effort involved in monitoring these LIFs is summarized in Table C1.1. Mortality searches were conducted on eight LIFs and consisted of 2,636 km of boat-based searches as well as 18 days of fixed-radius mortality searches (Table C1.1).

A total of 494 birds were documented contacting the LIFs: 146 birds (29.6% of observations) during daily surveys; 335 birds (67.8% of observations) during quick scans; and 13 birds observed incidentally during the regular course of formal monitoring activities (2.6% of observations, Table C1.2).

A total of 33 mortalities were documented in 2015: 18 mortalities during designated mortality searches, of which 16 birds were collected and two birds were not, and 15 mortalities observed incidentally during the regular course of formal monitoring activities, all of which were collected (Table C1.2).

Table C1.1 Monitoring effort at liquid impoundment facilities at Shell in 2015.

Routine Bird Surveys			
No. LIFs Surveyed	8		
No. Stations Surveyed	12		
No. Surveys	1,868		
Total Surface Area (over water) of LIFs Surveyed (ha)	1,134		
Quick Scan Surveys			
No. LIFs Surveyed	4		
No. Stations Surveyed	4		
No. Surveys	192		
Total Surface Area (over water) of LIFs Surveyed (ha)	18.23		
Mortality Searches			
No. LIFs Searched	8		
Total Surface Area (over water) of LIFs Surveyed (ha)	1,141		
	Search Method		
	Boat-transect	Fixed-radius	No. Small LIF searches
Distance Searched (km)	2,636	n/a	n/a
Number of days	n/a	18	n/a

Table C1.2 Number of bird observations from bird surveys, quick scans, and mortality searches at liquid impoundment facilities at Shell in 2015.

Bird Surveys

	Guilds	Total Landed	Total Oiled[1]	Lightly-Oiled	Moderately-Oiled	Dead/Euthanized or Heavily-Oiled
No. Observations	Target	128 (13)	19 (13)	18 (6)	1 (7)	0 (0)
	Non-target	18 (0)	0 (0)	0 (0)	0 (0)	0 (0)
No. Species[2]	Target	17	7	6	3	0
	Non-target	8	2	0	0	2

Quick Scans

	Guilds	Total Landed	Total Oiled[1]	Lightly-Oiled	Moderately-Oiled	Dead/Euthanized or Heavily-Oiled
No. Observations	Target	327	52	41	10	1
	Non-target	8	0	0	0	0
No. Species[2]	Target	16	8	7	3	1
	Non-target	3	0	0	0	0

Mortality Searches

	Guilds	Total Landed	Total Oiled[1]	Lightly-Oiled	Moderately-Oiled	Dead/Euthanized or Heavily-Oiled	
						Not Collected	Collected
No. Observations	Target	18 (21)	18 (21)	0 (7)	3 (0)	1(0)	14(14)
	Non-target	3 (1)	3 (1)	0 (0)	0 (0)	1(0)	2(1)
No. Species[2]	Target	11	11	2	2	1	12
	Non-target	3	3	0	0	1	2

Notes: Numbers in parentheses are incidental observations.

Individual live birds may be observed on multiple days and thus counted more than once.

[1] Oiled birds are included in the number landed.

[2] The number of species includes those from incidental observations.

C1.2 STANDARDIZED MONITORING

Surveys were conducted in accordance with the 2015 Oil Sands Bird Contact Monitoring Program (OSBCMP) protocols and involved:

- Daily surveys at the eight LIFs that were deemed high risk to waterbirds. During the daily surveys, monitoring occurred for a minimum of five minutes at each of the total 12 monitoring locations located on these eight LIFs, as per the new census approach implemented by the 2015 OSBCMP protocols. All landed birds within the specified survey area were counted during the survey period, which occurred on a daily basis if sites were accessible and weather conditions were acceptable; and
- Quick scans conducted twice weekly at the four LIFs that were deemed low risk to waterbirds, with no minimum survey time required.

Risk assessment of the LIFs to waterbirds was determined by application of the LIF risk model (OMEI 2015). Details of the standardized methods for bird surveys and quick scans are provided in Section C3.2 and Section C3.3, respectively.

Mortality surveys on the eight LIFs that were deemed high-risk to waterbirds were conducted as per the 2015 OSBCMP protocols (OMEI 2015). Boat-based and fixed-radius searches were conducted every ten days (Section C3.5). Boat-based mortality searches attempted to cover the entire LIF, while fixed-radius searches encompassed smaller areas that were identified as higher risk to birds due to bitumen content and the incidence of mortalities at those locations in previous years.

There were a number of deviations from the 2015 OSBCMP bird surveys and mortality search protocols (Table C1.3). In addition, fixed-radius searches on the Recycle Water Pond (RCW) were not conducted from July 7 to 24, 2015 due to monitoring personnel being off site as per the OSBCMP protocols.

Table C1.3 Deviations from the 2015 OSBCMP bird surveys and mortality search protocols.

Source of Deviation from 2015 OSBCMP Bird Surveys and Mortality Search Protocols	No. Deviations in 2015 Program
Number of times a new station was created to accommodate construction and access issues[1]	3
Survey sites inaccessible due to construction or field truck issues	8 days
Survey sites inaccessible due to weather-related events	5 days
Surveys missed due to human error	1 day
Number of times the minimum distance for a boat-based survey was not achieved within the 10-day period	12

[1] Appendix CI presents the details of the intra-year changes in survey locations.

C2.0 INTRODUCTION

C2.1 SITE

The 2015 Shell OSBCMP was conducted at two mine sites: Muskeg River Mine (MRM), west of Muskeg River and Jackpine Mine (JPM), east of Jackpine Creek (Figure C2.1).

MRM has been operating since late 2002 (Shell 2015a). It is located on Lease 13 approximately 70 km north of Fort McMurray, Alberta (Shell 2015a). MRM is contained within Townships 94 and 95, Ranges 9, 10 and 11, W4M. MRM contains seven LIFs that were assessed with the application of the LIF risk model (OMEI 2015) as having some risk of bird mortality (Figure C2.1):

- High-risk ponds requiring daily surveys:
    - External Tailings Facility (ETF) located at 12V E 466077 N 6343488;
    - South Expansion Area (SEA) located at 12V E 465648 N 6340245;
    - Recycle Water Pond (RCW) located at 12V E 469821 N 6345712;
    - Cell 1 (Inpit) located at 12V E 470698 N 6346877; and
    - Cell 2B (Inpit 2B) located at 12V E 472414 N 6349342; and
- Low-risk ponds requiring quick scans:
    - Pond 1 located at 12V E 472061 N 6348250; and
    - Seepage Collection located at 12V E 464494 N 6339479.

JPM has been operating since August, 2010 (Shell 2015b) and located on the east side of Lease 13, approximately 70 km north of Fort McMurray, Alberta. JPM is contained within Township 95, Range 9 W4M. JPM contains five LIFs that were assessed using the LIF risk model (OMEI 2015) as having a risk of bird mortality (Figure C2.1):

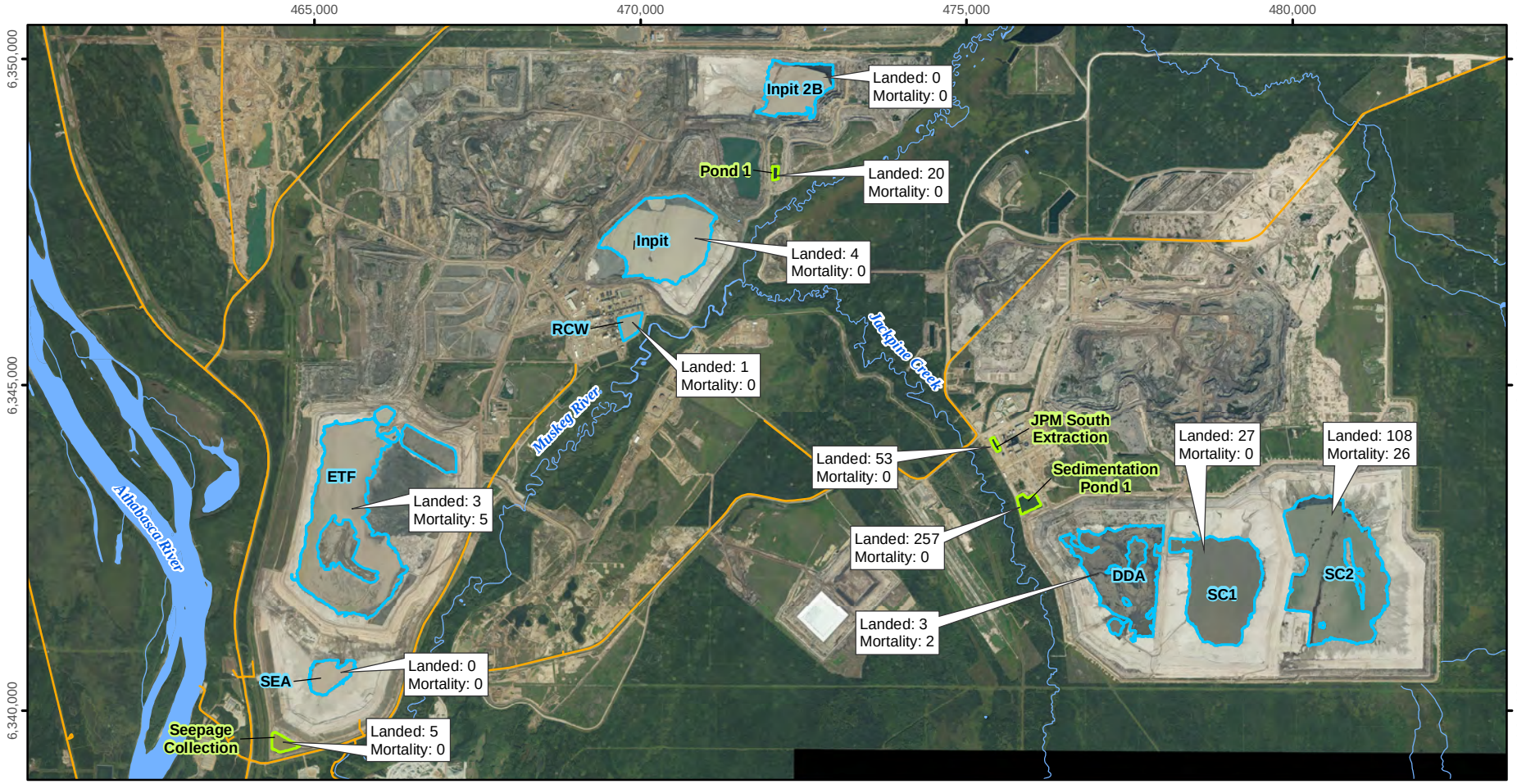
- High-risk ponds requiring daily surveys:
    - Sand Cell 1 (SC1 previously known as MFT) located at 12V E 478574 N 6342134;
    - Dedicated Disposal Area (DDA previously known as TT) located at 12V E 477583 N 6342387; and
    - Sand Cell 2 (SC2) located at 12V E 480393 N 6342651; and
- Low-risk ponds requiring quick scans:
    - Sedimentation Pond 1 located at 12V E 475936 N 6343179; and
    - JPM South Extraction located at 12V E 475438 N 6344080.

All LIFs were monitored in 2014 under the OSBCMP with the exception of the RCW, which was monitored for the first time in 2015. The RCW receives water from ETF for reuse in the plant operations (Shell 2015a).

The four LIFs that were monitored in 2015 using the quick scan protocols: Pond 1 and Seepage Collection in MRM; and Sedimentation Pond 1 and JPM South Extraction in JPM (Figure C2.1) all collect water from the surrounding LIF ditches and operations in order to contain all process-affected water within the mine environment (Shell 2015a, Shell 2015b).

No freshwater LIFs were monitored for bird contacts during the 2015 monitoring season.

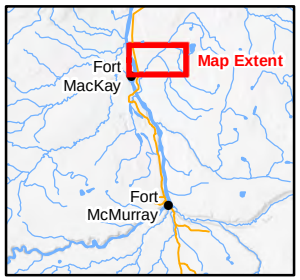
Figure C2.1 Liquid impoundment facilities at Shell that were monitored in 2015 under the OSBCMP.



Legend

- Road
- Watercourse
- Waterbody
- Daily survey
- Quick scan

**The mortality total is a summation of the mortalities observed during regular mortality searches and mortalities observed incidentally.



0 0.5 1 2 km

Scale: 1:95,000

Projection: NAD 1983 UTM Zone 12N

Data Sources:
1. Imagery, 17 September 2015
0.5 m resolution, GeoEye-1

N

Hatfield CONSULTANTS

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C2.2 PERSONNEL

Minimum qualifications for bird monitoring crew members included a B.Sc. in ecology or terrestrial biology and a minimum of one year of experience in avian biology and bird identification. Three of the four crew members had previous experience working with the OSBCMP at Shell. All new crew members received approximately three weeks of training prior to the commencement of the surveys. Training included the study of monitoring protocols and mine site orientation. Approximately 14 days of on-site survey experience was required by new crew members before they were able to fulfill monitoring roles independently.

Mortality search protocols were reviewed and evaluated by the Bird Crew Foreman and Shell. Mortality search personnel on the Shell site included the Bird Crew Foreman and Bird Crew Labourers with additional help from Hatfield Consultants (Hatfield) for one LIF (RCW). The Bird Crew Foreman managed the mortality surveys, trained Bird Crew Labourers, and completed QA/QC on final mortality search data. Foreman and labourers completed intensive site training which included mine drive, boat use, flare gun use, and how to haze wildlife. New personnel were typically given 40 hours of training at the beginning of the summer and mentored throughout the monitoring season. Until approved by the Bird Crew Foreman, mortality search personnel were not allowed to perform mortality searches independently. The positions filled for the 2015 Shell program are provided in Table C2.1.

Table C2.1 Positions filled at Shell in 2015 for the 2015 OSBCMP.

Position	Crews	Shift Length
Site lead, bird hazing, data verification	One crew, two persons	10hr X 4 days
Bird surveys, data verification	Two crews, one person	10hr X 7 days
Mortality searches, deterrent maintenance, bird hazing	Two crews, three persons	12hr X 14 days
Mortality searches, bird hazing	Three crews, three persons	12hr X 7 days
Program Manager	Off-site management personnel	

C2.3 MANAGEMENT OF AVIAN ATTRACTANTS AND CONTROL OF HAZARDS

To limit the attractiveness of LIFs to wildlife, vegetation was regularly removed from the edges of the LIFs and along the perimeter dykes during the winter season to avoid disturbance to breeding birds. Vegetation was also removed for mine-related purposes, which indirectly reduced the risk to waterbirds by minimizing the number of attractants on the LIFs. To decrease green-up on the floating muskeg in DDA, two floating backhoes over-turned, buried, and attempted to sink the floating muskeg mats throughout the season to prevent establishment of vegetation. Bitumen containment booms were placed around the inflow of process-affected water on ETF, SC1, and Inpit in an effort to contain the bitumen and decrease risk to waterbirds.

C2.4 DETERRENTS

The current deterrent system employed by Shell is a combination of on-demand BirdAvert ™ deterrent system, which consists of land-based cannons and water-based floats; human effigies deployed around the perimeter of selected LIFs; and small canons called Zons that are not linked to the BirdAvert ™ deterrent system and therefore set to random firing (Table C2.2). In 2015, units were deployed between March 18 and April 15 prior to spring migration and disassembled in November and December following fall migration.

LIFs at MRM are protected by a total of 122 BirdAvert ™ units, all linked to radar and established at a density of 0.09 units/ha (Table C2.3, Figure A.1.3). LIFs at JPM are protected by a total of 113 BirdAvert ™ units, all linked to radar and established at a density of 0.15 units/ha (Table C2.3, Figure A1.4). In addition to the BirdAvert ™ units, there are also: three floating units (Bird Guard) at the SEA in MRM that are not linked to radar-based units but are used in conjunction with them; 29 Zons at four LIFs surveyed via quick scans that are set to random and not linked to radar; and two human effigies erected around the perimeter of RCW.

Implementation and placement of the bird deterrent components were similar to 2014. Units were placed at 250 m intervals over the LIFs and associated shorelines as per the Shell Waterfowl Protection Plan (Shell 2015). On occasion, individual units were re-situated to accommodate construction work in and around the LIFs. The bulk of the units were allocated to ETF, SC1 and SC2, which have the largest surface area of the ponds selected for deterrence and monitoring in 2015 (Figure C2.1) and have generally been the most active LIFs in previous years for bird contacts and flyovers.

C2.5 HAZING PROCEDURES

Personnel on the deterrent crews received classroom and practical training at the beginning of the season on the proper use, handling, and storage of the flare guns. Deterrent personnel were taught and mentored from experienced individuals on how to initiate effective hazing. Effective hazing takes into account the risk to personnel and waterfowl. Hazing approaches involved the use of flare guns and various noise flares (e.g., screamers, whistlers, bangers) as well as the combination of boats and flares to avert waterfowl that were not deterred from the radar activation.

Table C2.2 Avian deterrents deployed at Shell (as of fall 2015).

Type of Deterrent	Description	Type of Stimulus	Sound Intensity at 1 m (dB)	Activation Control	Placement	No. of Units	LIFs
Floating Deterrent Unit	Floating units with propane cannons, strobe lights, and motorized falcon effigy with falcon sounds. Floats are relatively fixed but may move occasionally due to water levels, beach encroachment, anchor failure, and minor movement due to the necessary slack in anchor ropes to avoid unit damage or loss from increasing water depth and wind.	Audio, Visual	118	Radar	Floating	122	SC1, SC2, DDA, ETF, SEA, Inpit, Inpit 2B
Land Cannon	Propane cannon	Audio	118	Radar	Land	113	SC1, SC2, DDA, ETF, SEA, Inpit, Inpit 2B
Bird Guard	Floating units with propane cannons, strobe lights, and motorized falcon effigy with falcon sounds. Floats are relatively fixed but may move occasionally due to water levels, beach encroachment, anchor failure and some minor movement due to the necessary slack in anchor rope to avoid unit damage or loss from increasing water depth and wind.	Audio	118	Random	Floating	3	SEA
Zons	Propane cannon	Audio	-	Random	Land	29	Pond 1, Seepage Collection, Sedimentation Pond 1, JPM South Extraction
Human Effigy	Scarecrow-like statue	Visual	-	-	Land	2	RCW

Table C2.3 Number of avian radars and deterrents at liquid impoundment facilities at Shell (as of fall 2015).

Pond Name	Pond Area (over water, ha)	Number of Radar(s)	Combined Audio and Visual Deterrents[1]				Audio-only Deterrents				Visual-only Deterrents				Total	
			Linked to Radar		Not Linked		Linked to Radar		Not Linked		Linked to Radar		Not Linked			
			Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	Units	Density (units/ha)
Muskeg River Mine																
Inpit 2B	67.66	1	4	0	3	0	0	6	0	0	0	0	0	0	13	0.19
ETF	423.06	1	17	0	0	0	0	16	0	0	0	0	0	0	33	0.08
Inpit	183.56	1	6	0	0	0	0	9	0	0	0	0	0	0	15	0.08
SEA	42.21	1	4	0	0	0	0	11	0	0	0	0	0	0	15	0.36
RCW	10.5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0.19
Pond 1	2.15	0	0	0	0	0	0	0	0	5	0	0	0	0	5	2.33
Seepage Collection	8.34	0	0	0	0	0	0	0	0	21	0	0	0	0	21	2.52
Total	737.48	4	31	0	3	0	0	42	0	26	0	0	0	2	104	0.13
Jackpine Mine																
DDA	100.69	1	12	0	0	0	0	15	0	0	0	0	0	0	27	0.27
SC1	194.49	1	17	0	0	0	0	17	0	0	0	0	0	0	34	0.17
SC2	153.91	1	23	0	0	0	0	10	0	0	0	0	0	0	33	0.21
JPM South Extraction	2.12	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0.47
Sedimentation Pond 1	8.01	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0.25
Total	459.22	3	52	0	0	0	0	42	0	3	0	0	0	0	97	0.21
Shell Total	1196.7	7	83	0	3	0	0	84	0	29	0	0	0	2	201	0.15

[1] Combined deterrents count as one unit; individual components are described in Table C2.2.

C3.0 METHODS

Bird monitoring and bird deterrent methods followed the 2015 OSBCMP protocol as per Owl Moon Environmental Inc. (2015). Details are provided below.

C3.1 HABITAT CHARACTERISTICS OF LIQUID IMPOUNDMENT FACILITIES

An assessment of LIF habitat characteristics and a description of their contents were required to be obtained during the 2015 OSBCMP monitoring season. LIFs could potentially include process-affected water, surface bitumen, islands (vegetated and non-vegetated), and floating mats of vegetation. Habitat composition was characterized bi-weekly throughout the monitoring season for each LIF on which daily bird surveys (Section C3.2) were conducted and once during the monitoring season for LIFs on which quick scans (Section C3.3) were conducted. This habitat characterization provided information on the approximate abundances of habitat types within each routine survey area and what types of habitat were typically selected by waterbirds.

C3.2 DAILY SURVEYS

Daily surveys were conducted from April 16 to July 6, 2015 and from July 25 to October 31, 2015 to document bird activity during the spring and fall migration periods.

Monitoring stations located around LIFs were visited daily. As per the 2015 OSBCMP protocols, LIFs larger than 1.5 ha in size were required to have two monitoring stations in order to ensure maximum coverage of the LIFs surface during surveys. At MRM, the monitor visited two stations at ETF and Inpit and one station at SEA, Inpit 2B, and RCW. At JPM, the monitor visited two stations at SC1 and SC2 and one station at DDA (Figure A1.1 and A1.2).

Bird observations consisted of surface and shoreline scans of the LIF within a 500 m radius of the observation point. Bird flyovers were excluded from the 2015 protocols. The total survey area was defined as the area within the 500 m radius that included the LIF surface and adjacent beach. Bird monitors used binoculars and spotting scopes to aid in the detection and identification of birds. Each survey was conducted for a minimum of five minutes and monitors had up to a maximum of 30 minutes if more time was required to count all birds landed on the LIF. Locations of the monitoring stations are presented in Appendix CI.

Upon observing birds, monitors recorded:

- Date and time of survey;
- LIF name and monitoring station;
- Identification of individual(s) to guild or species;
- Number of individuals observed;
- Habitat type where bird was observed (e.g., open water, island, emergent vegetation, etc.); and
- If the bird was oiled.

Data were recorded in field notebooks and submitted to Owl Moon Environmental Inc. (OMEI) daily via the doForms app. Any deviation from the 2015 OSBCMP protocols was recorded in the field notebooks (refer to Table C1.3).

C3.3 QUICK SCANS

Four LIFs (Pond 1 and Seepage Collection in MRM and JPM South Extraction and Sedimentation Pond 1 in JPM) were surveyed by monitors a minimum of twice weekly using the quick scan procedure. Monitors would stand safe distance from the LIF and scan the surface for landed birds with a pair of binoculars or scope to help aid in identification of waterbirds. Quick scans had no minimum survey time requirement. These LIFs were deemed to be of low-risk to waterbirds based on the application of the LIF risk model (OMEI 2015). Data were recorded in the field notebooks and submitted to OMEI digitally via the doForms app. Data collected included date and time of survey and LIF name. If birds were observed on these LIFs, monitors recorded:

- Identification of individual(s) to guild or species;
- Number of individuals observed;
- Habitat type where birds were observed (e.g., open water, island, emergent vegetation, etc.); and
- If the bird was oiled.

C3.4 COMPARISON DAYS

One day each week was dedicated as a Comparison Day for training purposes and to make up for missed surveys due to access restrictions, weather, or other circumstances. Missed surveys at any given station during the week could only be resurveyed once.

C3.5 MORTALITY SEARCHES

Shell retained Paradox Environmental (Paradox) and Hatfield to conduct bird mortality searches once every ten days as outlined in the 2015 OSBCMP protocols. On large LIFs, mortality searches were boat-based and performed while conducting deterrent and hazing-related work in an effort to ensure the entire surface of the LIFs were scanned for mortalities. Mortality searches on RCW were conducted with a fixed-radius search that targeted areas of the facility where bitumen is known to accumulate and areas that are attractive to birds. These fixed-radius searches were conducted from a single location with a search radius set to the maximum distance within which bird mortalities could be easily detected (OMEI 2015). For all mortality searches, crew members used binoculars and scopes to scan the surface and shorelines, and collected the following:

- Date and time the survey;
- LIF name;
- Type of mortality survey (i.e., fixed-radius or boat-transect);
- Number of birds found during the survey;
- GPS track log information;
- Visibility conditions;

- Minutes spent conducting survey;
- Distance covered during survey;
- Percentage of LIF and shoreline searched;
- Percentage of bitumen coverage on LIF;
- Cloud cover;
- Wind speed and direction; and
- Precipitation (none, rain, fog, snow, hail).

In the event that birds were found during a mortality search, monitors would also record:

- Identification of individual(s) to guild or species;
- Number of individuals found;
- Habitat type the birds were observed in (e.g., open water, island, emergent vegetation, etc.);
- The extent of oil on the bird (low, moderately, high);
- End state (dead or alive); and
- Whether the carcass was collected, and if so, a carcass identification code.

All information was recorded on Avian Mortality Search forms and in field notebooks and submitted to OMEI daily via the doForms app. Any deviation from OSBCMP protocols was recorded using the field notebook (refer to Section C1.2 and Table C1.3).

C4.0 RESULTS

C4.1 HABITAT CHARACTERISTICS OF LIQUID IMPOUNDMENT FACILITIES

Daily survey monitoring stations were assessed for habitat a total of 13 times each in 2015 with the exception of Inpit 2B 1 (was replaced by Inpit 2B 3) and Inpit 3 (replaced with Inpit 4; Table C4.1). Total surface area of the LIFs that were surveyed ranged from 10.1 ha at RCW to 305.6 ha at SC1 (Table C4.2). Within each survey area, the total LIF surface cover ranged from 10.1 ha at RCW 1 to 51.5 ha at SC2 3 (Table C4.1). Monitoring stations at SC2 3 and SC2 4 had the most open water associated with them, with 30.9 ha and 45.3 ha, respectively (Table C4.2). SC2 4 and DDA 1 had the highest and second-highest non-vegetated island coverage, respectively (Table C4.2), DDA 1 was the only LIF with vegetated island coverage, and RCW 1 was the only LIF with vegetated banks.

LIFs that were surveyed via quick scan procedure were assessed for habitat once during the monitoring season. The survey area for each quick scan survey area was comparable to the total surface area of the LIF, which, for these four LIFs, ranged from 2.12 ha to 8.34 ha (Table C4.3). Seepage Collection and Sedimentation Pond 1 had the largest areas of open water, with 6.67 ha and 7.21 ha, respectively, of the LIFs receiving quick scans (Table C4.3). JPM South Extraction and Seepage Collection were the only two LIFs receiving quick scans that had vegetated banks (Table C4.3).

Table C4.1 Habitat characteristics of liquid impoundment facilities at Shell receiving daily surveys in 2015.

LIF	Station[1]	Area (Ha)	Dates Operated	No. Surveys		Protocol Requirements (%)[2]
				Number of Habitat Assessments	LIF	
Muskeg River Mine						
Inpit 2B	Inpit 2B 1	33.7	Apr 16 to May 21	3	13	100
	Inpit 2B 3	23.9	May 22 to Oct 31	10		
ETF	ETF 1	29.8	Apr 16 to Oct 31	13	26	100
	ETF 5	25.1	Apr 17 to Oct 31	13		
Inpit	Inpit 2	22.9	Apr 16 to Oct 31	13	26	100
	Inpit 3	21.1	Apr 16 to May 17	2		
	Inpit 4	22.7	May 18 to Oct 31	11		
SEA	SEA 1	22.6	Apr 16 to Oct 31	13	13	100
RCW	RCW 1	10.5	Apr 16 to Oct 31	13	13	100
Jackpine Mine						
DDA	DDA 1	35.5	Apr 16 to Oct 31	13	13	100
SC1	SC1 2	19.3	Apr 16 to Oct 31	13	26	100
	SC1 3	18.6		13		
SC2	SC2 3	51.5	Apr 16 to Oct 31	13	26	100
	SC2 4	50.3		13		

[1] Inpit 2B 3 replaced Inpit 2B 1 and Inpit 4 replaced Inpit 3. ETF 3 was active for only one day (April 16) and no habitat was assessed. This station was replaced by ETF 5. (Please see Appendix CI for the location of the stations).

[2] Stations were to be assessed bi-weekly from April 16 to July 6, 2015 and from July 25 to October 31, 2015.

Table C4.2 Mean area and standard deviation of each habitat type for stations at liquid impoundment facilities receiving daily surveys at Shell in 2015[1].

LIF	Station	Total LIF Area (over water, ha)	Area of Habitat (ha)											
			OW	IV	INV	EV	FGSM	FV	FC	BV	BNV	BAM	AS	Other
Muskeg River Mine														
Inpit 2B	Inpit 2B 1	33.7	30.3 (±0)	0	0	0	1.7 (±0)	0	0	0	0	0	1.7 (±0)	1.7 (±0)
	Inpit 2B 3	23.9	20.5 (±0.4)	0	1.2 (±0)	0	2.0 (±0.6)	0	0	0	1.2 (±0)	0	1.2 (±0)	0
ETF	ETF 1	29.8	20.3 (±1.7)	0	1.5 (±0)	0	4.8 (±0.7)	0	0	0	1.5 (±0)	0	2.8 (±0.6)	0
	ETF 5	25.1	20.5 (±1.1)	0	0	0	4.3 (±0.8)	0	0	0	0	0	0.8 (±0.7)	0
Inpit	Inpit 2	22.9	20.9 (±0.5)	0	0	0	1.9 (±0.5)	0	0	0	0	0	0	0
	Inpit 3	21.1	19.0 (±0)	0	0	0	0	0	0	0	1.1 (±0)	0	1.1 (±0)	0
	Inpit 4	22.7	19.6 (±0.5)	0	0	0	2.8 (±1.1)	0	0	0	1.1 (±0)	0	0	0
SEA	SEA 1	22.6	20.3 (±0)	0	0	0	2.3 (±0)	0	0	0	0	0	0	0
RCW	RCW 1	10.5	9.6 (±0.2)	0	0	0	0	0	0	0.5 (±0)	0.5 (±0)	0	0.5 (±0)	0
Jackpine Mine														
DDA	DDA 1	35.5	30.0 (±1.8)	1.8 (±0)	1.8 (±0)	0	3.7 (±1.8)	0	0	0	1.8 (±0)	0	0	0
SC1	SC1 2	19.3	16.1 (±2.0)	0	0	0	2.8 (±2.2)	0	0	0	0	0	1.0 (±0)	0
	SC1 3	18.6	16.6 (±0.5)	0	0	0	2.0 (±0.5)	0	0	0	0	0	0	0
SC2	SC2 3	51.5	30.9 (±3.3)	0	0	0	12.4 (±4.1)	0	0	0	5.2 (±0)	0	2.6 (±0)	5.2 (±0)
	SC2 4	50.3	45.3 (±0)	0	2.5 (±0)	0	2.5 (±0)	0	0	0	5.0 (±0)	0	0	0

[1] Calculated from maps and all assessments at each station Inpit 2B.

Notes: OW= Open Water; IV= Island Vegetated; INV= Island Non-vegetated; EV= Emergent Vegetation; FGSM= Flat Gravel/Sand/Mud; FV=Flat Vegetated; FC= Flat Coke; BV= Bank Vegetated; BNV= Bank Non-vegetated; BAM= Bank Artificial Material; AS= Artificial Structure; Other= habitat types that are not covered in the above columns (e.g., some may have categorized a bitumen mat as "Other").

(Please see Appendix CI for the location of the stations).

Table C4.3 Habitat characteristics of liquid impoundment facilities surveyed with quick scans at Shell in 2015[1].

LIF	Area of LIF (ha)	Survey Date	Area of Habitat (ha)											
			OW	IV	INV	EV	FGSM	FV	FC	BV	BNV	BAM	AS	Other
Pond 1	2.15	Aug 26	1.94	0	0	0	0	0	0	0	0.11	0	0.11	0
Seepage Collection	8.34	Aug 26	6.67	0	0	0	0	0	0	0.42	1.25	0	0	0
JPM South Extraction	2.12	Aug 26	1.91	0	0	0	0	0	0	0.11	0.11	0	0	0
Sedimentation Pond 1	8.01	Aug 26	7.21	0	0	0	0	0	0	0	0.80	0	0	0

[1] These LIFs were assessed once during the monitoring seasons via quick scan procedure.

Notes: OW= Open Water; IV= Island Vegetated; INV= Island Non-vegetated; EV= Emergent Vegetation; FGSM= Flat Gravel/Sand/Mud; FV=Flat Vegetated; FC= Flat Coke; BV= Bank Vegetated; BNV= Bank Non-vegetated; BAM= Bank Artificial Material; AS= Artificial Structure; Other= habitat types that are not covered in the above columns (E.g. some may have categorized a bitumen mat as "Other").

C4.2 RESULTS FROM DAILY SURVEYS

During the 2015 monitoring season, a total of 1,868 visits were made to LIFs that required daily surveys, with survey effort being the highest at those LIFs requiring two or more monitoring stations (Table C4.4).

Table C4.4 Bird survey effort by daily survey stations at Shell in 2015.

LIF	Stations	Dates Operated	No. Surveys		Protocol Requirements (%)[1]
			Station	LIF	
Muskeg River Mine					
Inpit 2B	Inpit 2B 1	Apr 16 to May 21	31	155	101
	Inpit 2B 3	May 22 to Oct 31	124		
ETF	ETF 1	Apr 16 to Oct 31	156	311	101
	ETF 3	Apr 16	1		
	ETF 5	Apr 17 to Oct 31	154		
Inpit	Inpit 2	Apr 16 to Oct 31	156	312	102
	Inpit 3	Apr 16 to May 17	28		
	Inpit 4	May 19 to Oct 31	128		
SEA	SEA 1	Apr 16 to Oct 31	156	156	102
RCW	RCW 1	Apr 16 to Oct 31	156	156	102
Jackpine Mine					
DDA	DDA 1	Apr 16 to Oct 31	155	155	101
SC1	SC1 2	Apr 16 to Oct 31	156	311	101
	SC1 3	Apr 16 to Oct 31	155		
SC2	SC2 3	Apr 16 to Oct 31	156	312	102
	SC2 4	Apr 16 to Oct 31	156		

[1] Stations were to be surveyed six days per week, from April 16 to July 6 and July 25 to October 31.

The number of bird contacts varied among LIFs during the monitoring season. The highest number of bird contacts occurred on SC2 (108 birds) and SC1 (27 birds), whereas Inpit 2B and SEA had zero bird contacts in the entire monitoring season (Table C4.5).

Species guilds that were documented coming into contact with LIFs that were monitored daily included dabblers, divers, waders, gulls and non-target species (Table C4.5). Divers were documented as the most common guild to make contact with LIFs (60 of 146 birds), while waders, dabblers, and non-target guilds accounted for 30, 27, and 18 birds, respectively (Table C4.5).

Table C4.5 Total number of bird contacts by liquid impoundment facility and guild during daily surveys at Shell in 2015.

LIF	Station	Guild						Total
		Dabblers	Divers	Unknown Waterfowl	Waders	Gulls	Non-target Guilds	
Muskeg River Mine								
Inpit 2B	Inpit 2B 1	0	0	0	0	0	0	0
	Inpit 2B 3	0	0	0	0	0	0	0
ETF	ETF 1	0	0	0	0	0	0	0
	ETF 3	0	0	0	0	0	0	0
	ETF 5	0	0	0	3	0	0	3
Inpit	Inpit 2	0	0	0	0	0	0	0
	Inpit 3	0	0	0	0	0	0	0
	Inpit 4	3	1	0	0	0	0	4
SEA	SEA 1	0	0	0	0	0	0	0
RCW	RCW 1	0	0	0	0	0	1	1
Jackpine Mine								
DDA	DDA 1	0	0	0	0	3	0	3
SC1	SC1 2	1	3	0	0	1	12	17
	SC1 3	4	5	0	1	0	0	10
SC2	SC2 3	3	2	0	15	4	5	29
	SC2 4	16	49	1	11	2	0	79
Total		27	60	1	30	10	18	146

A total of 19 oiled birds were observed during the daily surveys: seven at SC1; and 12 at SC2 (Table C4.6). In addition, there were incidental observations made of 13 oiled birds outside of designated daily surveys (Table C4.7).

The five most common species observed as oiled at LIFs routinely monitored (excluding unidentified birds) were mallard (*Anas platyrhynchos*), northern shoveler (*Anas clypeata*), lesser yellowlegs (*Tringa flavipes*), California gull (*Larus californicus*) and lesser scaup (*Aythya affinis*; Table CIII.II). The lesser scaup is provincially-listed as Sensitive by Alberta Parks, and Environment (AEP 2011).

Table C4.6 Number of oiled birds (and percent of total bird contacts) in daily surveys at Shell in 2015.

LIF	Station	Guild						Total
		Dabblers	Divers	Unknown Waterfowl	Waders	Gulls	Non-target Guilds	
Muskeg River Mine								
Inpit 2B	Inpit 2B 1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Inpit 2B 3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
ETF	ETF 1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	ETF 3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	ETF 5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Inpit	Inpit 2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Inpit 3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Inpit 4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SEA	SEA 1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
RCW	RCW 1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Jackpine Mine								
DDA	DDA 1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SC1	SC1 2	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	3 (18)
	SC1 3	1 (25)	3 (60)	0 (0)	0 (0)	0 (0)	0 (0)	4 (40)
SC2	SC2 3	1 (33)	1 (50)	0 (0)	0 (0)	3 (75)	0 (0)	5 (17)
	SC2 4	0 (0)	4 (8)	0 (0)	3 (27)	0 (0)	0 (0)	7 (9)
Total		2 (7)	11 (18)	0 (0)	3 (10)	3 (30)	0 (0)	19 (13)

Table C4.7 Incidental observations of oiled birds at Shell in 2015, made during daily surveys.

LIF	Guild						Total
	Dabblers	Divers	Unknown Waterfowl	Waders	Gulls	Non-target Guilds	
Muskeg River Mine							
Inpit 2B	0	0	0	0	0	0	0
ETF	0	0	0	0	0	0	0
Inpit	0	0	0	0	0	0	0
SEA	0	0	0	0	0	0	0
RCW	0	0	0	0	0	0	0
Seepage Collection	0	5	0	0	0	0	5
Jackpine Mine							
DDA	0	0	0	0	0	0	0
SC1	0	0	0	0	0	0	0
SC2	4	0	0	2	0	0	6
JPM South Extraction	0	2	0	0	0	0	2
Total	4	7	0	2	0	0	13

C4.3 RESULTS FROM QUICK SCANS

A total of 192 quick scan surveys were completed in 2015 for LIFs assessed as low-risk. Survey effort was uniform among all four LIFs (Table C4.8). Bird contacts varied among LIFs with the lowest bird contacts occurring at Seepage Collection (five birds) and the highest contacts occurring at Sedimentation Pond 1 (257 birds; Table C4.8).

Species guilds that were observed contacting LIFs included dabblers, divers, waders, and non-target. Waders accounted for the majority of contacts (171 of 335 birds) while dabblers, divers, and non-target accounted for 88, 68, and 8 birds, respectively (Table C4.8).

The five most common species observed as oiled during quick scans (excluding unidentified birds) were lesser scaup, greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs, spotted sandpiper (*Actitis macularius*), and killdeer (*Charadrius vociferous*; Table CIII.II). Two species that are provincially-listed by AEP as Sensitive were observed during quick scans: lesser scaup; and American green-winged teal (*Anas crecca*; Table CIII.II).

Table C4.8 Results of quick scans at Shell in 2015.

LIF	Scans	Protocol Requirements (%)[1]	Dabblers	Divers	Unknown Waterfowl	Waders	Gulls	Non-target Guilds	Total Landed	Total Oiled[2]	Lightly Oiled	Moderately Oiled	Dead/Euthanized or Heavily Oiled
Pond 1	48	94	0	10	0	10	0	0	20	0	0	0	0
Seepage Collection	46	90	0	2	0	2	0	1	5	0	0	0	0
JPM South Extraction	49	96	26	10	0	12	0	5	53	6	6	0	0
Sedimentation Pond 1	49	96	62	46	0	147	0	2	257	46	35	10	1
Total	192	94	88	68	0	171	0	8	335	52	41	10	1

[1] These LIFs were to be scanned twice per week from April 16 to July 6, 2015 and July 25 to October 31, 2015.

[2] Oiled birds are included in number landed.

C4.4 COMPARISON DAYS

A total of 12 monitoring stations were resurveyed during the 2015 monitoring season on Comparison Days due to access issues (e.g., construction and equipment) and weather on the scheduled survey days. The majority of the resurveys took place during the spring and fall periods (Table C4.9).

Table C4.9 Monitoring stations resurveyed on Comparison Days, 2015.

Survey Station	Comparison Day (Date Resurveyed)	Reason
Inpit 3	April 22, 2015	Access issues
Inpit 2B 3	April 22, 2015	Access issues
SC 2	April 29, 2015	Missed survey
Inpit 3	May 20, 2015	Access issues
ETF 5	August 12, 2015	Access was blocked
SC2 4	September 9, 2015	Weather and roads
ETF 5	September 9, 2015	Weather and roads
ETF 1	September 23, 2015	Access issues
Inpit 2	September 30, 2015	Truck issues
Inpit 4	September 30, 2015	Truck issues
Inpit 2B 3	September 30, 2015	Truck issues
Inpit 4	October 21, 2015	Weather and roads

C4.5 MORTALITY SEARCHES

A total of 2,636 km of boat-based searches were completed across seven of the eight LIFs in MRM (1,289.3 km) and JPM (1,346.8 km; Table C4.10) assessed as high-risk, and a total of 18 days of fixed-radius searches were completed for the RCW in MRM (Table C4.10). The highest and lowest search efforts occurred at SC2 and SEA, respectively (Table C4.10).

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Table C4.10 Mortality search effort at Shell in 2015.

LIF	Search Type	Apr 16 to 25	Apr 26 to May 5	May 6 to 15	May 16 to 25	May 26 to Jun 4	Jun 5 to 14	Jun 15 to 24	Jun 25 to Jul 4	Jul 5 to 14	Jul 15 to 24	Jul 25 to Aug 3	Aug 4 to 13	Aug 14 to 23	Aug 24 to Sep 2	Sep 3 to 12	Sep 13 to 22	Sep 23 to Oct 2	Oct 3 to 12	Oct 13 to 22	Oct 23 to 31*	Total	Mean (per 10-day period)
Muskeg River Mine																							
Inpit 2B	No. Fixed-radius Scan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transect (m)	4,100	6,000	6,800	0	23,600	0	21,100	11,500	10,200	11,500	12,800	14,300	12,300	23,900	10,600	16,400	10,500	10,700	10,200	8,800	225,300	11,313.9
ETF	No. Fixed-radius Scan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transect (m)	24,900	1,000	38,800	8,900	16,100	28,200	33,600	40,700	27,100	88,100	28,200	29,000	33,600	65,200	60,900	92,900	42,800	35,200	28,200	26,200	749,600	37,625.6
Inpit	No. Fixed-radius Scan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transect (m)	7,000	6,000	7,900	7,900	19,800	0	24,300	12,600	11,300	11,500	12,000	13,800	14,100	21,400	16,800	23,800	18,200	20,200	11,400	11,900	271,900	13,661.1
SEA	No. Fixed-radius Scan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transect (m)	1,500	1,000	2,500	2,200	2,700	6,000	7,200	5,700	3,700	5,000	4,300	6,100	8,500	10,900	4,500	6,900	4,500	6,300	5,100	5,400	100,000	5,030.0
RCW	No. Fixed-radius Scan	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	18	0.9
	Transect (m)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jackpine Mine																							
DDA	No. Fixed-radius Scan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transect (m)	2,700	3,600	11,300	2,900	1,600	6,100	5,700	934	6,000	8,900	10,700	10,000	13,100	10,600	7,600	914	12,966	7,800	12,700	5,500	141,614	7,111.3
SC1	No. Fixed-radius Scan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transect (m)	18,500	11,900	20,400	0	33,700	16,400	23,700	13,140	25,800	45,000	22,100	19,900	21,200	24,900	30,700	25,400	22,400	21,800	25,700	45,000	467,640	23,632.0
SC2	No. Fixed-radius Scan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transect (m)	48,800	23,100	53,100	21,400	64,400	16,000	26,800	32,400	16,100	24,700	26,000	26,100	31,400	36,500	39,500	57,700	38,100	31,500	33,200	33,200	680,000	34,184.4

* The last period was nine days long (and weighted accordingly in the mean calculation).

Back of table C4.10.

A total of 31 collected mortalities were documented in 2015, on three LIFs: ETF; DDA; and SC2 (Table C4.11). These mortalities consisted of 16 individuals during designated mortality searches and 15 individuals observed as incidental mortalities (Table C4.12). Twenty-eight (28) of the 31 mortalities were waterfowl (i.e., dabbles, dives, and unknown waterfowl; Table C4.12). Divers were the most-commonly observed guild that contacted bitumen during both designated mortality searches and incidentally (12 birds) followed by dabblers (9 birds; Table C4.12).

The six most common species documented through mortality searches or as an incidental observation (excluding unidentified birds) were Canada goose *Branta Canadensis*), common goldeneye (*Bucephala clangula*), common tern (*Sterna hirundo*), Wilson's snipe (*Gallinago delicata*), California gull (*Larus californicus*) and snowy owl (*Bubo scandiacus;* Table C4.12). Three species provincially-listed as Sensitive were documented in the 31 mortalities: horned grebe (*Podiceps auritus*); lesser scaup; and pied-billed grebe (*Podilymbus podiceps*; Table C4.12).

Table C4.11 Number of observations of oiled birds and mortalities by liquid impoundment facility at Shell in 2015.

LIF	Lightly-Oiled	Moderately-Oiled	Dead/Euthanized or Heavily-Oiled		Total Oiled	
			Not Collected	Collected	Not Collected	Collected
Muskeg River Mine						
Inpit 2B	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
ETF	0 (1)	0 (0)	1 (0)	2 (2)	1 (1)	2 (2)
Inpit	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SEA	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
RCW	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Jackpine Mine						
DDA	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)
SC1	0 (0)	1 (0)	0 (0)	0 (0)	1 (0)	0 (0)
SC2	0 (0)	2 (0)	0 (0)	13 (13)	2 (0)	13 (13)
Sedimentation 1	0 (6)	0 (0)	0 (0)	0 (0)	0 (6)	0 (0)
Total	0 (7)	3 (0)	2 (0)	16 (15)	5 (7)	16 (15)

Numbers in parentheses are incidental observations by mortality search personnel.

Individual live birds may be observed on multiple days and thus counted more than once.

Table C4.12 Number of observations of oiled birds and mortalities by species at Shell in 2015.

Guild	Species	Conservation Status	Total Oiled	% of Total	Lightly-Oiled	Moderately-Oiled	Dead/Euthanized or Heavily-Oiled	
							Not Collected	Collected
Dabblers	Canada Goose		4 (6)	19 (27)	0 (0)	1 (0)	0 (0)	3 (6)
Divers	American Coot		0 (2)	0 (9)	0 (1)	0 (0)	0 (0)	0 (1)
	Common Goldeneye		1 (1)	5 (5)	0 (0)	0 (0)	0 (0)	1 (1)
	Common Tern		0 (3)	0 (14)	0 (0)	0 (0)	0 (0)	0 (3)
	Horned Grebe	Sensitive	1 (0)	5 (0)	0 (0)	0 (0)	0 (0)	1 (0)
	Lesser Scaup	Sensitive	2 (0)	10 (0)	0 (0)	1 (0)	1 (0)	0 (0)
	Pied-Billed Grebe	Sensitive	0 (1)	0 (5)	0 (0)	0 (0)	0 (0)	0 (1)
	Ruddy Duck		0 (1)	0 (5)	0 (0)	0 (0)	0 (0)	0 (1)
	Unknown Scaup		2 (1)	10 (5)	0 (0)	0 (0)	0 (0)	2 (1)
Unknown Waterfowl	Unknown Duck		1 (6)	5 (27)	0 (6)	1 (0)	0 (0)	0 (0)
Waders	Wilson's Snipe		3 (0)	14 (0)	0 (0)	0 (0)	0 (0)	3 (0)
Gull	California Gull		2 (0)	10 (0)	0 (0)	0 (0)	0 (0)	2 (0)
	Franklin's Gull		1 (0)	5 (0)	0 (0)	0 (0)	0 (0)	1 (0)
	Unknown Gull		1 (0)	5 (0)	0 (0)	0 (0)	0 (0)	1 (0)
Non-target	Horned Lark		0 (1)	0 (5)	0 (0)	0 (0)	0 (0)	0 (1)
	Savannah Sparrow		1 (0)	5 (0)	0 (0)	0 (0)	1 (0)	0 (0)
	Snowy Owl		2 (0)	10 (0)	0 (0)	0 (0)	0 (0)	2 (0)
Total			21 (22)	100 (100)	0 (7)	3 (0)	2 (0)	16 (15)

Numbers in parentheses are incidental observations.

Individual live birds may be observed on multiple days and thus counted more than once.

Pink shading indicates species listed under the Species at Risk Act (Government of Canada 2015).

Olive shading indicates species listed as Sensitive, May be at Risk, or At Risk by Alberta Environment and Sustainable Resource Development (2010). Species shaded in Pink are also included in the AEP listing.

C5.0 DISCUSSION

C5.1 BIRD DETERRENTS

The density of deterrents at the four longest-operating LIFs (ETF, Inpit, SC1 and DDA) and at Inpit 2B has been consistent since 2011 and 2014, respectively. In 2015, SC2 became a fully-functioning LIF and was assessed as a high-risk LIF; an increase in the density of required deterrents for this LIF was therefore necessary for 2015. Deterrent units were placed at 250 m intervals over the larger LIFs and associated shorelines, such that they effectively covered the entire areas requiring deterrence. On occasion, individual units were re-situated to accommodate construction work at and around the LIFs.

Zons were placed around the perimeter of all four LIFs that were surveyed via quick scan. The Zons aided in deterring unwanted landings and use by waterbirds. Additional deterrent system components will be placed around Sedimentation Pond 1 in 2016 to enhance bird deterrence.

RCW was monitored in 2015 for the first time and was incorporated into daily surveys. Human effigies have been erected around the perimeter of RCW since 2002; the use of canons is prohibited on RCW due to its proximity to the Froth Treatment Plant and the associated presence of flammable gases.

C5.2 BIRD CONTACTS

C5.2.1 Trends in Bird Contacts at LIFs

A total of 146, 335, and 13 birds were detected during the 2015 monitoring season during daily surveys, quick scans, and by incidental observations, respectively. SC2 and Sedimentation Pond 1 had the highest number of bird contacts documented with 108 and 257 birds, respectively. Inpit 2B, Inpit, ETF, and SEA had zero bird contacts throughout the 2015 monitoring season. The lowest number of contacts documented during quick scan surveys was at Seepage Collection (five bird contacts).

Both SC2 and Sedimentation Pond 1 have unique habitat relative to other LIFs at Shell. SC2 became fully operational in 2015 and in 2015 was composed of areas with deeper waters and a relatively high proportion of islands that functioned as breeding grounds for herring gulls (*Larus argentatus*), California gulls, and Canada geese. Although the emergent vegetation on SC2 was not visible on aerial photographs, it was enough to attract waterbirds. Although RCW had vegetated banks, it was situated in the middle of MRM among buildings that were constantly frequented by people and heavily trafficked roads. The high use of this area was likely the reason for the low number of bird contacts observed in 2015.

Sedimentation Pond 1 was situated adjacent to an abandoned burrow pit that provided breeding grounds for bufflehead (*Bucephala albeola*) and mallards; these adults and their broods were observed foraging at both the abandoned burrow pit and Sedimentation Pond 1. To prevent additional landings and deter use of these two water bodies, Shell increased the deterrence effort by engaging deterrent crews to conduct routine hazing. The three other LIFs (Pond 1, Seepage Collection, and JPM South Extraction) surveyed via quick scans had fewer bird contacts. These LIFs had no vegetation, islands, nor were they in proximity to productive standing water or wetlands. The lack of habitat features to attract waterbirds around the LIFs was the likely reason for the lower number of bird contacts observed.

C5.2.2 Inter-year Comparisons

Comparisons were made in the 2014 Shell OSBCMP report to the previous monitoring years (2013 and 2014). This comparison was not possible in 2015 given modifications to the monitoring protocols that were made for 2015[1].

C5.2.3 Mortalities

Mortality observations during formal mortality searches accounted for 8.8% of the total observed mortality in 2014 (3) and 51.6% of the total observed mortality in 2015 (16). Mortalities during the 2015 seasons were documented on three ponds: ETF, DDA, and SC2. Although all three LIFs had islands, SC2 had the majority of the collected mortalities observed in 2015 (26 of 31). Deterrent crews were kept busy deterring birds from the islands on SC2 as it appeared to be very attractive to waterbirds due to its complex habitat consisting of emergent vegetation and varying water depths. In 2015, deterrent crews reported Canada geese using small, vegetated islands on SC2 for nesting. The large island on SC2 located in the middle of the LIF also functioned as breeding grounds for herring gulls and California gulls.

The increased use at SC2 may be attributed to Kahago Creek which is well-used by wildlife and waterfowl. In 2010, Kahago Creek was diverted around the perimeter of the then newly-developed SC2. The high use and subsequent mortality rate of waterbirds observed at SC2 may be a result from those individuals exhibiting strong philopatry. Philopatry results when an animal returns to breed at the site of previous breeding attempts (Greenwood 1980; Robertson and Cooke 1999). Waterbirds that are returning may be trying to utilize the larger body of water for nesting instead of the newly-diverted Kahago Creek that runs adjacent to SC2. It is likely that the number of landed birds and associated mortalities observed at SC2 will decrease in 2016 as those birds with failed nests in 2015 will begin to select for more suitable habitat to aid in successful broods. Similar observations were made at DDA after the initial startup in the fall of 2010. DDA was deemed a high-risk LIF by Alberta Environment and Parks (AEP) in 2011 due to the high number of landings and associated mortalities; however, by 2014 AEP no longer deemed DDA a high-risk to waterbirds and survey effort at this LIF were decreased.

C6.0 RECOMMENDATIONS

In 2015, SC2 possessed a relatively-high proportion of islands and the adjacent shorelines and some islands were sparsely vegetated. As in 2014, vegetation in 2015 was too meagre to be detected on aerial photographs but was sufficient to attract waterbirds. Mitigative compensation in 2015 involved active hazing but in 2016, SC2 will likely need proactive island and vegetation management to ensure that the LIF is unattractive for nesting and migrant waterbirds.

Sedimentation Pond 1 is located adjacent to an abandoned burrow pit containing freshwater, vegetation, and small islands. Sedimentation Pond 1 is used as a foraging ground by waterbirds inhabiting the abandoned burrow pit. This LIF will likely require vegetation management in 2016 and the implementation of a boom around the inflow of process-affected water to decrease risk to waterbirds. The adjacent burrow pit will also likely require vegetation management and removal of islands to make it less attractive to waterbirds. These construction works should take place outside the breeding bird season. It is also recommended that this LIF become implemented into the daily surveys for 2016 under the OSBCMP.

[1] Please refer to Table 4 in the 2015 OSBCMP protocols for a description of specific changes to monitoring procedures from 2013 to 2015.

C7.0 DOCUMENTS CITED

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[Hatfield] Hatfield Consultants Partnership. 2015. 2014 Oil sands bird contact monitoring program report. Report to Shell Canada Energy. Fort McMurray (AB).

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Shell Canada Energy. 2015a. Shell Canada Energy 2014 environment report – Muskeg River Mine. Fort McMurray (AB): Shell Canada Energy.

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Shell Canada Energy. 2015. Waterfowl protection plan. Fort McMurray (AB): Shell Canada Energy.

[OMEI] Owl Moon Environmental Inc. 2015. Oil sands bird contact monitoring program (OSBCMP) 2015 protocols: Program description and rationale for changes. [Calgary (AB)].

APPENDICES

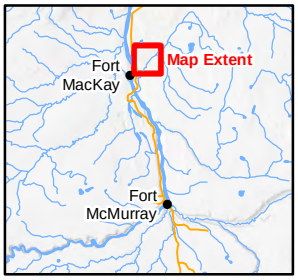
Appendix CI

Location of Deterrents and Monitoring Stations at Shell LIFs in 2015

Figure CI.I Bird monitoring and quick scan stations at Shell Muskeg River Mine, 2015.

Legend

- Monitoring station
- Monitoring station range
- Road
- Watercourse
- Waterbody
- Daily survey
- Quick scan



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Scale: 1:60,000

Projection: NAD 1983 UTM Zone 12N

Data Sources:
1. Imagery, 17 September 2015
0.5 m resolution, GeoEye-1

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Hatfield CONSULTANTS

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Figure CI.II Bird monitoring and quick scan stations at Shell Jackpine Mine, 2015.

Legend

- Monitoring station
- Monitoring station range
- Road
- Watercourse
- Daily survey
- Quick scan

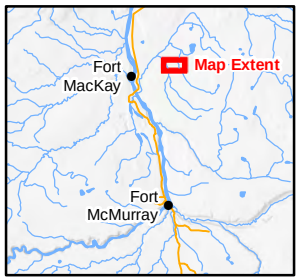

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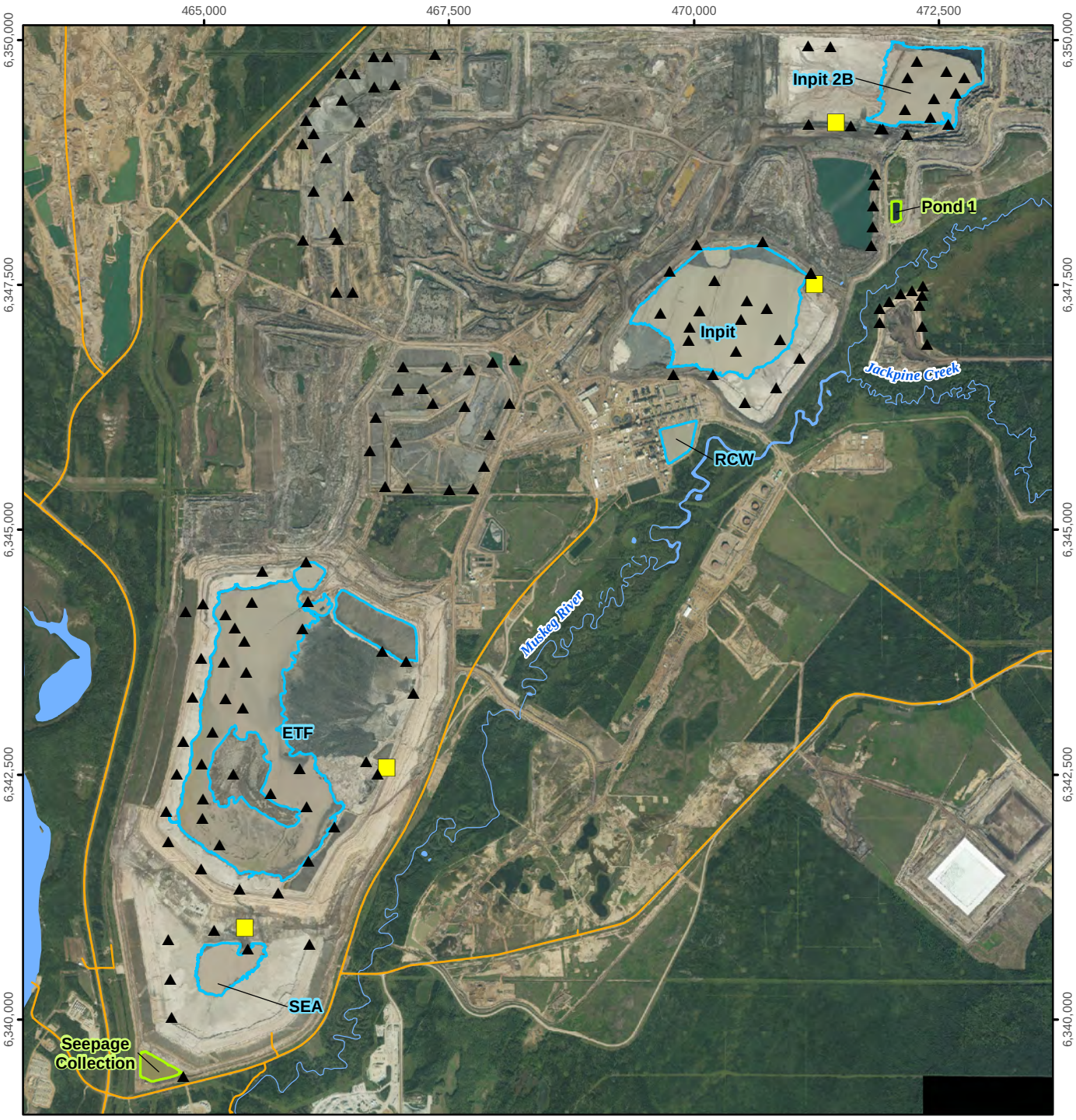
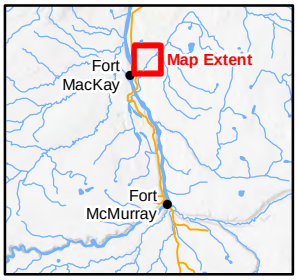
Figure CI.III Liquid impoundment facilities and bird deterrent locations at Shell Muskeg River Mine, 2015.



Legend

- Radar station
- Bird Avert system location
- Road
- Watercourse
- Waterbody
- Daily survey
- Quick scan



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Scale: 1:60,000

Projection: NAD 1983 UTM Zone 12N

Data Sources:
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0.5 m resolution, GeoEye-1

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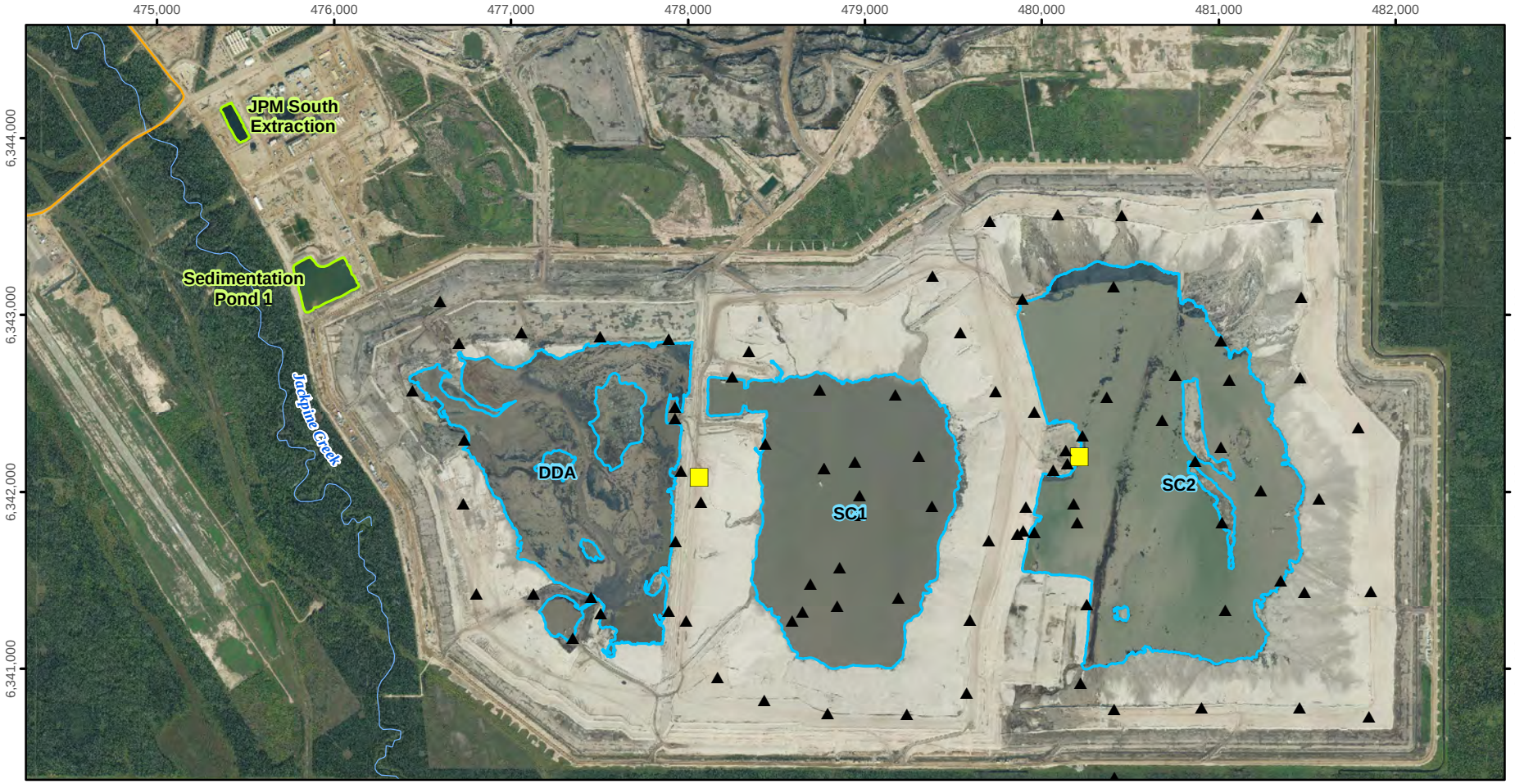
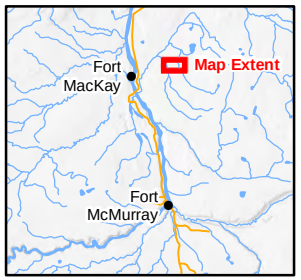
Figure CI.IV Liquid impoundment facilities and bird deterrent locations at Shell Jackpine Mine, 2015.



Legend

- Radar station
- Bird Avert system location
- Road
- Watercourse
- Daily survey
- Quick scan



0 250 500 1000 m

Scale: 1:35,000

Projection: NAD 1983 UTM Zone 12N

Data Sources:
1. Imagery, 17 September 2015
0.5 m resolution, GeoEye-1

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Hatfield CONSULTANTS

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Appendix CII

Number of Bird Observations by Species at Shell LIFs in 2015

Table CII.I Observations of oiled species by bird surveys at Shell in 2015.

Guild	Species	Conservation Status	Lightly Oiled	Moderately Oiled	Heavily Oiled or Dead/Euthanized	Total Oiled	% of Total
Dabbles	American Green-winged Teal	Sensitive	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Canada Goose		0 (2)	0 (0)	0 (0)	0 (2)	0 (15)
	Mallard		1 (0)	0 (0)	0 (0)	1 (0)	5 (0)
	Northern Pintail	Sensitive	0 (0)	0 (2)	0 (0)	0 (2)	0 (15)
	Northern Shoveler		1 (0)	0 (0)	0 (0)	1 (0)	5 (0)
Dives	Bufflehead		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Common Goldeneye		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Lesser Scaup	Sensitive	10 (2)	0 (0)	0 (0)	10 (2)	53 (15)
	Ring-necked Duck		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Surf Scoter		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Unknown Diver		1 (0)	0 (0)	0 (0)	1 (0)	5 (0)
	Unknown Diving Duck		0 (0)	0 (5)	0 (0)	0 (5)	0 (38)
	Unknown Scaup		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Unknown Waterfowl	Unknown Duck		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Wades	Baird's Sandpiper		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Killdeer		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Lesser Yellowlegs		0 (2)	1 (0)	0 (0)	1 (2)	5 (15)
	Spotted Sandpiper		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Unknown Calidris Sandpiper		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Unknown Yellowlegs		2 (0)	0 (0)	0 (0)	2 (0)	11 (0)
Gull	Herring Gull		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Unknown Gull		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	California Gull		3 (0)	0 (0)	0 (0)	3 (0)	16 (0)
	Ring-billed Gull		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Non-target	Barn Swallow	Sensitive	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Common Raven		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Horned Lark		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Lapland Longspur		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total			18 (6)	1 (7)	0 (0)	19 (13)	100 (100)

Numbers in parentheses are incidental observations.

Individual live birds may be observed on multiple days and thus counted more than once.

Pink shading indicates species listed under the *Species at Risk Act* (Government of Canada 2015).

Olive shading indicates species listed as Sensitive, May be at Risk, or At Risk by Alberta Environment and Sustainable Resource Development (2010). Species shaded in Pink are also included in the AESRD listing.

Table CII.II Observations of oiled species by quick scan surveys at Shell in 2015.

Guild	Species	Conservation Status	Lightly Oiled	Moderately Oiled	Heavily Oiled or Dead/Euthanized	Total Oiled	% of Total
Dabbles	American Green-winged Teal	Sensitive	1	0	0	1	2
	American wigeon		0	0	0	0	0
	Mallard		0	0	0	0	0
	Northern Shoveler		0	0	0	0	0
	Unknown Dabbling Duck		0	0	0	0	0
Dives	Bufflehead		0	0	0	0	0
	Common Goldeneye		0	0	0	0	0
	Lesser Scaup	Sensitive	4	0	0	4	8
	Ring-necked Duck		0	0	0	0	0
	Ruddy Duck		0	1	0	1	2
Wades	Baird's Sandpiper		0	0	0	0	0
	Greater Yellowlegs		14	4	0	18	35
	Killdeer		2	0	0	2	4
	Lesser Yellowlegs		15	5	1	21	40
	Pectoral Sandpiper		0	0	0	0	0
	Solitary Sandpiper		1	0	0	1	2
	Spotted Sandpiper		4	0	0	4	8
	Unknown Calidris Sandpiper		0	0	0	0	0
	Unknown Sandpiper		0	0	0	0	0
	Unknown Shorebird		0	0	0	0	0
	Unknown Yellowlegs		0	0	0	0	0
Non-target	Common Raven		0	0	0	0	0
	Red-winged blackbird		0	0	0	0	0
	Brewer's blackbird		0	0	0	0	0
Total			41	10	1	52	100

Pink shading indicates species listed under the *Species at Risk Act* (Government of Canada 2015).

Olive shading indicates species listed as Sensitive, May be at Risk, or At Risk by Alberta Environment and Sustainable Resource Development (2010). Species shaded in Pink are also included in the AESRD listing.

OIL SANDS BIRD CONTACT MONITORING PROGRAM
2015 REGIONAL REPORT

APPENDIX D

SUNCOR ENERGY INC. – BASE MINE

Prepared for:

Suncor Energy Inc.

March 2016

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March 31, 2016

Alberta Energy Regulator
111 Twin Atria Bldg.
4999 - 98 Avenue
Edmonton, AB T6B 2X3

RE: 2015 Oil Sands Bird Contact Monitoring Program Report
Suncor Energy Inc. Oil Sands Processing Plant and Mine
EPEA Approval No. 94-02-00 (as amended)

Dear Sir or Madame:

Please find attached a copy of the Suncor's site specific section of the Oil Sands Bird Contact Monitoring Program Report as required by Clauses 6.1.82 and 6.1.83 of Suncor's Base Mine EPEA Approval 94-02-00 (as amended).

Please contact me at (403) 296-3716 with any questions or concerns.

Sincerely,

Mark Boulton
Environmental Compliance
Suncor Energy Services Inc.

Cc: Sheila Chernys, Suncor Energy Inc.
Andrea McGregor, Alberta Environment and Parks
Joann Skilnick, Alberta Environment and Parks
Richard Wiacek, Environment Canada

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D1.0 INTRODUCTION

Suncor Energy Inc. (Suncor) operates an oil sands mining, extraction and upgrading facility known as the Suncor Oil Sands Base Mine (Suncor) project, in the Athabasca Oil Sands region of northeastern Alberta, Canada. Operations at this facility began in 1967. Suncor is one of five mining operators in the Alberta oil sands region that participates in the monitoring of their liquid impoundment facilities (LIFs) to improve understanding of bird landings and mortalities, using the Oil Sands Bird Contact Monitoring Program (OSBCMP) Protocol (OMEI 2015).

Suncor is committed to minimizing and understanding interactions between birds and the LIFs required for its operations as per its 2015 Waterfowl Protection Plan (WPP; Suncor 2013, 2015). Suncor's WPP is a requirement for its *Environmental Protection and Enhancement Act* (*EPEA*) Approval and it focuses on using the Best Available Technology Economically Achievable (BATEA) to prevent bird contact and bird mortalities associated with industrial wastewater. BATEA involves deployment and maintenance of deterrents including advanced on-demand radar activated deterrent systems. The WPP also includes methods for reducing bitumen distribution and bird attractants within the LIFs, monitoring for bird contacts (through standardized bird surveys, mortality searches, and quick scans), hazing of landed waterbirds, and reporting requirements.

This report summarizes data collected at the Suncor Oil Sands Base Mine Project. It is submitted in accordance with the Suncor Energy *EPEA* Approval (No. 94-02-00; Conditions 6.1.81 to 83), issued to Suncor for operation of the Base Mine Project.

D2.0 LIQUID IMPOUNDMENT FACILITIES

D2.1 Risk Model and Liquid Impoundment Facilities Inclusion

All site LIFs were evaluated using the inclusion and exclusion criteria described in the OSBCMP Protocol, and those LIFs that did not satisfy the initial inclusion or exclusion criteria were assessed using the risk model. Data used to evaluate LIFs against the inclusion and exclusion criteria and the risk model were obtained through communications between the Suncor Environmental Advisor and the area owners on site.

Application of the LIF inclusion list and risk model resulted in 11 LIFs (tailings facilities and LIFs with a high mortality risk) being included in the bird survey and mortality search components of the program. Of the 38 LIFs identified as being of low risk (excluded from bird survey and mortality search programs), 24 were included in the quick scan procedure (Table D-1, Figure D-1). As a measure of due diligence, Suncor included Mist Pond, North Booster Pumphouse and South Booster Pumphouse, designated low risk by application of the risk model, and 13 (of 24) LIFs in the quick scan procedure in the mortality search component.

Table D-1: High and Low Risk LIFs as Defined by the OSBCMP Risk Model

High Risk LIFs Bird Survey & Mortality Search	Low Risk LIFs		
	Quick Scan	Not Monitored	
Extraction Emergency Pond (East) Millennium API Separator Surge Pond Pond 1A Pond 2/3 Pond 6 Pond 7 Pond 8A Pond 8B Pond B East Sand Dump 8 South Tailings Pond	Cooling Water Pond EDP-7 Extraction Decant Pond (East) Extraction Emergency Pond (West) Mine North Gate Sump* PAW Pond* Pond 4 G Pond 4 G2 Pond A* Pond A East Pond B* Pond C Pond D* Pond E Pond F* South Triangle Pond DDA1 - Panel-A Sump (System 4)* DDA1 - Panel-B Sump (System 5)* DDA1 - Panel-C Sump (System 7 Expansion/"System 8")* DDA1 - Panel-C Sump (System 7) – New* DDA1 - Panel-C Sump (System 7) – Old* D11A Upper Wood Creek Mid-Plant Drainage (Weir #10) South Mine Drainage (Weir #1)	API Retention Ponds (West & East) API Separator Old APL Sump Ash Pond Construction Camp Pond Downstream Wetlands Lower Camp Settling Pond (Weir #11) Mine U Sump North Mine Drainage Sump (Weir #12) NSZ1 NSZ3 Pond 1 Flood plain Pond Pond R Sump Surface Runoff Water Southwest Bridge Abutment Pond Sulphur Pad Drainage Sump South of unnamed Creek (Water Tree Sump) Unnamed Pond 1 Y Sump	API Separator New API Sump Ash Decant Pond Butane Sphere Pond D11A Lower Wood Creek Flare Pond MD9 Road Sump North Mine Drainage (Weir #7) North Triangle Pond NSZ2 NSZ4 Pond R Site 111 Sump Spruce Sump Sump north of unnamed Creek Top Shop Lagoon X Sump
		Mist Pond* N Booster Pumphouse* S Booster Pumphouse*	

Note:
* Low risk LIFs at which mortality searches were conducted.

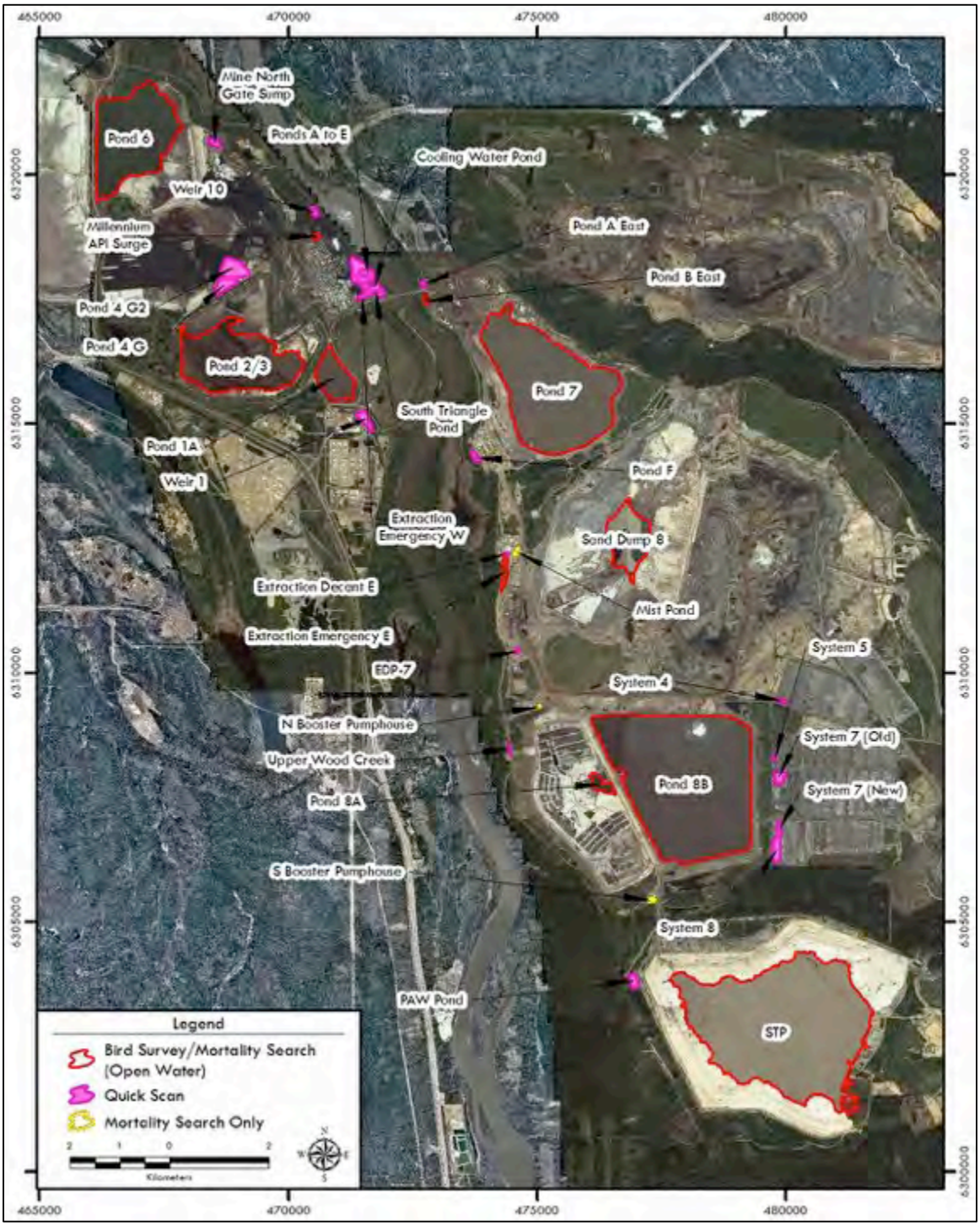


Figure D-1:Liquid Impoundment Facilities (LIFs) included in the 2015 Oil Sands Bird Contact Monitoring Program at Suncor Base Mine

D2.2 Liquid Impoundment Facilities and Bird Survey Area Descriptions

The 11 LIFs included in the bird survey, mortality search and quick scan procedures at Base Mine are shown in Appendices DI and DII. The largest LIFs where bird surveys were conducted were South Tailings Pond (STP) (794.4 ha), Pond 8B (713.4 ha), and Pond 7 (479.8 ha) (ha of fluid; 2014 data).

The survey areas (Appendix DI), observed from Suncor's 20 bird survey stations, were characterized according to the habitat assessment procedure, and area coverage of each habitat in the survey areas was estimated every two weeks. At the request of the OSBCMP Program Manager, habitats within the 24 LIFs where quick scans (Appendix DII) were conducted were characterized in September 2015. The areas (in ha) of the bird survey areas and total quick scan LIF areas were delineated from a June 2015 satellite image in a Geographic Information System and were either confirmed or adjusted based on field observations taken during bird monitoring activities. Habitat characteristics of the bird survey areas are presented in Table D-2.

All survey areas included open water and non-vegetated bank habitats. Islands were present in three survey areas: EEPE-1 (at Extraction Emergency Pond East) (6% of survey area), Pond 1A_1 (4%), and Pond 8A-1b (1%). There were 0.2 ha of emergent vegetation recorded in the Pond 7-1 (less than 1% of survey area) and Pond B East (6%) survey areas. No coke flat or other habitat types were recorded in any of the survey areas. Bitumen presence was recorded during each bird survey. Surface bitumen was observed least frequently at Millennium API Separator Surge Pond (observed in 57% of surveys) and most frequently at Pond 2/3 (100%). Bitumen presence, observed in over half of all surveys, poses a potential oiling risk to birds.

Habitats within the LIFs in the quick scan procedures comprised mainly open water and non-vegetated bank (Table D-3). Small amounts of vegetated island habitat were observed at South Triangle Pond (3% of LIF) and South Mine Drainage Weir #1 (Weir 1) (10%), and non-vegetated island habitat was observed at DDA1 - Panel-C Sump System 7 – Old (System 7 Old) (5%). Small amounts of emergent vegetation were observed at seven LIFs. Fifteen of the 24 LIFs where quick scans were conducted had bitumen presence recorded in the dataset.

D3.0 DETERRENTS

The 2015 bird deterrent program was implemented and maintained by a qualified contractor under the direction of Suncor's Extraction Tailings department and Suncor Environmental Affairs. Deterrents were deployed at LIFs that could pose a potential risk to birds (Figure D-2). Suncor used auditory and visual stimuli to discourage waterfowl from landing on tailings and other LIFs by deploying a combination of radar linked and non-radar linked deterrents. The combination, placement, and number of deterrents deployed were designed to address the characteristics and risks unique to each LIF. Seasonally-deployed shore based deterrents were deployed by March 15 and seasonally-deployed floating deterrents were deployed by May 1. Deployment dates varied due to weather, LIF ice conditions, and safety related to access.

Table D-2: Habitat Characteristics of Bird Survey Areas Monitored at Suncor Base Mine in 2015 (ha; Mean ± Standard Deviation)

LIF	Survey Station	Total Area (ha)	Open Water	Island		Emergent Vegetation	Flat			Bank			Artificial Structure	Other*
				Vegetated	Non-vegetated		Gravel/ Sand/Mud	Vegetated	Coke	Vegetated	Non-vegetated	Artificial Material		
Extraction Emergency E	EEPE - 1	4.7	3.7 (±0.2)	0.1 (±0.1)	0.2 (±0.1)	0	0.1 (±0.1)	0.1 (±0.1)	0	0.3 (±0.2)	0.4 (±0.1)	0	0.2 (±0.1)	0
Millennium API Surge	API Surge - 1	1.1	0.9 (±0.1)	0	0	0	<0.1 (±0.1)	0.1 (±0.1)	0	0.1 (±0.1)	0.1 (±0.1)	0	0	0
Pond 1A	Pond1A_1	25.9	22.1 (±1.1)	0.9 (±0.6)	0.2 (±0.5)	0	0	0.4 (±1.0)	0	2.4 (±1.3)	0.5 (±1.0)	0	0	0
Pond 2/3	Pond 2/3 - 1	33.6	27.1 (±0.9)	0	0	0	2.8 (±1.3)	0.7 (±0.9)	0	1.5 (±0.6)	0.7 (±1.3)	0.2 (±0.6)	1.9 (±0.9)	0
	Pond 2/3 - 2	31.8	27.3 (±1.4)	0	0	0	1.3 (±1.0)	0.5 (±0.8)	0	0	2.8 (±0.7)	0.2 (±0.6)	0.4 (±0.7)	0
Pond 6	Pond 6 - 1	27.6	20.1 (±2.4)	0	0	0	4.6 (±2.5)	0.5 (±0.7)	0	0.2 (±0.5)	2.5 (±0.9)	0.2 (±0.5)	0.3 (±1.0)	0
	Pond 6 - 2a	36.0	12.6 (±9.3)	0	0	0	22.8 (±9.9)	0	0	0	1.8 (±0)	0	0	0
	Pond 6 - 2b	39.3	34.7 (±1.3)	0	0	0	1.1 (±2.2)	0	0	0	3.7 (±0.6)	0	0	0
Pond 7	Pond 7 - 1	29.2	22.4 (±1.2)	0	0	0.2 (±0.6)	2.0 (±1.1)	0.4 (±0.7)	0	0.8 (±1.4)	3.4 (±1.8)	0	1.3 (±0.4)	0
	Pond 7 - 2	30.0	24.2 (±1.2)	0	0	0	2.2 (±2.3)	0.9 (±0.8)	0	0.2 (±0.6)	3.0 (±1.4)	0	0.9 (±0.8)	0
Pond 8A	Pond 8A - 1a	8.6	5.6 (±0.6)	0	0	0	2.1 (±0.3)	0	0	0	0.9 (±0)	0	0.9 (±0.4)	0
	Pond 8A - 1b	10.5	6.6 (±2.3)	0	0.1 (±0.2)	0	2.5 (±2.0)	0	0	0	0.7 (±0.2)	0.1 (±0.2)	0.7 (±0.4)	0

LIF	Survey Station	Total Area (ha)	Open Water	Island		Emergent Vegetation	Flat			Bank			Artificial Structure	Other*
				Vegetated	Non-vegetated		Gravel/ Sand/Mud	Vegetated	Coke	Vegetated	Non-vegetated	Artificial Material		
Pond 8B	Pond 8B - 1	27.7	22.6 (±2.3)	0	0	0	1.0 (±2.1)	0	0	0	3.3 (±1.8)	0	1.5 (±0.9)	0
	Pond 8B - 2	38.8	32.2 (±1.3)	0	0	0	1.7 (±1.2)	0	0	0	4.3 (±1.6)	0.2 (±0.7)	1.7 (±0.7)	0
	Pond 8B - 3	36.6	32.8 (±0.5)	0	0	0	0	0	0	0	3.5 (±1.2)	0	0.5 (±1.4)	0
Pond B East	Pond B East - 1	3.5	2.6 (±0.2)	0	0	0.2 (±0.2)	0.3 (±0.2)	0.2 (±0.2)	0	0.2 (±0.1)	0.2 (±0.1)	0	0	0
Sand Dump 8	Sand Dump 8 - 1	30.1	22.1 (±2.3)	0	0	0	3.6 (±1.4)	0	0	0.2 (±0.6)	2.8 (±1.4)	0.4 (±1.1)	2.7 (±1.3)	0
STP	STP - 1	27.9	21.1 (±1.6)	0	0	0	3.6 (±1.6)	0	0	0	1.5 (±0.8)	0	1.9 (±0.7)	0
	STP - 2	25.3	18.1 (±2.0)	0	0	0	1.6 (±1.4)	2.7 (±1.9)	0	2.4 (±1.7)	0.5 (±0.7)	0.2 (±0.5)	1.5 (±0.7)	0
	STP - 3	30.1	24.1 (±1.5)	0	0	0	3.8 (±1.2)	0	0	0	1.7 (±0.9)	0	1.8 (±0.6)	0

Note:
* Two habitat assessments were conducted at some LIFs included in the quick scan component, and for those LIFs, average habitat cover areas are presented.

Table D-3: Habitat Characteristics of Quick Scan LIFs at Suncor Base Mine in 2015 (ha; Mean ± Standard Deviation)

LIF	Date	Total Area (ha)	Open Water	Island		Emergent Vegetation	Flat			Bank			Artificial Structure	Other*
				Vegetated	Non-vegetated		Gravel/ Sand/Mud	Vegetated	Coke	Vegetated	Non-vegetated	Artificial Material		
Cooling Water Pond	Sept 7	2.74	2.26	0	0	0.07	0	0	0	0.21	0.14	0	0.07	0
	Sept 12													
EDP-7	Sept 4	0.59	0.41	0	0	0	0.09	0	0	0	0.09	0	0	0
	Sept 9													
Extraction Decant E	Sept 4	0.57	0.25	0	0	0	0.10	0	0	0	0.17	0.03	0.01	0
	Sept 9													
Extraction Emergency W	Sept 7	1.57	0.98	0	0	0	0.16	0	0	0.12	0.08	0.04	0.20	0
	Sept 12													
Mine North Gate Sump	Sept 9	2.91	2.33	0	0	0.15	0	0.15	0	0.29	0	0	0	0
PAW Pond	Sept 7	3.91	3.23	0	0	0	0.20	0	0	0.39	0.10	0	0	0
	Sept 9													
Pond 4 G	Sept 7	8.62	6.46	0	0	0	1.08	0	0	0	0.86	0	0.22	0
	Sept 9													
Pond 4 G2	Sept 7	16.86	9.27	0	0	0	5.90	0	0	0	1.69	0	0	0
	Sept 9													
Pond A	Sept 7	1.23	1.04	0	0	0	0	0	0	0.12	0.03	0	0.03	0
	Sept 12													
Pond A East	Sept 7	1.10	0.79	0	0	0.19	0	0	0	0.11	0	0	0	0
	Sept 9													
Pond B	Sept 7	2.73	2.26	0	0	0	0	0	0	0.27	0	0.07	0.14	0
	Sept 12													
Pond C	Sept 7	0.41	0.29	0	0	0	0	0	0	0.02	0.01	0	0.09	0
	Sept 12													

LIF	Date	Total Area (ha)	Open Water	Island		Emergent Vegetation	Flat			Bank			Artificial Structure	Other*
				Vegetated	Non-vegetated		Gravel/ Sand/Mud	Vegetated	Coke	Vegetated	Non-vegetated	Artificial Material		
Pond D	Sept 7	8.37	6.28	0	0	0	0	0	1.05	0.63	0.21	0.21	0	0
	Sept 12													
Pond E	Sept 7	3.28	2.63	0	0	0.08	0	0	0	0.49	0	0.08	0	0
	Sept 12													
Pond F	Sept 9	2.17	1.52	0	0	0	0.22	0	0	0.43	0	0	0	0
South Triangle Pond	Sept 7	3.92	1.57	0.10	0	0.10	1.37	0	0	0.39	0.10	0	0.29	0
	Sept 12													
System 4	Sept 4	1.16	0.93	0	0	0	0	0	0	0.14	0.06	0.03	0	0
	Sept 9													
System 5	Sept 5	0.57	0.41	0	0	0.01	0.06	0.01	0	0	0.06	0.01	0	0
	Sept 9													
System 7 (New)	Sept 4	2.16	1.51	0	0	0	0	0	0	0	0.65	0	0	0
System 7 (Old)	Sept 9	4.34	2.50	0	0.22	0	0.98	0	0	0	0.43	0.11	0.11	0
	Sept 9													
System 8	Sept 4	6.77	4.57	0	0	0	1.02	0	0	0	1.02	0.17	0	0
	Sept 12													
Upper Wood Creek	Sept 9	0.82	0.66	0	0	0	0	0.04	0	0.08	0	0	0.04	0
Weir 1	Sept 4	5.71	4.14	0.57	0	0	0	0	0	1.00	0	0	0	0
	Sept 9													
Weir 10	Sept 5	2.05	1.43	0	0	0.51	0	0.10	0	0	0	0	0	0
	Sept 9													

Note:
* Two habitat assessments were conducted at some LIFs included in the quick scan component, and for those LIFs, average habitat cover areas are presented.

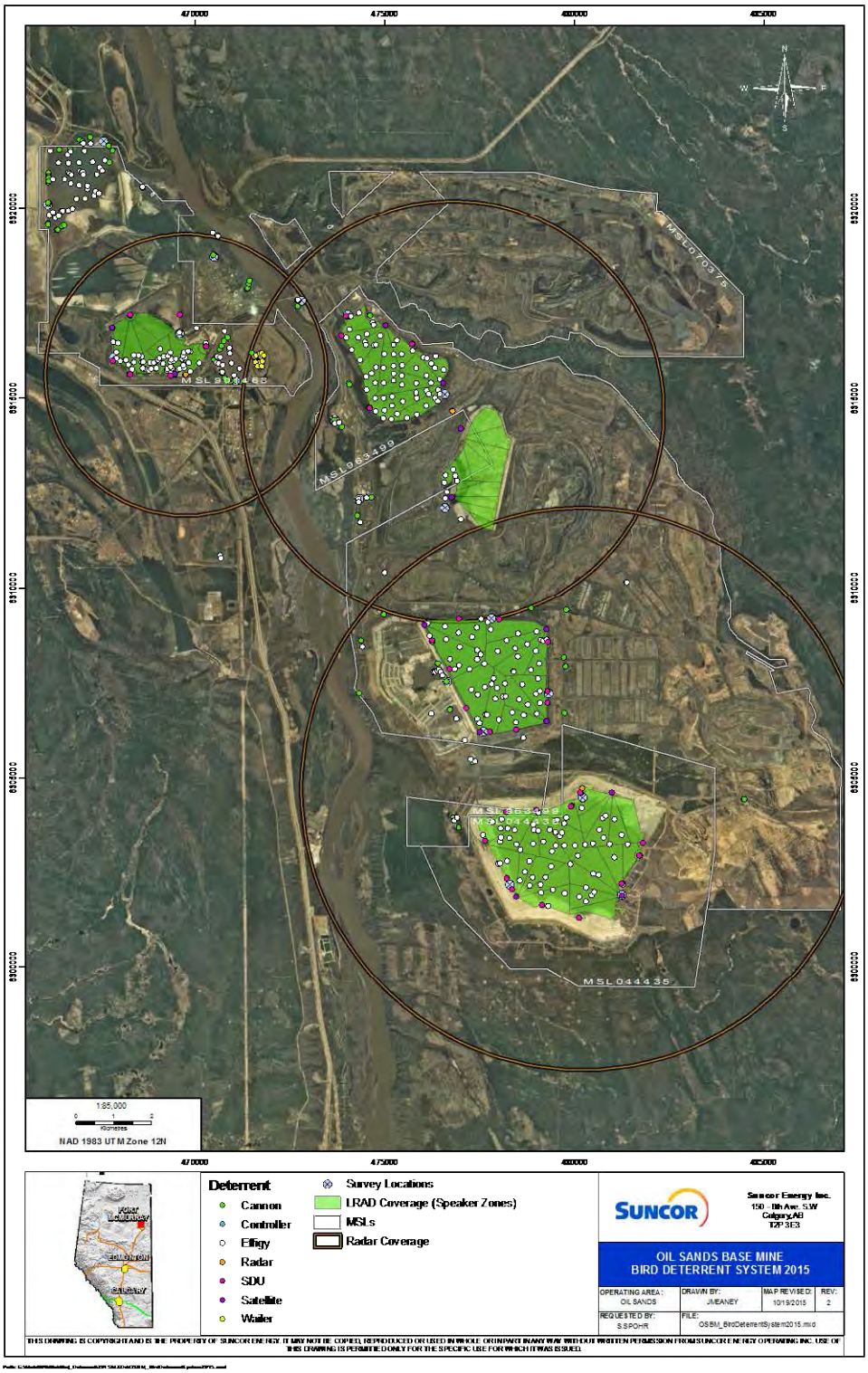


Figure D-2:Deterrent System Deployment at Suncor Base Mine in 2015

There were 100 audio deterrents, 380 visual deterrents, 119 combined audio/visual deterrents (linked to radar) and three radar systems deployed at Base Mine in 2015 (Tables D-4 and D-5).

D3.1 Radar Linked Deterrents

Some deterrents were programmed to trigger randomly, while others were activated by the Merlin Detect and Deter™Bird Control Radar System (BCRS) bird detection system. The BCRS (a combination of a horizontal scanning and vertical scanning radars) can detect birds distances of up to 5.6 km. Upon detection by the radar, the BCRS software transmits radio signals to activate the auditory and visual bird deterrent devices in the corresponding control zone to provoke a flight response and divert incoming birds. In the event that communications between the BCRS and deterrent devices are interrupted, the deterrent system reverts to a random mode until communications are restored.

The primary deterrent component of the BCRS is the satellite unit, which consists of mobile trailers equipped with acoustic hailing devices (AHD) and lasers. The AHD model used in 2015 was the Long Range Acoustic Device 1000 (LRAD). AHDs have a powerfully focused sound beam that can project at variable intensities (up to 152 decibels at 1 m) ranging out to approximately 2 km, and include a large number of sound tracks (e.g., bird distress calls). Green lasers distribute patterns on the LIFs' surface to visually deter birds in low visibility conditions and are active from sunset to sunrise. To enhance deterrence at low LRAD coverage areas and in high risk areas, Secondary Deterrent Units (SDU) were deployed. SDUs consist of smaller mobile trailers equipped with a combination of AHDs, propane powered bird scare cannons, Bird Gard® speakers, flapping peregrine falcons, and/or inflatable effigies. Both the primary and secondary deterrent components are placed on trailers to facilitate coverage flexibility, transportation and storage.

Three bird detection radar systems were used on the Suncor site (Tables D-4 and D-5): one on Pond 2/3, one that covered Pond 7 and Sand Dump 8, and one that covered Pond 8B and STP. Radars locations did not change through the season. At Pond 2/3, one satellite unit was relocated to the north side of the LIF to accommodate new lines from secondary extraction and at Sand Dump 8, one satellite unit was moved to the south side of the LIF to accommodate a discharge line.

D3.2 Non-radar Linked Deterrents

Non-radar linked deterrent units were deployed on 28 LIFs (Tables D-4 and D-5). Propane powered bird scare cannons produce a loud, shotgun-like noise that is created by igniting propane. At Suncor, one activation per minute is the standard. Per the Suncor WPP, a minimum average density of 0.125 cannons per ha of open water was targeted, the average density recommended by Ronconi and St. Clair (2006). Bird scare cannons were deployed on LIF shores by March 15, 2015 and recovered as LIFs began to freeze in the fall. Bird scare cannons were deployed at areas on Pond 2/3, Pond 7, Pond 8B, and STP that were expected to remain open throughout the winter. Cannons at Extraction Emergency Pond (East), Millennium API Separator Surge Pond, Pond 1A (two cannons near discharge pipes), and Ponds A, B, and D remain operational through all months of the year.

Table D-4: Avian Deterrents Deployed at Suncor Base Mine in 2015

Deterrent	Description	Stimuli	Sound Intensity at 1 m (dB)	Activation Control	Placement	Location and Number
Primary Deterrent Unit	Acoustic Hailing Device Laser	Audio and visual	149	Radar	Land	Pond 2/3 = 12 (4 lasers, 8 LRAD) Pond 7 = 15 (4 lasers, 11 LRAD) Pond 8B = 19 (8 lasers, 11 LRAD) Sand Dump 8 = 12 (4 lasers, 8 LRAD) STP= 30 (8 lasers, 22 LRAD)
Secondary Deterrent Unit	Wailer Bird scare cannon Inflatable effigy	Audio and visual	125	Radar	Land	Pond 2/3 = 6 Pond 7 = 4 Pond 8B = 10 STP = 11
Bird scare cannon	Propane powered cannon	Audio	125	Every sixty seconds	Land	Extraction Emergency E=2 Millennium API Surge= 2 Pond 1A= 11 Pond 2/3= 2 Pond 6= 34 Pond 7= 4 Pond 8A= 5 Pond 8B= 4 Pond B East= 2 STP= 2 Mine North Gate Sump*=1 PAW Pond*= 2 Pond A*= 1 Pond B*= 1 Pond D*= 2 Pond F*= 2 System 4*= 1 System 5*= 1 System 7 (New)*= 2 System 8*= 2 Upper Wood Creek*= 2 Weir 10*= 2 Mist Pond**= 1 N Booster Pumphouse**= 1 S Booster Pumphouse**= 1 Soft Cap**= 9 System 4 Expansion**= 1
Effigy	Human effigies dressed as workers	Visual	–	–	Land and water (floating)	Extraction Emergency E= 3 Millennium API Surge= 1 Pond 1A= 17 Pond 2/3= 63 Pond 6= 40 Pond 7= 67 Pond 8A= 7 Pond 8B= 60 Pond B East= 1 Sand Dump 8= 10 STP= 78 Mine North Gate Sump*= 1 PAW Pond*= 2 Pond A*= 1 Pond B*= 1 Pond D*= 2 Pond F*= 2

Deterrent	Description	Stimuli	Sound Intensity at 1 m (dB)	Activation Control	Placement	Location and Number
Effigy (cont'd)						System 4*= 1 System 5*= 1 System 7 (New)*= 2 System 8*= 2 Upper Wood Creek*= 1 Weir 10*= 2 Mist Pond**= 1 N Booster Pumphouse**= 2 S Booster Pumphouse**= 2 Soft Cap**= 9 System 4 Expansion**=1
Avian wire	Physical deterrent	Visual	–	–	Over water surface	Extraction Emergency E Millennium API Surge PAW Pond

Notes:
* LIFs included in the quick scan procedure.
** LIFs not included in OSBCMP procedures.

Table D-5: Number and Density of Avian Deterrents Deployed at Suncor Base Mine in 2015*****

LIF	Area Over Water (ha)***	# Radars	Combined Audio-Visual Deterrents****				Audio-only Deterrents				Visual-only Deterrents				Total
			Linked to Radar		Not Linked		Linked to Radar		Not Linked		Linked to Radar		Not Linked		
			Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	# Units
Extraction Emergency E	4.8									2				3	5
Millennium API Surge	0.9									2				1	3
Pond 1A	51.4									11			17		28
Pond 2/3	249.4	1		18						2			63		84
Pond 6	269.4									34			40		74
Pond 7	479.8	0.5		19						4			67		90.5
Pond 8A	33.7									5				7	12
Pond 8B	713.4	0.5		29						4			60		93.5
Pond B East	1.8									2				1	3
Sand Dump 8	58.1	0.5		12									10		22.5
STP	794.4	0.5		41						2			78		121.5
Mine North Gate Sump*	0.8									1				1	2
PAW Pond*	3.3									2				2	4
Pond A*	0.9									1				1	2
Pond B*	2.9									1				1	2
Pond D*	4.3									2				2	4
Pond F*	1.8									2				2	4
System 4*	1									1				1	2
System 5*	0.6									1				1	2
System 7 (New)*	3.2									2				2	4
System 8*	4.8									2				2	4
Upper Wood Creek*	1.1									2				1	3
Weir 10*	2.2									2				2	4

LIF	Area Over Water (ha)***	# Radars	Combined Audio-Visual Deterrents****				Audio-only Deterrents				Visual-only Deterrents				Total
			Linked to Radar		Not Linked		Linked to Radar		Not Linked		Linked to Radar		Not Linked		
			Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	Floating	On Land	# Units
Mist Pond**	0.3									1				1	2
N Booster Pumphouse**	0.4									1				2	3
S Booster Pumphouse**	0.4									1				2	3
Soft Cap**	2.2									9				9	18
System 4 Expansion**	0.4									1				1	2
Total	**2,687.7**	**3**		**119**						**100**			**335**	**45**	**602**

Notes:
* Quick Scan LIFs.
** Low risk LIFs at which deterrents were deployed.
*** Area over Water (ha) for high risk LIFs based on 2014 data, or calculated for input into the risk model prior to the monitoring season.
**** Combined deterrents count as one unit.
***** Avian wire deterrents not included in the table.

Effigies are human-like structures consisting of high-visibility coveralls and hard hats attached to metal frames. They may be anchored to remain in place, attached to a permanent structure or placed on shore, or float on the pond surface. Effigies are deployed on LIFs year round and maintained at a target density of 0.2 to 0.3 effigies per ha. Suncor ensured a minimum of one effigy was deployed for every 200 m of LIF shoreline, the industry standard for distribution.

Wailers (Phoenix or BirdGard®) are audio deterrents that consist of a control box with speaker(s). A combination of electronic and natural sounds (e.g., raptor calls) are emitted randomly from the speaker(s) to deter birds. The wailers at Suncor are all associated with the SDUs, deployed around vegetated or high risk areas where shorebird activity has been observed.

Avian wires function as a physical deterrent to approaching waterfowl and may be installed on small industrial wastewater ponds. The wire is hung on a level plane over the area from which birds are to be excluded. The actual mechanism by which avian wire works is unknown, but it is thought that birds are startled by the thin, hard to see line when approaching to land (Harris and Davis 1998). Avian wires remain in place on Extraction Emergency Pond (East), Millennium API Separator Surge Pond, and PAW Pond from previous seasons.

D3.3 Maintenance

All deterrents on site were inspected and maintained on a regular basis. Radar linked deterrents were examined daily and each SDU and cannon was examined every second or third day. Maintenance was conducted as required and included servicing generators, refueling (diesel and propane), replacing batteries and cannon parts, and cannon cleaning. Effigies were repaired or replaced as needed.

D4.0 SITE MANAGEMENT PROGRAMS

D4.1 Vegetation and Habitat

Vegetation management and removal is expected to reduce avian attraction to the LIFs. As described in Suncor's WPP, vegetative growth around the LIFs is evaluated each year, and removed as appropriate and where possible. Prior to peak 2015 spring migration, vegetation was removed from the STP and the PAW Pond. Typical vegetation management methods include clearing or brushing of trees, shrubs, cattails, grasses, and any other vegetative material. Vegetation control activities occur outside of the bird nesting periods.

D4.2 Containment Booms

Bitumen containment booms on site are permanent and remain in approximately the same locations (Pond 2/3, Pond 1A and Sand Dump 8) year round, with adjustments being made when booms shift out of position. These booms contain and reduce the spread of bitumen, reducing the probability of bird-bitumen contact.

D4.3 Hazing Procedures

On a daily basis, Suncor hazed birds landed on LIFs to reduce the potential of bird oiling. Hazing strategies were decided on a case-by-case basis, taking into account the relative risk posed to birds. Fatigued birds, and birds at risk of being pushed into a potentially hazardous area, were not hazed as doing so would have caused unnecessary stress, increased the risk of bird oiling, and/or had limited potential for hazing success. Shorebirds typically respond to hazing by circling and landing again and were, therefore, hazed less frequently.

Equipment used to haze waterfowl included the use of boats, air horns, CAPA launchers, pyrotechnic scare cartridges (bangers, screamers, and howlers), handheld lasers and/or handheld acoustic devices. Hazing would only commence under safe conditions for the hazing personnel. Unsafe conditions included but were not limited to reduced visibility due to forest fire smoke, severe weather (e.g., heavy winds, heavy precipitation and/or lightning), hazing over vegetation during high forest fire risk, uneven terrain, and nearby construction activity.

Bird survey personnel hazed birds only after completion of a bird survey. The bird crew notified the hazing crew of the presence of any birds that the bird crew could not safely or reasonably haze.

All personnel on site were required to contact Tailings operators, Environmental On-Call, or Security to report bird sightings, and the message would be relayed to the hazing crew. Crew response times could vary from two minutes to more depending on the hazing crew location and safety constraints when the crew was called (e.g., the crew was already on the boat when they received the call and were relatively close to the called-in bird).

D5.0 MONITORING METHODS

D5.1 Habitat Assessments

Bird survey area habitat assessments were completed every two weeks, except for the first two-week period. Data were entered into forms on electronic tablets and submitted to the OSBMCP program manager.

As per the request of the OSBCMP manager, habitat assessments were conducted on the LIFs in the quick scan component in September. Suncor completed two habitat assessments at 20 of these 24 LIFs; for these LIFs, the areas of each habitat were averaged for analysis and interpretation in the regional analysis of bird-habitat associations.

D5.2 Bird Survey

Bird surveys were conducted by two, one-person crews for a minimum of five minutes, six times per week, in both the spring and fall monitoring seasons. Bird survey stations and their associated survey areas are illustrated in the images presented in Appendix DI.

Surveys began as soon after sunrise as possible and the order of survey stations was varied on a daily basis. If a survey station could not be monitored, the survey was classified as a missed survey, and an attempt was made on the following comparison day to make up the missed survey. Observations of visible avian species landed within the survey area, and the habitat in which they were observed, were recorded using electronic data tablets.

In total, there were 2,721 bird surveys conducted during the spring and fall seasons in 2015 (Table D-6). At Suncor, at least 96% of the scheduled surveys were completed at each LIF. The missed surveys that could not be made up were due to survey station inaccessibility and time constraints.

Table D-6: Bird Survey Effort at Suncor Base Mine in 2015

LIF	Station	Dates Operated	# Surveys		Protocol Guidance (%)
			Station	LIF	
Extraction Emergency E	EEPE - 1	Apr 16 to Oct 31		152	99
Millennium API Surge	API Surge - 1	Apr 16 to Oct 31		150	98
Pond 1A	Pond1A_1	Apr 16 to Oct 31		148	96
Pond 2/3	Pond 2/3 - 1	Apr 16 to Oct 31	152	303	99
	Pond 2/3 - 2		151		
Pond 6	Pond 6 - 1	Apr 16 to Oct 31	153	305	99
	Pond 6 - 2a	Apr 16 to May 19	26		
	Pond 6 - 2b	May 20 to Oct 31	126		
Pond 7	Pond 7 - 1	Apr 16 to Oct 31	151	298	97
	Pond 7 - 2		147		
Pond 8A	Pond 8A - 1a	Apr 16 to Jul 5	69	152	99
	Pond 8A - 1b	Jul 6 to Oct 31	83		
Pond 8B	Pond 8B - 1	Apr 16 to Oct 31	152	460	100
	Pond 8B - 2		155		
	Pond 8B - 3		153		
Pond B East	Pond B East - 1	Apr 16 to Oct 31		149	97
Sand Dump 8	Sand Dump 8 - 1	Apr 16 to Oct 31		148	96
STP	STP - 1	Apr 16 to Oct 31	154	456	99
	STP - 2		150		
	STP - 3		152		

Two bird survey stations were abandoned and replaced over the course of the season. The Pond 6-2a station was replaced by Pond 6-2b station on May 20 due to access constraints. The Pond 8A-1a station was replaced by Pond 8A-1b on July 6 due to decreasing water levels.

Hazing before or during bird surveys was avoided as much as possible, however, there were nine cases of hazing before or during a survey (six at Pond 8B, two at STP, and one at Sand Dump 8), due to bird(s) being present near or in hazardous areas.

D5.3 Mortality Search

Standardized mortality searches were conducted at LIFs at a minimum of every 10 days from April 16 to October 31 (inclusive), and included transect, fixed-radius scan and small LIF search procedures. Mortality search data were recorded on paper data sheets and entered into an Excel spreadsheet within 24 hours of a search being completed.

Mortality search transects were conducted by boat on Pond 1A, Pond 2/3, Pond 6, Pond 7, Pond 8B, and STP. Search routes were recorded using the tracking options on portable GPS units. One transect was conducted by motor vehicle at Pond 2/3 on June 6, otherwise, the remaining ground-based transects at the remaining LIFs were conducted on foot. Where accessible, 100% of the LIF shoreline and area were searched every 10 days. If searching the LIF perimeter by foot was not possible (e.g., due to weather) the search was rescheduled for later in the 10-day period.

Based on the LIF open water area in 2014, a transect search distance target of 79 km every 10 days, or 1,581 km for the season, was derived. This target contemplated the majority of effort being allocated to boat transect searches on open water areas, however, Suncor allocated greater effort to foot searches in LIF perimeter habitats that were inaccessible by boat, and where oiling risk was considered to be higher (287 foot transects of 367 total transects; 78%) (Table D-7). The remaining transects were conducted by boat (79) and by vehicle (1). While the emphasis on foot transects resulted in less distance searched (742 km) relative to the search target, a greater proportion of high bird-oiling risk area was included in the area searched.

Sixty fixed-radius scans were completed in 2015, focusing on areas of elevated oiling risk. Fixed-radius scans were conducted in high-risk areas (e.g., bitumen mats or where previous mortalities were found), which varied, depending on operational activities and wind direction. A total of 182 small LIF searches were completed.

There were three adjustments to the mortality search component of the OSBCMP at Suncor. Pond A, Pond B and Pond D were searched as one LIF for mortalities at the beginning of the season. Updated LIF areas were generated a few weeks into the monitoring season, and it was determined that Ponds B and D were large enough to require their own transect searches. The last date of Ponds A, B and D being searched as one unit was June 19. Three LIFs (Mist Pond, North Booster Pumphouse and South Booster Pumphouse) and 13 of the 24 LIFs in the quick scan component were added to the mortality search component, a due diligence decision by Suncor.

D5.4 Quick Scan

Quick scans were performed twice per week through the spring and fall monitoring seasons. In 2015, there were 1,151 quick scans conducted (Table D-8), achieving an average of 94% of protocol guidance quick scan effort (with a minimum of 90% at each LIF). Missed quick scans were due to weather and/or safety imposed access restrictions.

Table D-7: Mortality Search Effort at Suncor Base Mine in 2015

LIF	Transect (m)	Fixed-radius Scan (No.)	Small LIF (No.)
Extraction Emergency E	13,147	0	1
Millennium API Surge	0	0	20
Pond 1 A	47,919	19	0
Pond 2/3	60,977	0	0
Pond 6	38,604	19	0
Pond 7	128,380	1	0
Pond 8 A	12,840	0	0
Pond 8B	176,033	1	0
Pond B East	4,843	0	2
Sand Dump 8	39,380	0	0
STP	155,327	20	0
Mine North Gate Sump*	0	0	20
PAW Pond*	10,927	0	2
Pond A*	362	0	12
Pond B*	4,278	0	0
Pond D*	5,365	0	0
Ponds A, B, D**	5,537	0	0
Pond F*	7,134	0	4
System 4*	812	0	17
System 5*	0	0	20
System 7 (New)*	8,495	0	1
System 7 (Old)*	4,281	0	0
System 8*	12,124	0	1
Upper Wood Creek*	0	0	18
Weir 10*	5,577	0	3
Mist Pond *	0	0	20
N Booster Pumphouse*	0	0	20
S Booster Pumphouse*	0	0	21
Totals	**742,342**	**60**	**182**

Notes:

* Low risk LIFs at which mortality searches were conducted.

** Pond A, Pond B, and Pond D are grouped together as “Ponds A, B, D” when one mortality search was conducted for all LIFs simultaneously (due to close proximity and small size).

Table D-8: Quick Scan Effort at Suncor Base Mine in 2015

LIF	# Scans	Protocol Guidance (%)*
Cooling Water Pond	48	94
EDP-7	48	94
Extraction Decant E	46	90
Extraction Emergency W	47	92
Mine North Gate Sump	48	94
PAW Pond	49	96
Pond 4 G	48	94
Pond 4 G2	48	94
Pond A	50	98
Pond A East	48	94
Pond B	46	90
Pond C	49	96
Pond D	50	98
Pond E	50	98
Pond F	49	96
South Triangle Pond	49	96
System 4	48	94
System 5	47	92
System 7 (New)	42	82
System 7 (Old)	47	92
System 8	48	94
Upper Wood Creek	48	94
Weir 1	49	96
Weir 10	49	96
Total	**1,151**	**94**

D5.5 Data Submission and QA/QC

Bird survey, quick scan and habitat assessment data were entered into electronic tablets, exported to Excel, reviewed, and submitted to the OSBCMP manager every two weeks. Mortality search data were recorded on paper, entered into an Excel spreadsheet daily, reviewed and submitted to the OSBCMP program manager every two weeks. On-site personnel reviewed data on a semi-weekly interval, and the OSBCMP manager reviewed the entire dataset after completion of 2015 monitoring activities.

D6.0 RESULTS AND DISCUSSION

In 2015, there were 4,903 observations of landed birds from target guilds, 307 (6%) of which were recorded during bird surveys (Table D-9) and 4,615 (94%) during quick scans (Table D-10). A total of 32 species were recorded, including four species of conservation concern (Table D-11). Individuals of species of concern represented 8% of all landed bird observations. None of the landed birds observed during bird surveys or quick scans were oiled, nor did site personnel report any incidental observations of oiled birds.

Table D-9: Bird Survey Observations at Suncor Base Mine in 2015

LIF	Station	Dabblers	Divers	Unknown Waterfowl	Waders	Gulls	Non-target	Total
Extraction Emergency E	EEPE - 1	0	0	0	0	0	0	0
Millennium API Surge	API Surge - 1	0	0	0	0	0	0	0
Pond 1A	Pond1A_1	0	0	0	0	0	0	0
Pond 2/3	Pond 2/3 - 1	0	0	0	0	0	0	0
	Pond 2/3 - 2	0	0	0	0	0	0	0
Pond 6	Pond 6 - 1	0	0	0	0	0	1	1
	Pond 6 - 2a	0	0	0	0	0	0	0
	Pond 6 - 2b	0	0	0	0	0	0	0
Pond 7	Pond 7 - 1	0	0	0	0	0	0	0
	Pond 7 - 2	0	31	0	0	0	0	31
Pond 8A	Pond 8A - 1a	0	0	0	0	0	0	0
	Pond 8A - 1b	0	0	0	0	0	0	0
Pond 8B	Pond 8B - 1	0	14	0	0	0	0	14
	Pond 8B - 2	12	56	0	0	0	0	68
	Pond 8B - 3	2	31	0	0	0	0	33
Pond B East	Pond B East - 1	4	1	0	30	1	0	36
Sand Dump 8	Sand Dump 8 - 1	0	0	0	0	0	0	0
STP	STP - 1	2	98	5	0	0	0	105
	STP - 2	16	1	0	0	0	0	17
	STP - 3	2	0	0	0	0	0	2
Totals		**38**	**232**	**5**	**30**	**1**	**1**	**307**

No resident birds (chicks, resident species, or resting migrants) were observed during bird surveys or quick scans in 2015.

One Mallard (target guild) and two Savannah sparrows (non-target guild) were observed as oiled and dead during mortality searches (Table D-12, Appendix DIII). All three were found during ground-based (on foot) transect mortality searches at Sand Dump 8 (Figure D-3). The two Savannah sparrows were observed on a floating bitumen mat. The Mallard was observed on a pipe two days before it could be collected safely. Suncor immediately informed the local Fish and Wildlife office when they collected an oiled bird (live or dead), consistent with the conditions contained in the research permit and collection license. Monthly summaries of collected birds were supplied to Alberta Environment and Parks, Alberta Justice, and the Canadian Wildlife Service.

Table D-10: Quick Scan Observations at Suncor Base Mine in 2015

LIF	Dabblers	Divers	Unknown Waterfowl	Waders	Gulls	Non-target Guilds	Lightly Oiled	Moderately Oiled	Dead/ Euthanized or Heavily Oiled	Total Landed	Total Oiled
Cooling Water Pond	79	9	0	0	0	0	0	0	0	**88**	0
EDP-7	3	44	0	36	2,537	4	0	0	0	**2,624**	0
Extraction Decant E	0	0	0	0	0	0	0	0	0	**0**	0
Extraction Emergency W	143	69	0	11	0	1	0	0	0	**224**	0
Mine North Gate Sump	0	0	0	0	0	0	0	0	0	**0**	0
PAW Pond	0	0	0	0	0	0	0	0	0	**0**	0
Pond 4 G	0	0	0	0	0	0	0	0	0	**0**	0
Pond 4 G2	0	0	0	1	0	0	0	0	0	**1**	0
Pond A	0	4	0	0	0	0	0	0	0	**4**	0
Pond A East	14	26	0	0	0	0	0	0	0	**40**	0
Pond B	0	0	0	9	0	0	0	0	0	**9**	0
Pond C	0	0	0	0	0	0	0	0	0	**0**	0
Pond D	0	0	0	0	0	0	0	0	0	**0**	0
Pond E	0	0	0	0	0	0	0	0	0	**0**	0
Pond F	8	0	0	0	0	0	0	0	0	**8**	0
South Triangle Pond	72	125	0	18	0	12	0	0	0	**227**	0
System 4	0	0	0	0	0	0	0	0	0	**0**	0
System 5	0	0	0	0	0	0	0	0	0	**0**	0
System 7 (New)	780	449	0	84	0	1	0	0	0	**1,314**	0
System 7 (Old)	0	6	0	1	0	1	0	0	0	**8**	0
System 8	0	20	0	0	0	0	0	0	0	**20**	0
Upper Wood Creek	0	2	0	0	0	0	0	0	0	**2**	0
Weir 1	2	41	0	0	0	0	0	0	0	**43**	0
Weir 10	3	0	0	0	0	0	0	0	0	**3**	0
Total	**1,104**	**795**	**0**	**160**	**2,537**	**19**	**0**	**0**	**0**	**4,615**	**0**

Table D-11: Bird Species Observed during Bird Surveys, Mortality Searches and Quick Scans at Suncor Base Mine 2015

Guild	Species	Conservation Status	Total Landed	Total Oiled*	Lightly Oiled	Moderately Oiled	Dead/ Euthanized or Heavily Oiled
Dabbles	Canada Goose		20	0	0	0	0
	American Green-winged Teal	Sensitive	77	0	0	0	0
	Mallard		489	1	0	0	1
	American Wigeon		419	0	0	0	0
	Blue-winged Teal		35	0	0	0	0
	Northern Shoveler		101	0	0	0	0
	Northern Pintail	Sensitive	1	0	0	0	0
	Snow Goose		1	0	0	0	0
Dives	Common Goldeneye		162	0	0	0	0
	American Coot		6	0	0	0	0
	Bufflehead		339	0	0	0	0
	Common Loon		19	0	0	0	0
	Horned Grebe	Sensitive	52	0	0	0	0
	Unknown Diver		4	0	0	0	0
	Canvasback		77	0	0	0	0
	Lesser Scaup	Sensitive	242	0	0	0	0
	Redhead		30	0	0	0	0
	Ring-necked Duck		59	0	0	0	0
	Ruddy Duck		24	0	0	0	0
	Common Tern		3	0	0	0	0
	Common Merganser		10	0	0	0	0
Unknown Waterfowl	Unknown Duck		5	0	0	0	0
Wades	Greater Yellowlegs		1	0	0	0	0
	Killdeer		49	0	0	0	0
	Lesser Yellowlegs		116	0	0	0	0
	Semipalmated Sandpiper		24	0	0	0	0
Gull	California Gull		2,438	0	0	0	0
	Ring-billed Gull		100	0	0	0	0
Non-target	Savannah Sparrow		2	2	0	0	2
	Black-billed Magpie		6	0	0	0	0
	Common Raven		5	0	0	0	0
	Red-winged Blackbird		9	0	0	0	0
		Total	**4,925**	**3**	**0**	**0**	**3**

Notes:
There were no incidental observations of oiled birds by any crew.
Individual live birds may be observed on multiple days and thus counted more than once.
* Oiled bird observations are included in the total recorded numbers of birds observed landed.
Olive shading indicates species listed as Sensitive, May be at Risk, or At Risk by Alberta Environment and Sustainable Resource Development (2010).

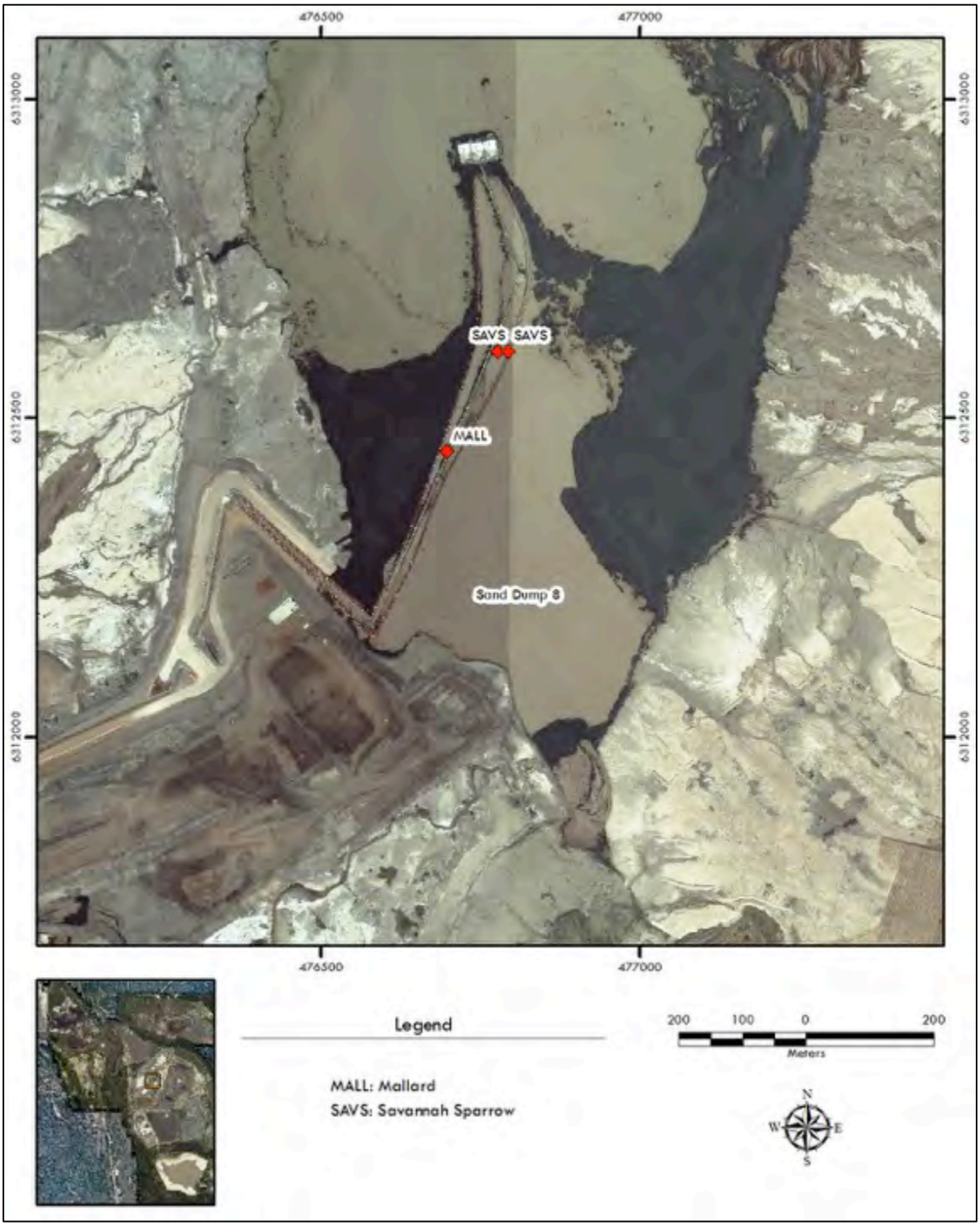


Figure D-3: Avian Mortalities at Suncor Base Mine

Table D-12: Mortality Search Observations at Suncor Base Mine in 2015

LIF	Lightly Oiled	Moderately Oiled	Dead/Euthanized or Heavily Oiled		Total Oiled	
			Not Collected	Collected	Not Collected	Collected
Extraction Emergency E	0	0	0	0	0	0
Millennium API Surge	0	0	0	0	0	0
Pond 1A	0	0	0	0	0	0
Pond 2/3	0	0	0	0	0	0
Pond 6	0	0	0	0	0	0
Pond 7	0	0	0	0	0	0
Pond 8A	0	0	0	0	0	0
Pond 8B	0	0	0	0	0	0
Pond B East	0	0	0	0	0	0
Sand Dump 8	0	0	0	3	0	3
STP	0	0	0	0	0	0
Mine North Gate Sump*	0	0	0	0	0	0
PAW Pond*	0	0	0	0	0	0
Pond A*	0	0	0	0	0	0
Pond B*	0	0	0	0	0	0
Pond D*	0	0	0	0	0	0
Pond F*	0	0	0	0	0	0
System 4*	0	0	0	0	0	0
System 5*	0	0	0	0	0	0
System 7 (New)*	0	0	0	0	0	0
System 7 (Old)*	0	0	0	0	0	0
System 8*	0	0	0	0	0	0
Upper Wood Creek*	0	0	0	0	0	0
Weir 10*	0	0	0	0	0	0
Mist Pond**	0	0	0	0	0	0
N Booster Pumphouse**	0	0	0	0	0	0
S Booster Pumphouse**	0	0	0	0	0	0
Total	**0**	**0**	**0**	**3**	**0**	**3**

Notes:
* LIFs in the quick scan component at which mortality searches were also conducted.
** Low risk LIFs at which mortality searches were conducted.

D7.0 SITE-LEVEL RECOMMENDATIONS FOR 2016

In 2015, 94% of the target guild birds observed landed were recorded during quick scans, more than anticipated by application of the risk model to these LIFs prior to initiation of monitoring. Similarly, few to no landed birds were observed at several LIFs identified as being of high risk. None of the 4,615 birds observed during the 1,151 quick scans were observed as being oiled, suggesting that the risk model performed relatively well in predicting the risk of bird oiling (no oiled, landed birds were observed during bird surveys). These data, together with those obtained by the other four participants in the OSBCMP will be useful in evaluating the performance of the landing potential component of the risk model. The characteristics of the LIFs with high numbers of landed birds observed during the quick scans, in particular EDP-7, will be examined as part of the model evaluation.

No changes in the types of deterrents, deterrent locations, or operation of deterrents are planned in 2016. Vegetation removal will remain a primary activity to limit LIF attractiveness to birds. Vegetation at STP and PAW Pond was removed prior to April 16, 2015. In early spring of 2016, vegetation presence will be assessed for each LIF, and where necessary, vegetation control measures taken; this includes the planned annual vegetation removal at STP and PAW Pond.

D8.0 DOCUMENTS CITED

Alberta Sustainable Resource Development (2010) Sensitive Species Inventory Guidelines. http://www.srd.alberta.ca/FishWildlife/WildlifeManagement/documents/SensitiveSpeciesInventoryGuidelines-Aug2010.pdf.

Harris, R.E. and R.A. Davis (1998) *Evaluation of the Efficacy of Products and Techniques for Airport Bird Control*. Prepared by LGL Limited for Transport Canada. LGL Report TA2193. 104 pp.

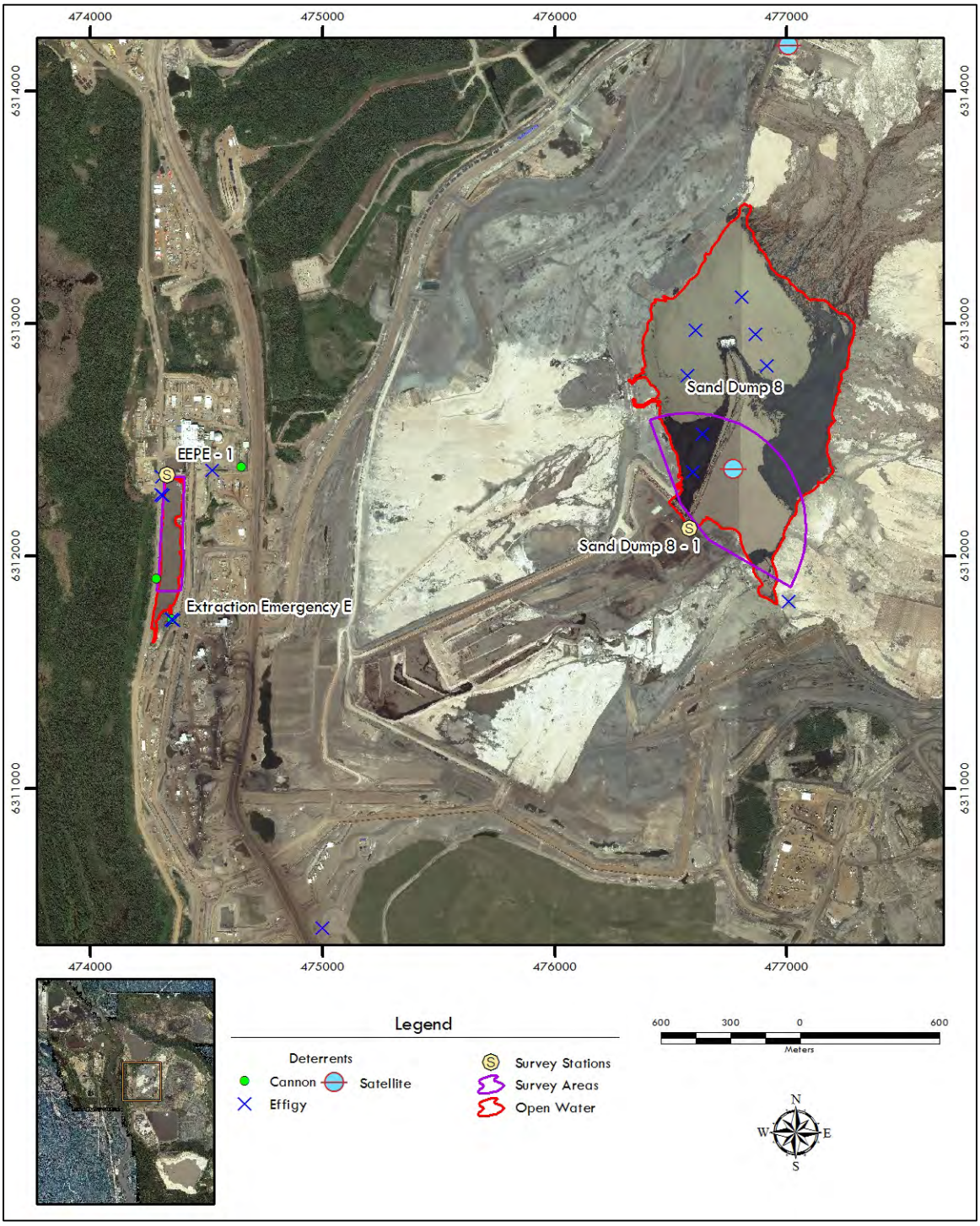
Owl Moon Environmental Inc. (OMEI) (2015) *Oil Sands Bird Contact Monitoring Program 2015 Protocol: Program Description & Rationale for Changes*. Prepared for Canadian Natural Resources Limited, Imperial Oil Canada Limited, Shell Canada Energy, Suncor Energy Inc., Syncrude Canada Limited. April 2015. 75 pp.

Ronconi, R.A. and C.C. St. Clair (2006) Efficacy of a radar-activated on-demand system for deterring waterfowl from oil sands tailings ponds. *Journal of Applied Ecology, 43*, 111-119.

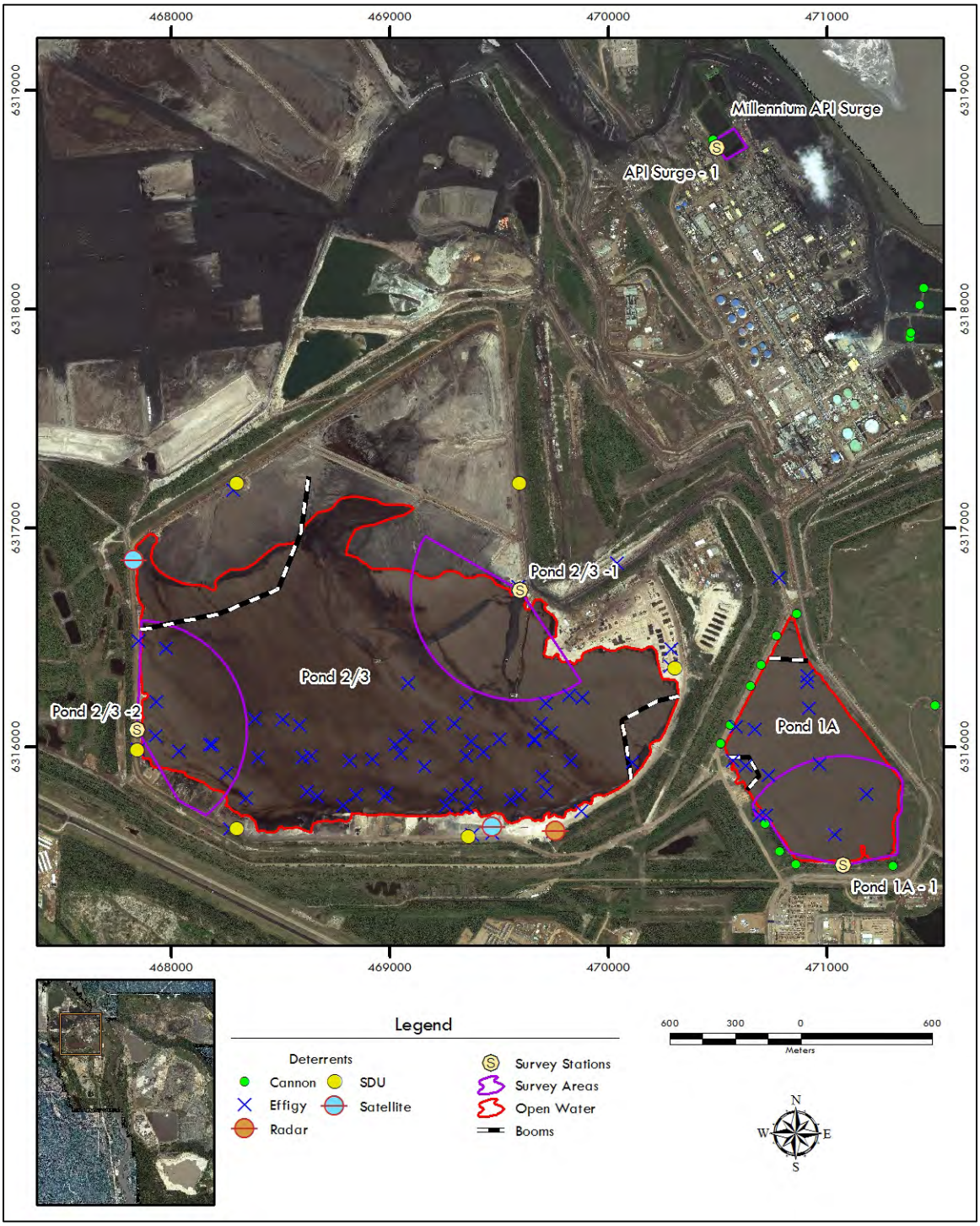
Suncor Energy Inc. (2015) *2015 Waterfowl Protection Plan Update: Oil Sands*. Submitted to the Alberta Energy Regulator. January 30 2015, 15 pp.

Suncor Energy Inc. (2013) *2013 Annual Waterfowl Protection Plan Report*. Prepared for Suncor Energy Inc. and Alberta Environment and Sustainable Resource Development. March 2014, 113 pp.

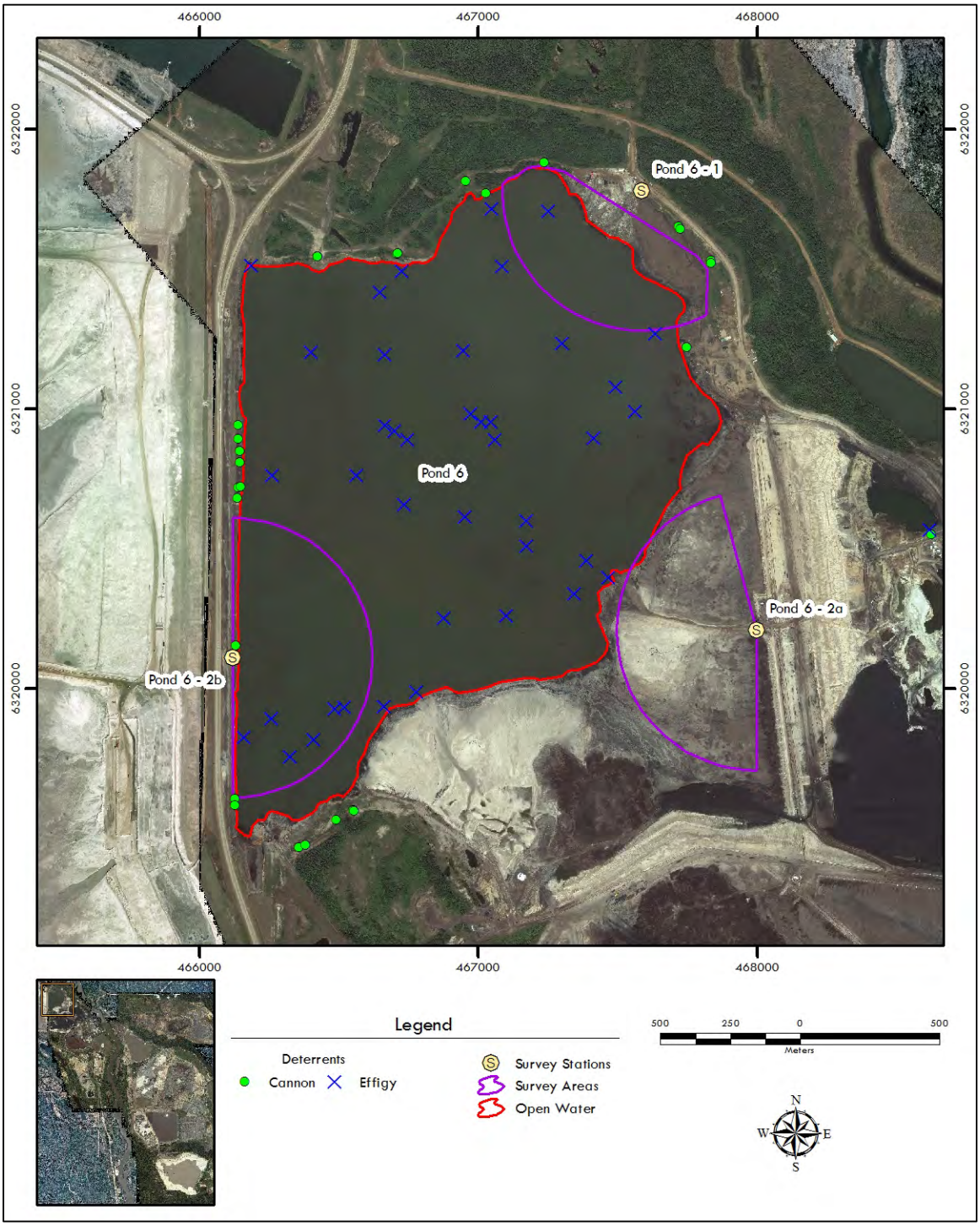
Appendix DI:
Bird Survey Stations and Survey Areas at Suncor Base Mine 2015



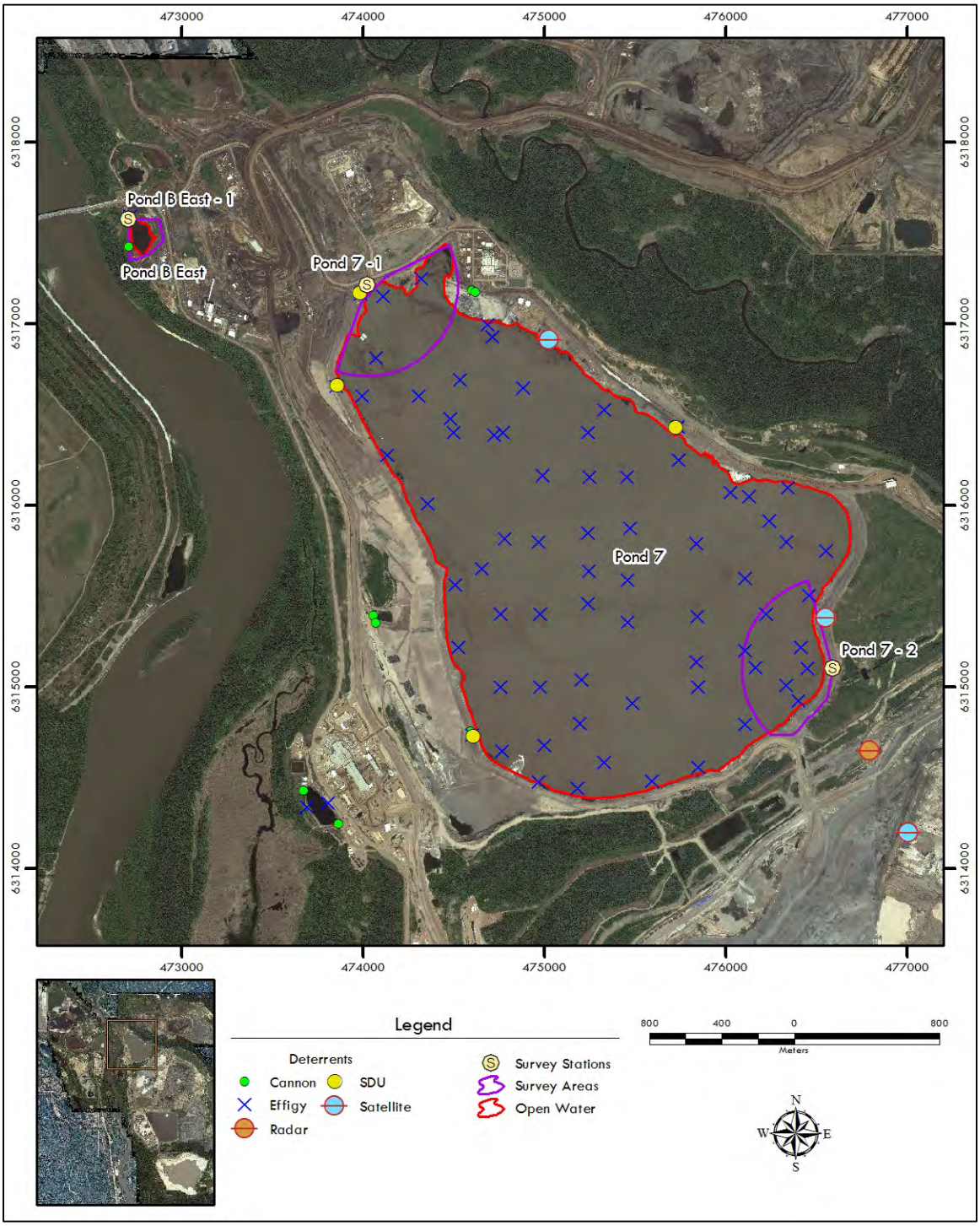
Extraction Emergency E and Sand Dump 8



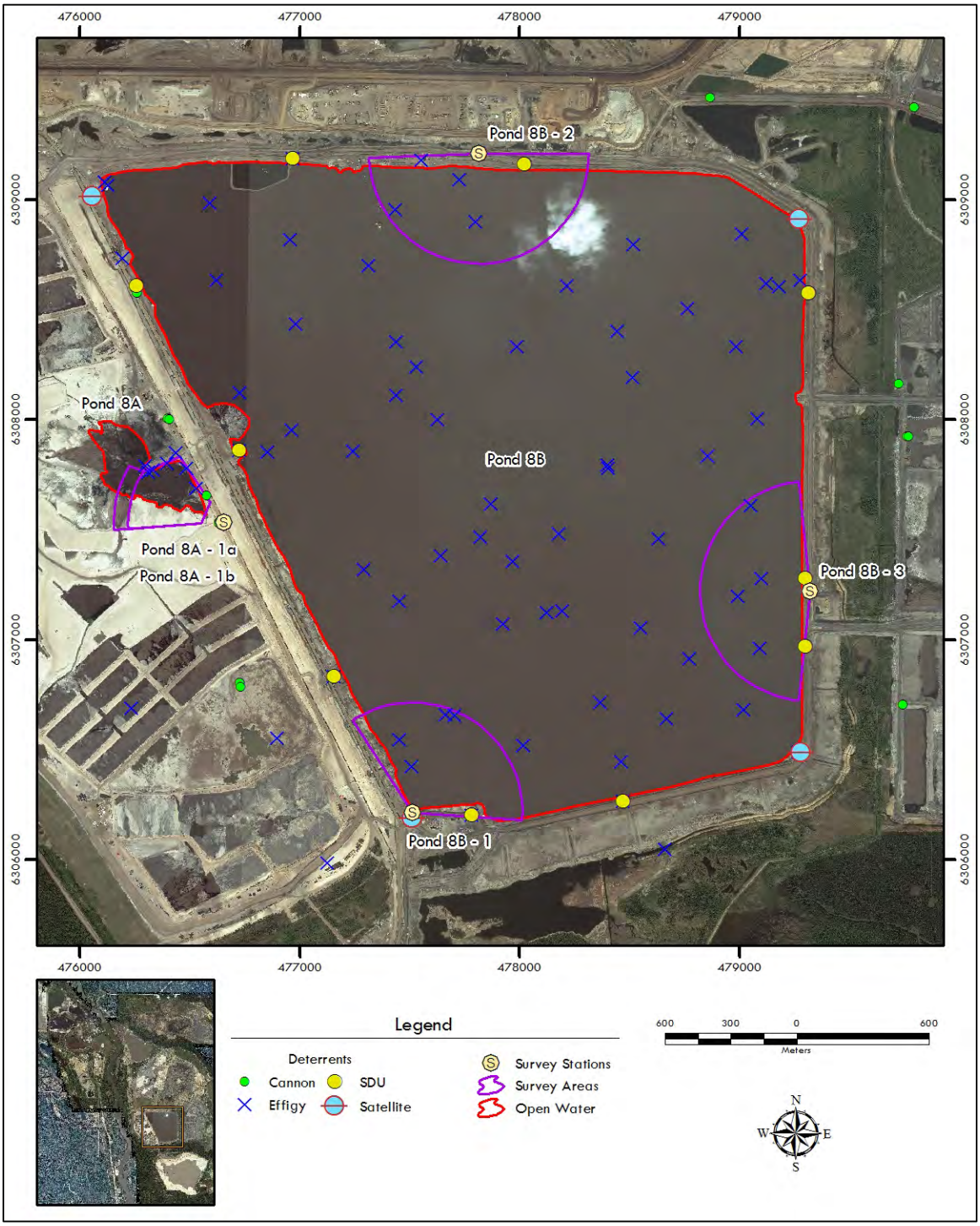
Millennium API Surge, Pond 1A and Pond 2/3


466000
467000
468000
6322000
6321000
6320000
Pond 6 - 1
Pond 6
Pond 6 - 2a
Pond 6 - 2b
Legend
Deterrents
Cannon
Effigy
Survey Stations
Survey Areas
Open Water
500
250
0
500
Meters
N
W
E
S

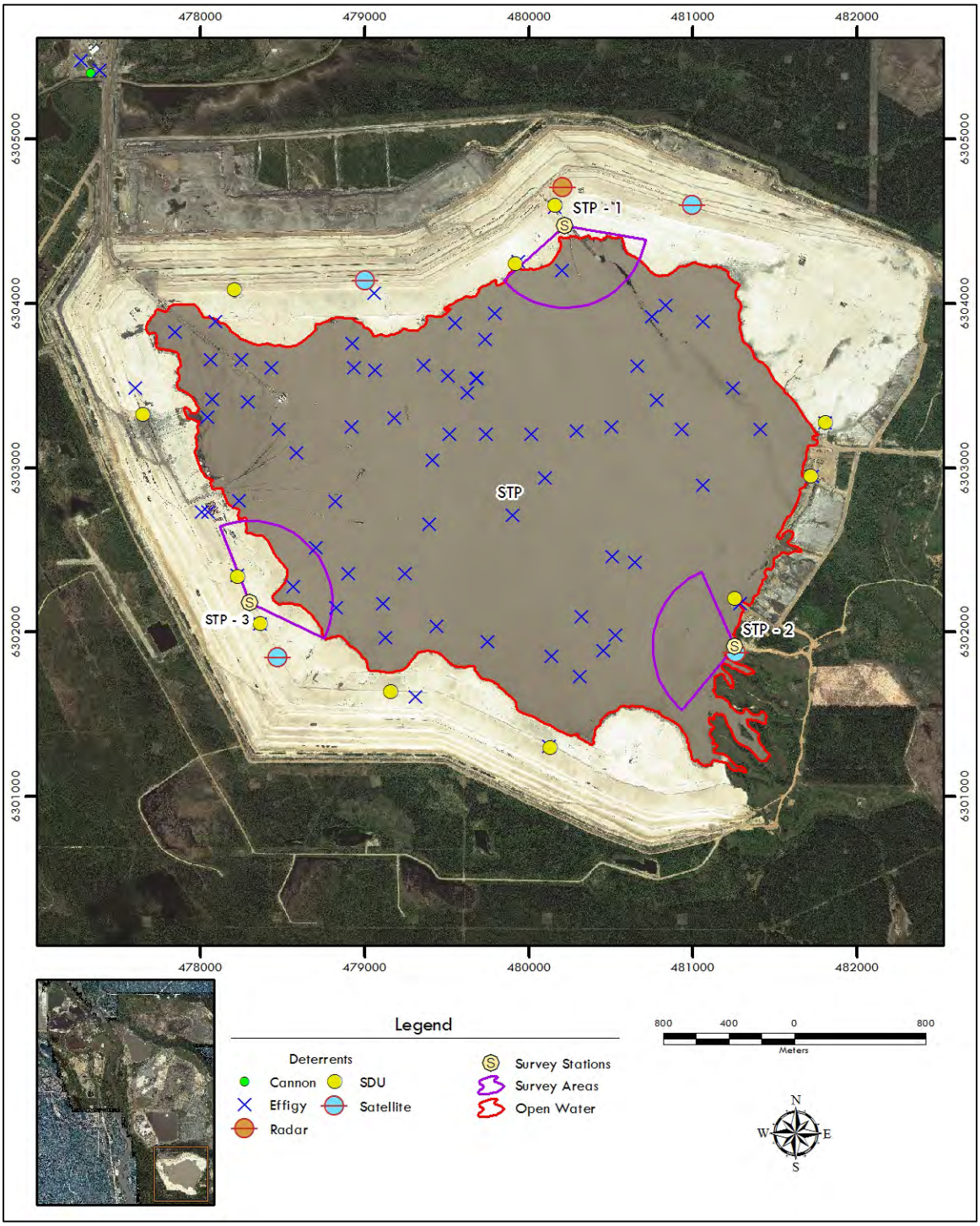
Pond 6



Pond B East and Pond 7

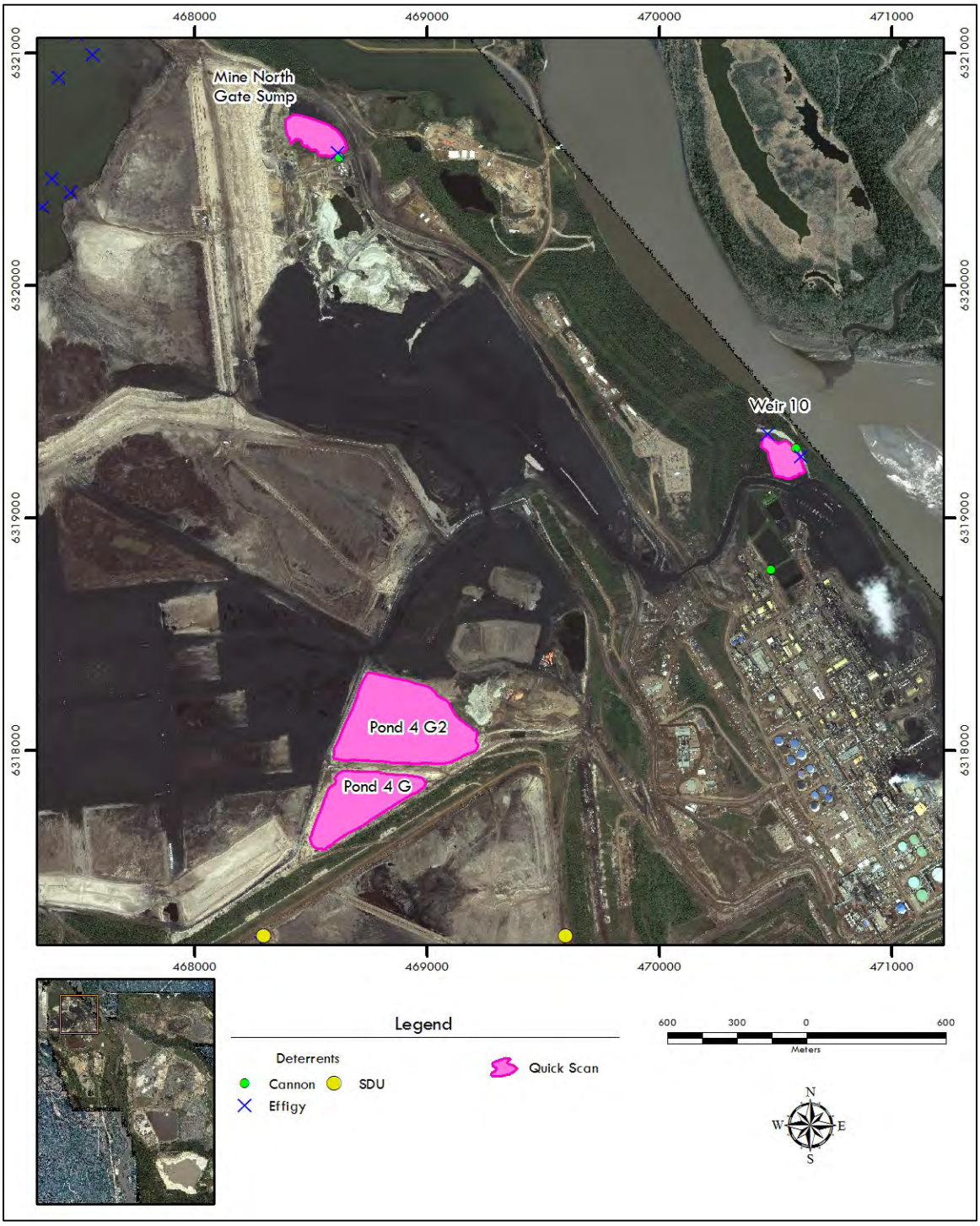


Pond 8A and Pond 8B

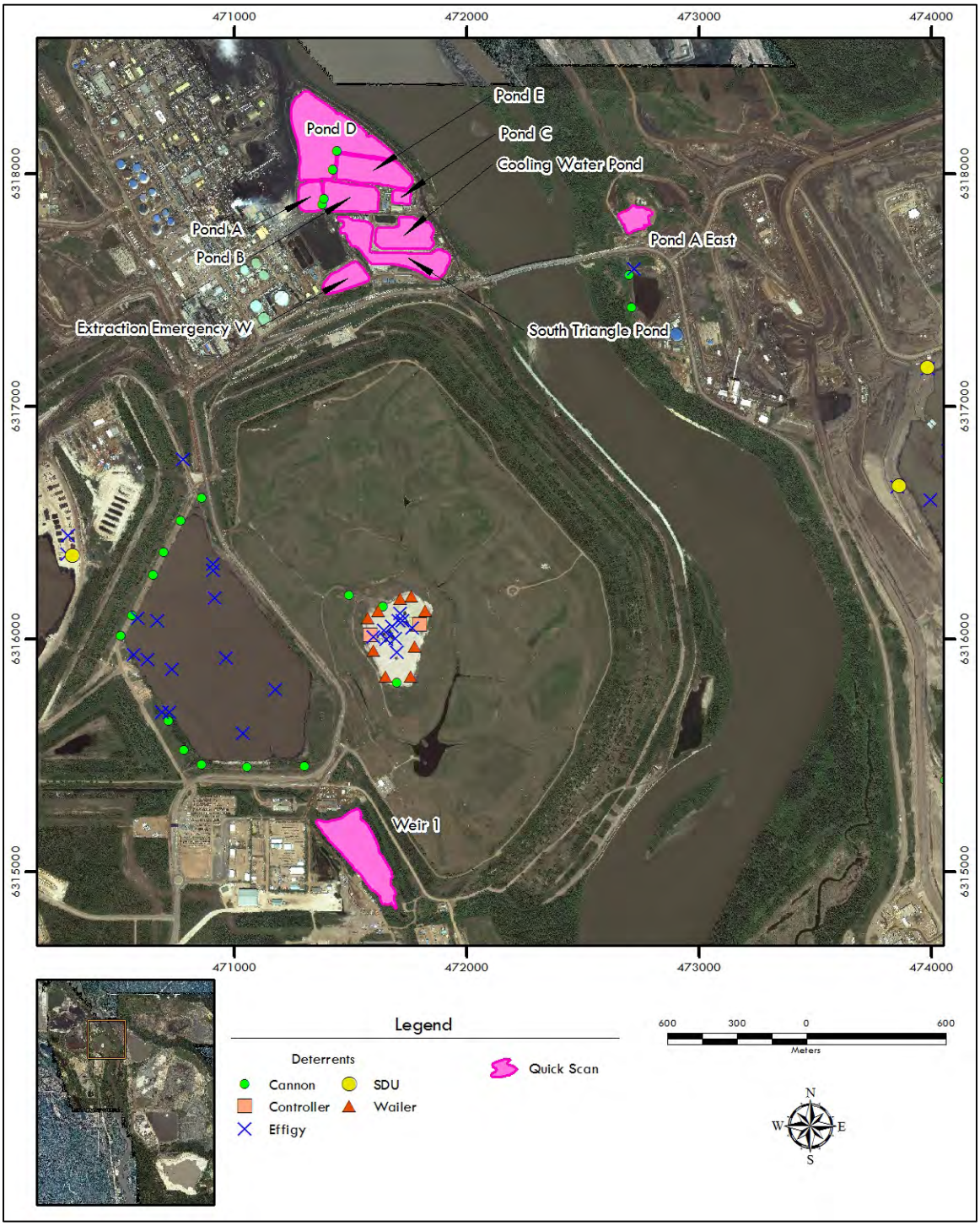


South Tailings Pond (STP)

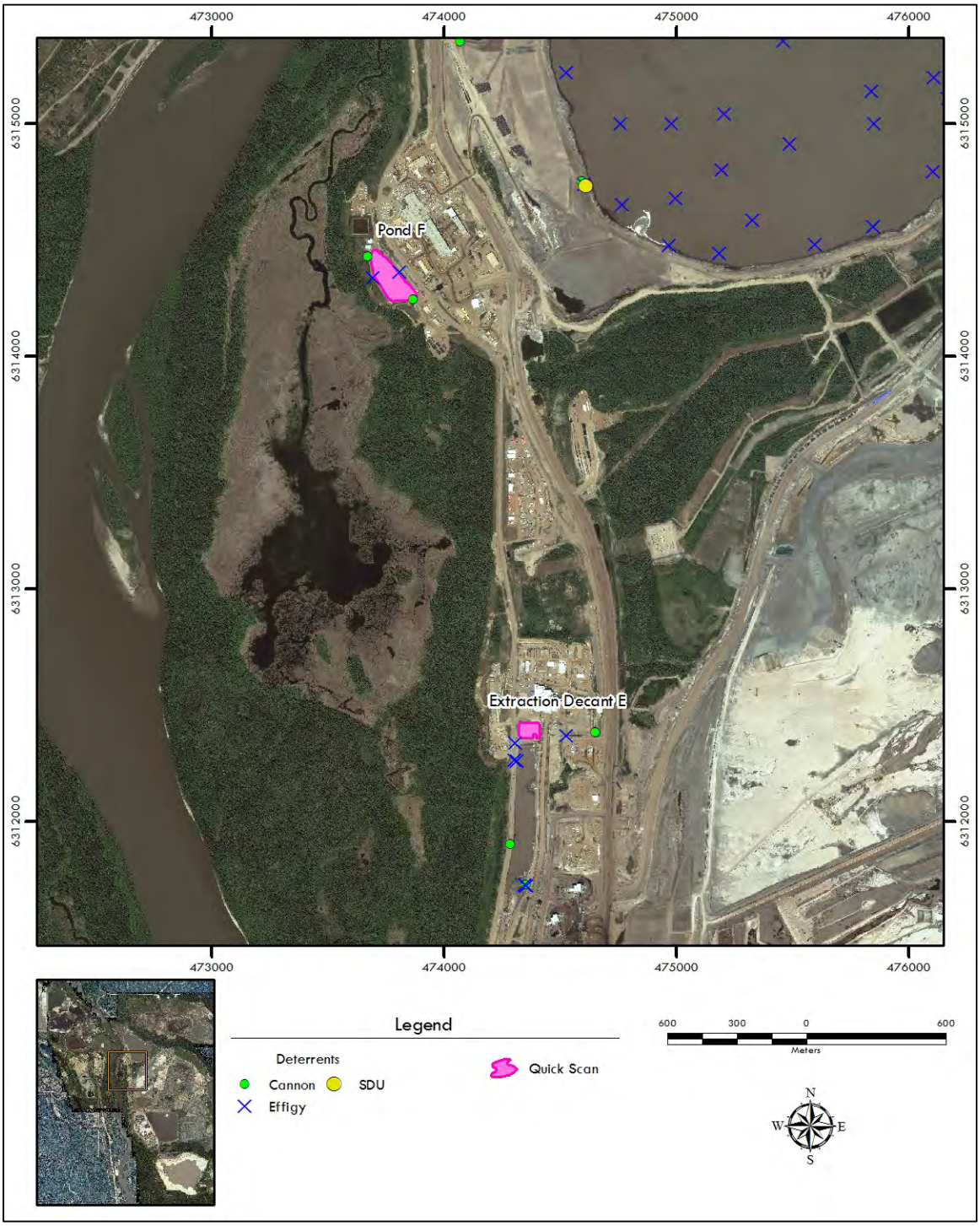
Appendix DII:
LIFs at which Quick Scans and/or Mortality Searches were Conducted in 2015



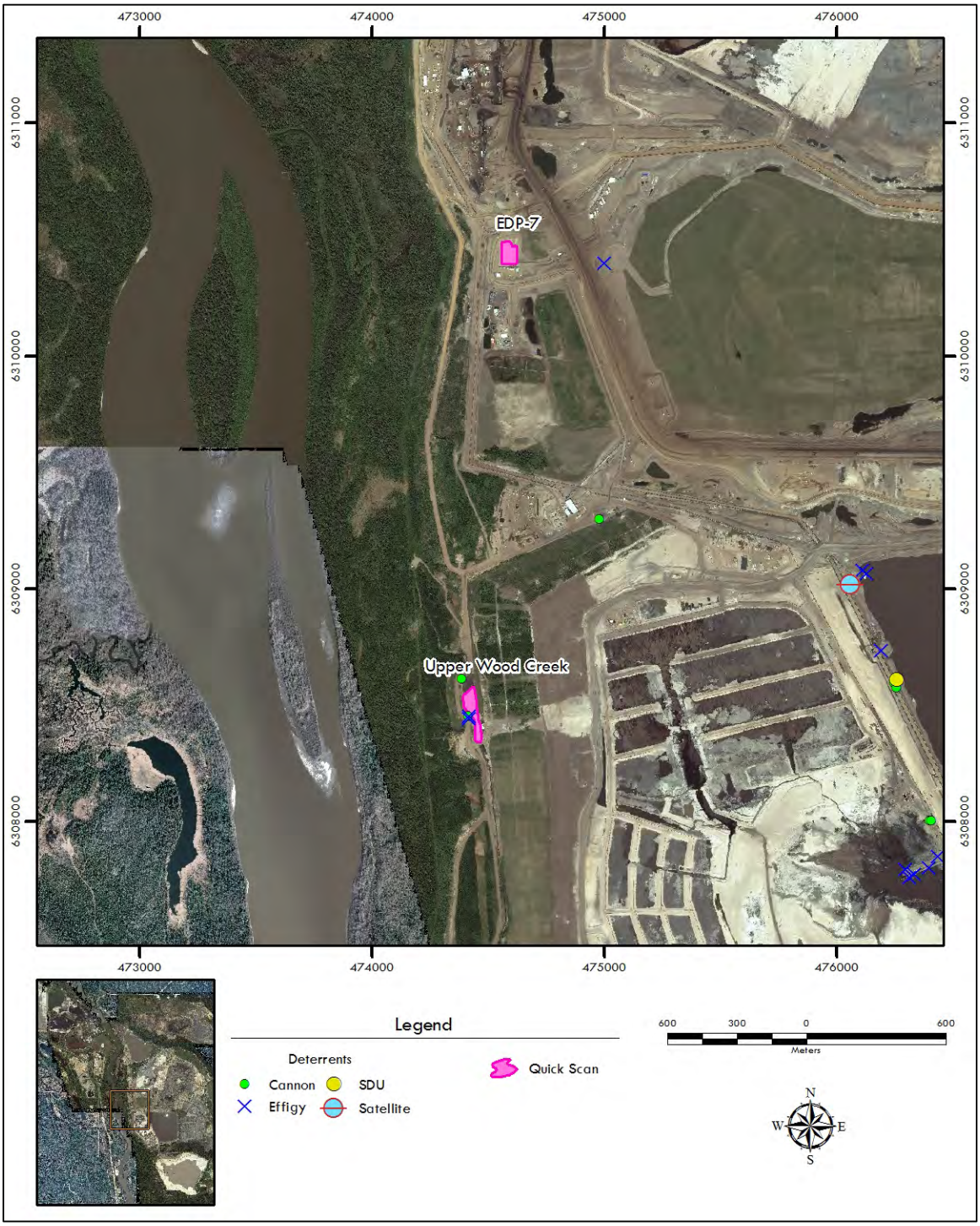
Pond 4 G2 and Pond 4 G (Quick Scans) and
Mine North Gate Sump and Weir 10 (Quick Scans and Mortality Searches)



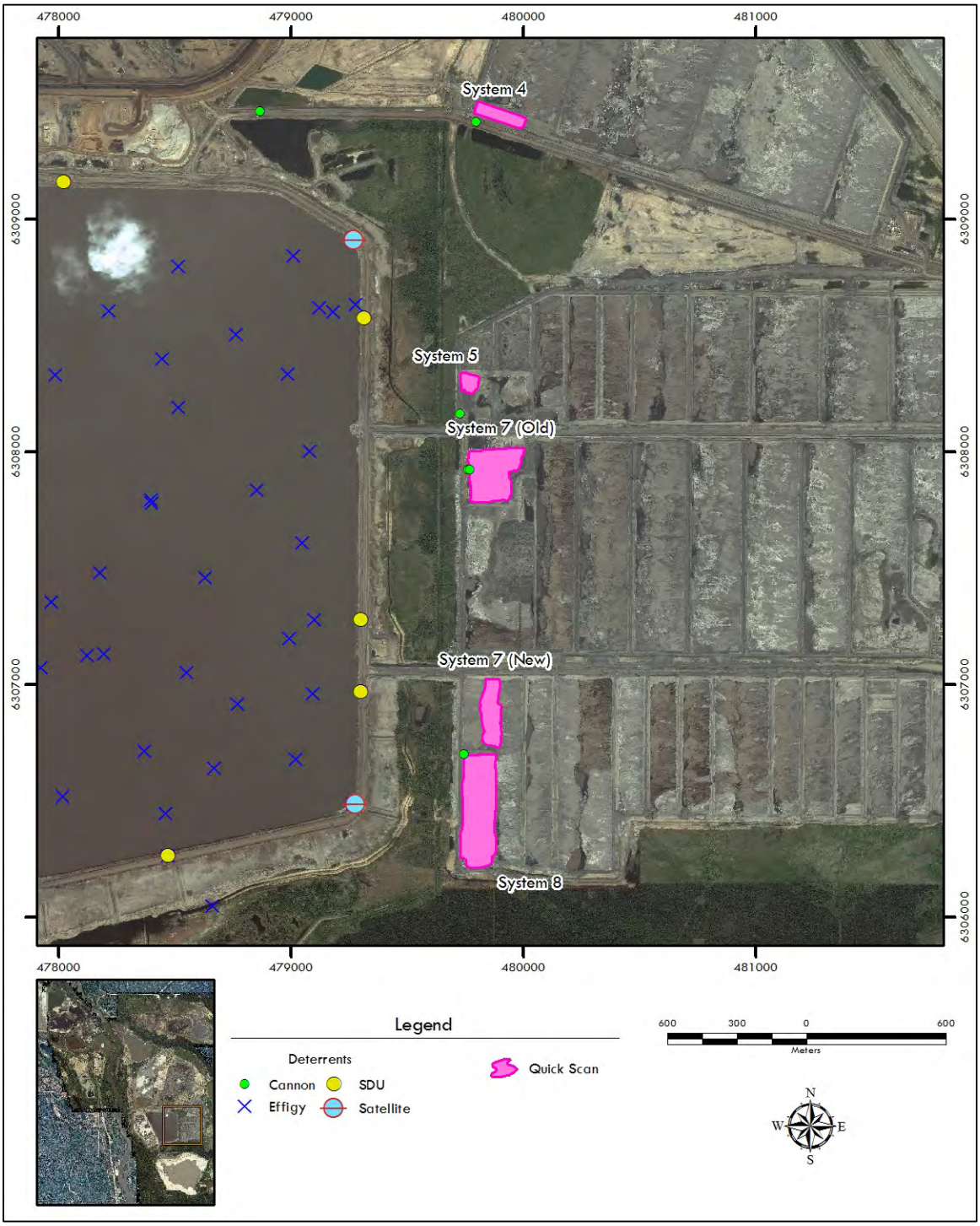
Pond A East, Ponds C and E, Cooling Water Pond, South Triangle Pond, Emergency Extraction West and Weir 1 (Quick Scans) and Ponds A, B and D (Quick Scans and Mortality Searches)



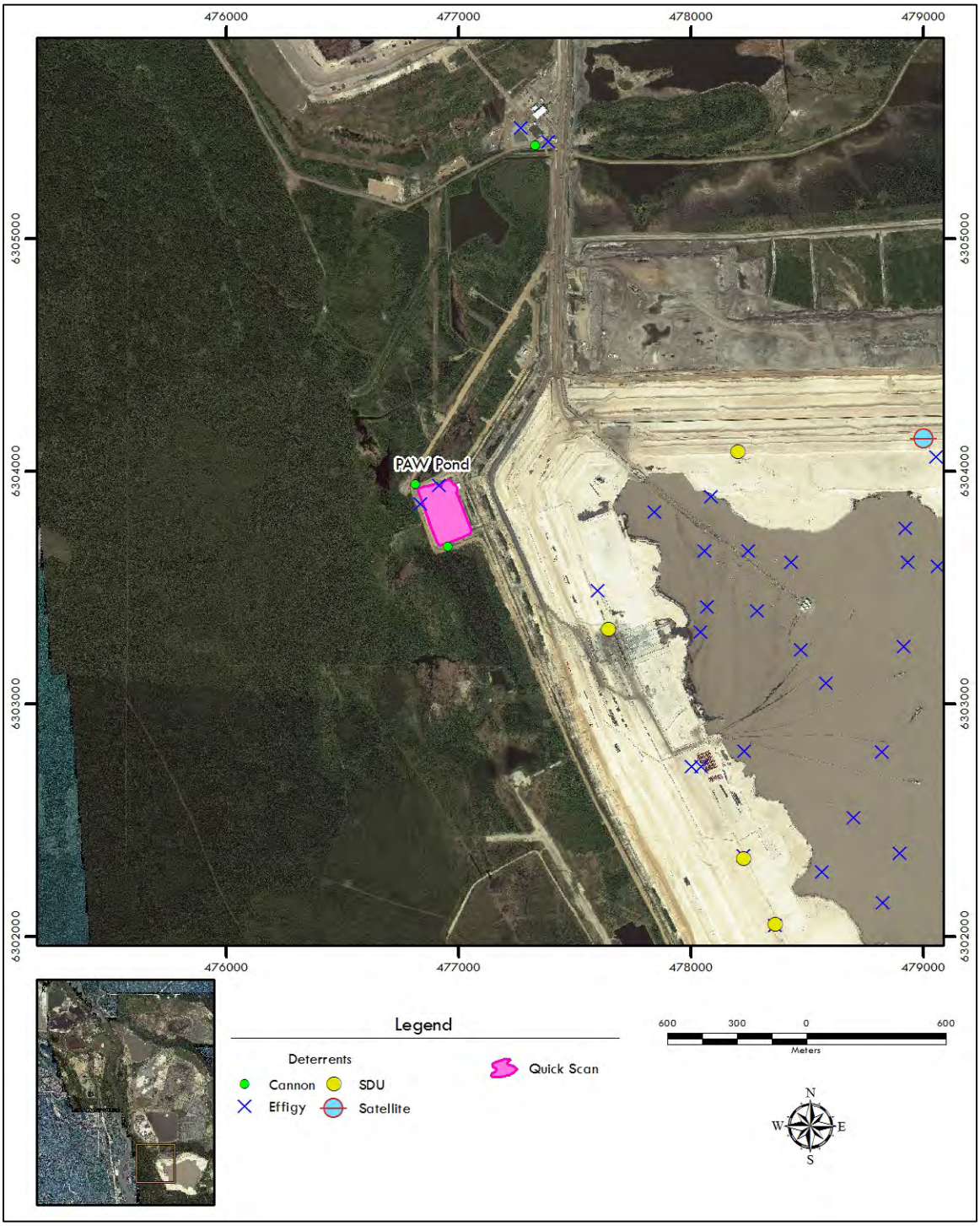
Extraction Decant E (Quick Scans) and
Pond F (Quick Scans and Mortality Searches)



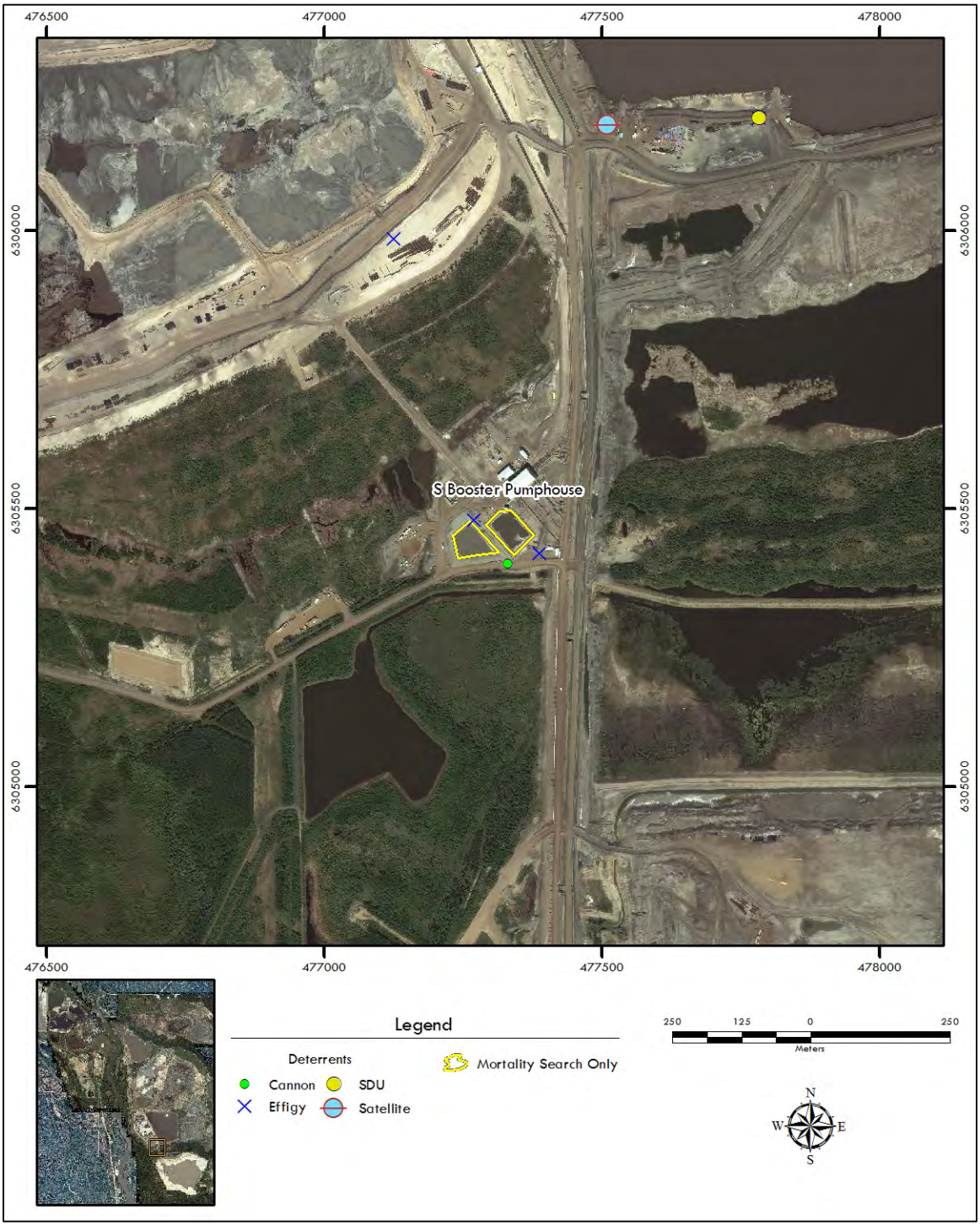
Emergency Dump Pond 7 (Quick Scans) and Upper Wood Creek (Quick Scans and Mortality Searches)



System 4, System 5, System 7 (Old), System 7 (New) and System 8 (Quick Scans and Mortality Searches)

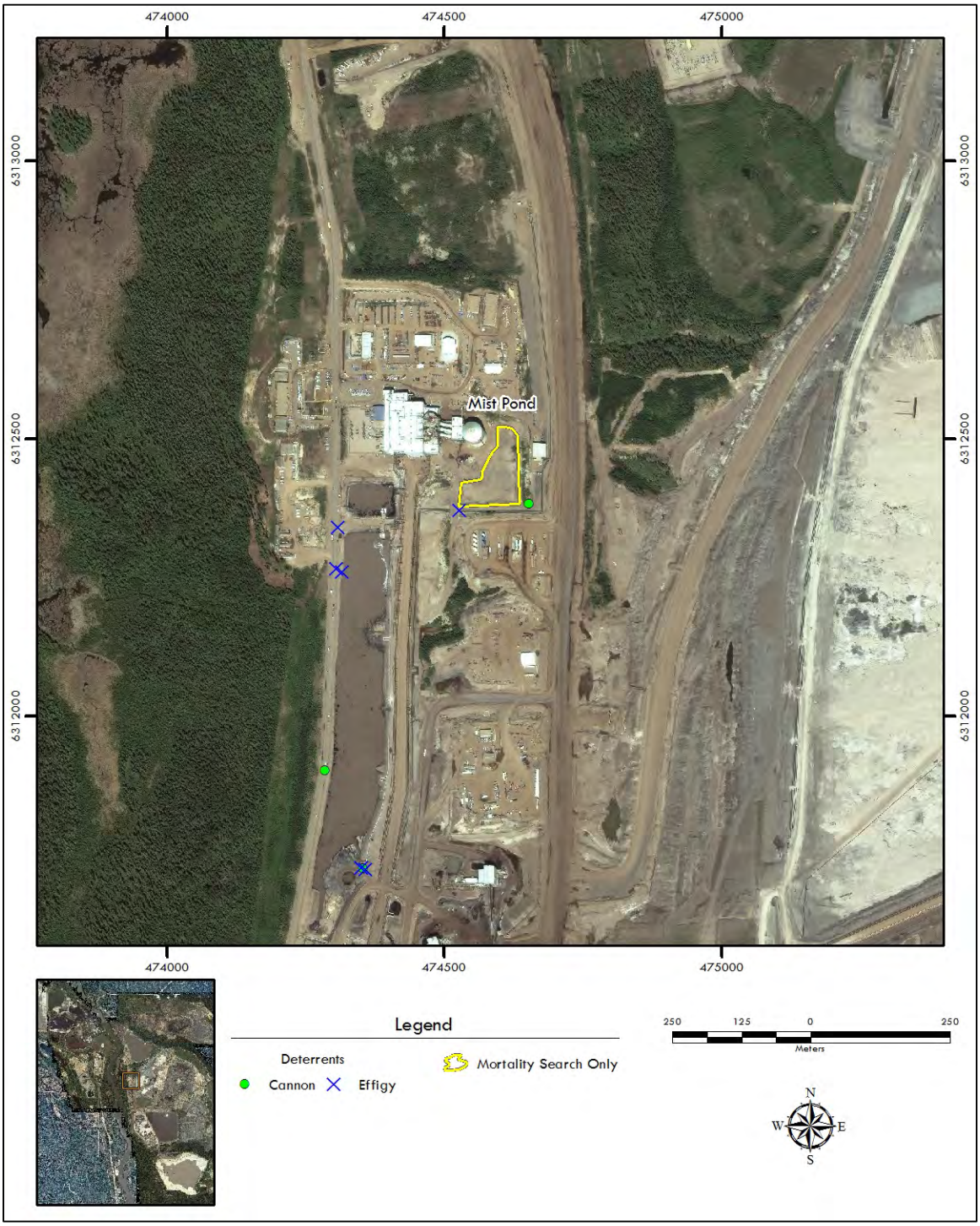


PAW Pond (Quick Scans and Mortality Searches)



South Booster Pumphouse (Mortality Searches)

North Booster Pumphouse (Mortality Searches)



Mist Pond (Mortality Searches)

Appendix DIII:
Bird Oiling and Mortality Events at Suncor Base Mine in 2015

Date	Location	Species	Monitoring Method*	No.	Substrate Where Observed	State When Observed	Oiling Level	End State
Aug 21	Sand Dump 8	Savannah Sparrow	MS-Walking Transect	1	Open water (bitumen mat)	Dead	Heavy	Dead
Aug 21	Sand Dump 8	Savannah Sparrow	MS-Walking Transect	1	Open water (bitumen mat)	Dead	Heavy	Dead
Sep 4	Sand Dump 8	Mallard	MS-Walking Transect	1	Artificial Structure (pipe near catwalk)	Dead	Heavy	Dead, injured/decayed, collected on September 6

Note:
* Monitoring methods: MS = mortality search.

OIL SANDS BIRD CONTACT MONITORING PROGRAM
2015 REGIONAL REPORT

APPENDIX E

SYNCRUDE CANADA LTD.
MILDRED LAKE AND AURORA NORTH MINES

Prepared by:

Syncrude Canada Ltd.

March 2016

Syncrude
Environmental Affairs

March 21, 2016

Alberta Energy Regulator
EPEA Monitoring & Evaluation
Suite 402, 4999-98th Ave NW
Edmonton, Alberta
T6B 2X3

Dear Sir/ Madam

AEPEA 26-02 Syncrude Canada Ltd. Aurora North Mine and Mildred Lake Mine

Please find enclosed Oil Sands Bird Contact Monitoring Program report as part of clause 6.1.77(b) of Syncrude Canada Ltd. AEPEA Approval 26-02 (as amended).

Please contact me at Gorman.Courtney@syncrude.com if you have any questions or concerns regarding the content of this report.

Sincerely,

C. Gorman

Courtney Gorman

Syncrude Canada Ltd.

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E1.0 INTRODUCTION

Syncrude Canada Ltd. is one of the world's largest producers of synthetic crude oil extracted from the Athabasca Oil Sands region of northeastern Alberta. Syncrude was established in 1964, and production commenced 30 km north of Fort McMurray in 1978 at the Mildred Lake plant. Shortly after, in 1998, Syncrude expanded its operations approximately 35 km north, to include another mine site known as Aurora. There is a total of 14 Liquid Impoundment Facilities (LIFs) located at Syncrude, 10 at Mildred Lake with a total area of 3300 ha, and four at Aurora with a total area of 923 ha.

Large quantities of water are stored on these sites as by-product during the production of oil. This process-affected water can be used repeatedly in the extraction process, and is held in LIFs, also known as settling basins. LIFs possess the potential to negatively impact wildlife, especially waterfowl. The leading cause of waterfowl mortality on site is contact with bitumen, a viscous substance found floating on LIF surfaces. Bitumen poses a specific threat to birds because it can coat feathers to impede flight, buoyancy, thermoregulation and foraging.

Athabasca's oil sands are susceptible to waterfowl landings as they are situated on the flight path leading to the Peace-Athabasca Delta, an internationally recognized breeding ground for waterfowl. During migration, birds may seek cover from early spring or late fall weather events in areas of open water; LIFs receiving warm water effluent have less ice cover than natural waterbodies making them a desirable refuge for birds escaping inclement weather.

Syncrude began participating in the Oil Sands Bird Contact Monitoring Program (OSBCMP) in 2011. Participation in this program is a regulatory requirement outlined through regulatory approval conditions and a Waterfowl Protection Plan submitted by Syncrude as part of the *Environmental Protection and Enhancement Act* (EPEA) approval conditions. The OSBCMP is a standardized monitoring program that seeks to measure contact by birds with process-affected water ponds and resulting mortality. The OSBCMP utilizes two primary monitoring methods, bird surveys and mortality searches, conducted at LIFs where the risks of bird contact/bird mortality are greatest. In addition, quick scans are executed to provide information for areas deemed of lesser risk and incidental observations are recorded when bird mortality is identified outside of the standard monitoring procedures. While Syncrude's active deterrent management activities coincide with migration, standardized monitoring takes place each year during the spring (April 16 to July 6) and fall (July 25 to October 31) periods.

E2.0 APPROVAL AND WPP-RELATED REQUIREMENTS

The OSBCMP is undertaken as an obligation under Syncrude's EPEA Approval 26-02. Pursuant to sections 6.1.76 and 6.1.78 of Alberta Environment Approval 26-02 as amended, Syncrude submitted an updated Waterfowl Protection Plan (WPP) in 2014. The WPP outlines Syncrude's commitment to waterfowl protection, and is based on active contribution to the OSBCMP and Syncrude's on-going adaptive management practices with respect to its bird deterrent program.

E3.0 LIF INCLUSION AND EXCLUSION CRITERIA, AND RISK MODEL

The protocol for the 2015 season included a set of inclusion and exclusion criteria used in the first steps of evaluating the risk to birds of exposure to the potentially detrimental contents of each LIF. Application of the inclusion criteria resulted in all 10 of Syncrude's settling basins being included in the OSBCMP monitoring programs (bird surveys and mortality searches). An additional 25 LIFs were assessed using the LIF Inclusion and Exclusion Criteria as well as the Liquid Impoundment Facility Risk Model. None of the LIFs were able to be excluded as all of the preset criteria were not met or no data for the Target Guild Landings per Survey criterion was obtained in previous years. Therefore all 25 LIFS were put through the risk model in its entirety- four of these LIFs resulted in being included into the monitoring program based on the outcome of Bird Mortality Risk. The four LIFs were included into the monitoring program based on a high bird mortality potential combined with a moderate or low landing potential. The other 21 LIFS resulted in a low bird mortality risk, so they were excluded due to either low/ moderate bird landing potential combined with low/moderate bird mortality potential.

The 10 settling basins are tabled below with their 2015 surface area and contents. North Mine South Pit East was not finished construction in 2015 and was not included in the monitoring program.

Table E-1: LIF Inclusion List at Syncrude 2015

Pond Name	Surface Area in 2015 (ha)	Contents
Mildred Lake Settling Basin (MLSB)	590	Tailings/process water
East In- Pit (EIP)	80	Tailings/process water
Base Mine Lake(BML) [Formerly West In-Pit]	790	Tailings/process water
Southwest In- Pit (SWIP)	320	Tailings/process water
Southwest Sands Storage (SWSS)	1500	Tailings/process water
North Mine South Pit West (NMSPW)	270	Tailings/process water
Aurora Settling Basin (ASB)	480	Tailings/process water
Aurora East Pit Northeast (AEPNE)	290	Tailings/process water
Aurora East Pit Northwest (AEPNW)	70	Tailings/process water
Aurora East Pit South (AEPS)	310	Tailings/process water

Mildred Lake Recycle water, Effluent pond, 45 Dump Sump and Pumphouse 691 Sump were LIFs that ranked as a High Bird Mortality Risk after assessment using the Liquid Impoundment Facility Risk Model. These LIFs each had a bird mortality associated with the LIF in the preceding two years, as well as a presence of bitumen. This resulted in a high Bird Mortality Potential and ultimately a high Bird Mortality Risk.

Of the remaining 21 other LIFS, eight were chosen for inclusion into the Quick Scan section of the OSBCMP. The Quick Scan LIFs are distributed throughout Syncrude, with two at Aurora and six at Mildred Lake Lease. The chosen Quick Scan LIFs were distributed around Mildred Lake and Aurora leases to achieve a spatial representation of landings or mortalities at small LIFs.

E4.0 LIF DESCRIPTIONS

Table E-2 provides descriptions for all LIFs monitored at Syncrude during the 2015 OSBCMP season. It describes content, size in ha, risk model outcome, type of monitoring as well as type of mortality search.

Table E-2: LIF Descriptions at Syncrude 2015

LIF Name	LIF Content	Size in ha	Risk Model Outcome	Type of Monitoring	Type of Mortality Search
Aurora East Pit Northeast	Process-affected	335	High	Bird survey	Pond transect and fixed radius
Aurora East Pit Northwest	Process-affected	146	High	Bird survey	Pond transect and fixed radius
Aurora East Pit South	Process-affected	180	High	Bird survey	Pond transect and fixed radius
Aurora Settling Basin	Process-affected	707	High	Bird survey	Pond transect and fixed radius
Effluent	Process-affected	5	High	Bird survey	Small LIF search
East In-pit	Process-affected	145	High	Bird survey	Pond transect and fixed radius
Mildred Lake Settling Basin	Process-affected	950	High	Bird survey	Pond transect and fixed radius
NMSPW	Process-affected	343	High	Bird survey	Pond transect and fixed radius
Recycle Water	Process-affected	14	High	Bird survey	Small LIF search
Southwest In-pit	Process-affected	315	High	Bird survey	Pond transect and fixed radius
Southwest Sands Storage	Process-affected	1742	High	Bird survey	Pond transect and fixed radius
Base Mine Lake	Process-affected	819	High	Bird survey	Pond transect and fixed radius
691 PH Sump	Process-affected	<1.5	High	Bird survey	Small LIF search
45 Dump	Process-affected	<1.5	High	Bird survey	Small LIF search
PWCS	Process-affected	<1.5	Low	Quickscan	Quickscan
Bechtel Sump	Process-affected	<1.5	Low	Quickscan	Quickscan
7-01	Process-affected	<1.5	Low	Quickscan	Quickscan
7-02	Process-affected	<1.5	Low	Quickscan	Quickscan
4-84	Process-affected	<1.5	Low	Quickscan	Quickscan
MH-4	Process-affected	<1.5	Low	Quickscan	Quickscan
AN Emergency Dump	Process-affected	<1.5	Low	Quickscan	Quickscan
ASB MR Seepage	Process-affected	<1.5	Low	Quickscan	Quickscan

E5.0 DETERRENTS

Syncrude's primary deterrent systems consist of bird scaring devices designed to deter birds from frequenting LIFs and other industrial facilities. These primary deterrents consist of high powered acoustic devices (HyperSpikes), falcon scare units, propane cannons, and human effigies.

HyperSpikes and falcon scare units are radar-activated deterrent systems linked to Accipiter™ radar and controller systems. Accipiter™ is a network of digital avian radars designed and programmed to respond to the presence of birds in designated locations. When a target is detected within a location established on a pond, the long range-audio deterrents are activated. When triggered, HyperSpikes broadcast loud programmed acoustic calls of Peregrine Falcons, while falcon effigies flap their wings, flash strobe lights and produce a high volume noise that mimics a predatory and/or anthropogenic sound.

Hyperspikes are restricted to land, whereas falcon units are water-based. Falcon units float on a platform and can be deployed individually or in combination with propane cannons. Groups of floating deterrents are programmed to activate together to protect a specific area of a pond.

Propane cannons are another form of audio deterrent. They produce a loud blast at timed intervals by using propane gas from an LPG tank, transferring it to a metal firing chamber, and firing it using a spark generated from a battery.

Human effigies (scarecrows) are visual deterrents made of rebar and fitted with reflective personal protection equipment and accessories that move in the wind. Effigies are mainly deployed on shore but can be used in combination with cannons on floating rafts.

Bird deterrent activities began when weather forecasts predicted the onset of consecutive days reaching above freezing temperatures. The number of primary deterrents deployed at each LIF was based on the ponds most recent satellite imagery delineating its surface area. HyperSpike units, falcon units and/or scare cannons were placed at a density of 0.125 per ha of total pond surface area. A minimum of 30% of that allocation was designated to water-deployed deterrents, while the remainder was shore-deployed deterrents placed on the perimeter of the LIFs. Syncrude achieved a minimum effigy coverage density of 0.125 per ha of pond water area, in addition to the placement of all other primary deterrents.

Approximately 50 water deployed cannons were placed within the first week of the ice free date, and full deployment was achieved soon after, as pond protection in early spring is high priority. Water-deployed primary deterrents were gradually reduced from LIFs around mid-October during the onset of below freezing ambient temperatures and ice cover on ponds. Reduction of shore deployed deterrents followed after pond surfaces froze over. During the winter when most LIF areas are ice covered, deterrents are placed on the shoreline near areas of open water.

Deterrents may be shuffled around due to operations or construction onsite; however, the required minimum density of 0.125 per ha is always maintained. Refer to Table E-3 for an inventory of deterrents at each LIF taken from a typical day in July.

Table E-3: Total Deterrent Deployment at Syncrude 2015[1,2]

	Combined Audio and Visual				Audio Only				Visual Only			
	Radar Linked		Not Radar Linked		Radar Linked		Not Radar Linked		Radar Linked		Not Radar Linked	
Pond	**Floating**	**On Land**	**Floating**	**On Land**	**Floating**	**On Land**	**Floating**	**On Land**	**Floating**	**On Land**	**Floating**	**On Land**
MLSB	16	7	0	0	0	16	18	82	0	0	0	57
EIP	6	2	0	0	0	5		6	0	0	0	31
BML	32	3	0	0	0	6	8	54	0	0	0	67
SWIP	10	3	0	0	0	8	10	18	0	0	0	25
SWSS	34	3	0	0	0	11	28	109	0	0	0	58
NMSPW	20	0	0	0	0	5	17	0	0	0	0	28
RCW	0	0	0	0	0	0	0	4	0	0	0	4
EFF	0	0	0	0	0	0	0	2	0	0	0	6
ASB	33	3	0	0	0	15	3	34	0	0	0	80
AEPNE	16	4	0	0	0	6	0	21	0	0	0	65
AEPNW	0	3	0	0	0	4	0	7	0	0	8	7
AEPS	18	4	0	0	0	9	0	22	0	0	0	28
ANRCW	0	0	0	0	0	0	0	4	0	0	0	12
691 PH	0	0	0	0	0	0	0	2	0	0	0	1
45 Dump	0	0	0	0	0	0	0	2	0	0	0	1

Notes:

[1] Deterrent deployment densities are maintained throughout the season but distribution and composition may vary.

[2] Deterrents listed represent the deterrents deployed at the end of July 2015.

E5.1 Hazing Procedures

Hazing activities were conducted at LIFs as necessary, from April until November. Bird Environment Team (BET) was responsible for assessing all waterfowl calls reported to dispatch. Crews chose hazing strategies that best suited the situation of concern, all while considering the relative risk posed to birds at different ponds including the potential for pushing fatigued birds into increasingly high risk areas. Birds unable to fly (moulting and juvenile) were never hazed.

Hazing activities were conducted by boat and on foot, depending on location and weather conditions. When birds were within close range, ground-based hazing efforts were used. Each team carried short-range hazing pistols that discharge pyrotechnic scare cartridges (bangers, screamers and whistles) and air horns.

Hazing efforts were directed at dabblers, divers and gulls, as shorebirds have a tendency to retreat to shore instead of flying away as intended. Specific hazing procedures are initiated for diving ducks: bird(s) are briefly harassed to encourage them to leave the area, the hazing ceases for 30-60 minutes. The bird(s) often vacate the area prior to BETs return; however, if they remain another hazing attempt is made. This cycle continues until the bird(s) leave. The time interval between hazing events is beneficial to divers as their first response is commonly to dive rather than fly away, and the period of suspended hazing allows them to flyaway when they feel safe to do so.

E6.0 VEGETATION/HABITAT MANAGEMENT PROGRAMS

Syncrude is committed to returning former mines and tailings areas to viable landscapes that provide a suitable habitat for native flora and fauna. However, suitable habitat located near active tailings areas can be problematic, as it acts as an attractant to waterfowl. Waterfowl habitat found on site includes: vegetation, flats and large areas of open water.

Syncrude has continued to demonstrate its dedication to the prevention of waterfowl losses by reducing habitat attractive to waterfowl around LIFs. Various remediation methods have been employed to reduce the presence of vegetation, the complexity of flats and undesirable water-levels. These methods may include: machinery to re-slope flats to reduce habitat attractiveness, removing vegetation in and around the LIF and/or spraying with herbicide, or filling in and removing unneeded LIFs.

E7.0 STANDARDIZED MONITORING – PROTOCOL

Bird surveys were conducted as per the OSBCMP 2015 regional protocol by avian biologists working for Terracon Geotechnique. A team of six individuals took part in the monitoring; four worked each day, three at Mildred Lake and one at Aurora North site. Daily bird surveys began at 0600 hours or later depending on time of sunrise.

To complete daily monitoring, monitors used Zeiss Conquest 10x42 binoculars, Bushnell/Bushmaster 20x60x60 Spotting Scopes, Tripod, 3G network capable tablets, and the Sibley Field Guide to Birds of North America. Bird Survey data were entered into the bird survey data form, and submitted electronically into the OSBCMP database.

Six days a week were designated for bird monitoring and one day a week, Mondays, were designated as “Comparison Days” (per protocol definition) and were used as an alternative day where missed surveys could be monitored. Other tasks completed on the Comparison Day included data verification (QA/QC) additional orientation and training as necessary for new team members, maintenance, communication, coordination and administrative tasks.

Occasionally, some bird survey stations could not be monitored due to blocked roads, heavy machinery, presence of hydrocarbons, or time limitations. A primary example of this occurred at South West Sands Storage Station #2 (SWSS 2) (UTM E452953/N6317662). SWSS 2 was monitored from April 16 until August 4 but after two weeks of continuous inaccessibility due to the presence of H_2S gas, the station was moved 145 m NNE to an alternate station named SWSS2a (UTM E453092/N631770). SWSS2a was monitored from July 26 until August 24 but many bird surveys and mortality searches were missed during that time due to the persistence of H_2S gas in the area. Eventually the station was abandoned and a replacement station was established, called SWSS5 (UTM E452200/N6312837).

A site-level adjustment was made at Aurora East Pit South station; protocol recommends a 200 m distance between observer and LIF boundary, however, restricted access made that distance unattainable at Aurora East Pit South Station 1 (AEPS 1) (UTM E464080/N6317783). AEPS1 was established approximately 300m away from the LIF boundary.

Mortality searches were conducted in accordance with the regional protocol. Searches were executed at random times throughout the day from April 16 to October 31. Three types of searches were included in the mortality search procedure: (1) transect searches, (2) fixed-radius scans, and (3) small LIF searches.

BET conducted transect-based mortality searches by boat when crews were undertaking tasks such as deterrent maintenance, hazing, bird capture and any other watercraft-based activities. All searches were performed by at least two people. To perform searches, operators used boats, trucks, binoculars, handheld GPS units and data sheets. Distance travelled and effective search width was recorded using handheld GPS units. Information was recorded on data sheets which were subsequently entered in to tablets where the data could be submitted electronically into the OSBCMP database.

Fixed-radius scans and small LIF mortality searches were conducted by avian biologists. Information was collected then entered into mortality search forms and submitted electronically in to the OSBCMP database.

Quicks scans were conducted twice per week by avian biologists through each of the spring (April 16 to July 6) and fall (July 25 to October 31) monitoring seasons as per OSBCMP regional protocol. Surveys were conducted between 1200 hours and 1630 hours.

Incidental observations included birds that were detected between April 16 and October 31 outside of formal bird surveys and mortality searches. Birds counted were either oiled or dead. Birds observed were immediately reported to BET for assessment and were captured if contaminated. Oiled birds were immediately reported to Syncrude's Wildlife Advisor who would contact Fish and Wildlife authorities to discuss recommendations on path forward; authorization to euthanize was common.

E8.0 SUMMARY AND 2015 OBSERVATIONS

In accordance with the OSBCMP regional protocol, avian monitoring was conducted at Syncrude Canada Limited's Oil Sands Mine, during the spring (April 16 to July 6) and fall migration periods (July 25 to October 31). Monitoring consisted of four components: daily bird surveys, mortality searches, quick scans and incidental observations.

Table E-4: Monitoring Effort at LIFs at Syncrude in 2015

Bird Surveys			
# LIFs Surveyed:	14		
# Stations Surveyed:	27		
# Surveys:	4,051		
Mortality Searches			
# LIFs Searched:	14		
Method	**Transect**	**# Fixed-radius Scans**	**# Small LIF searches**
Effort	2873 km	645	90
Quick Scans			
# LIFs Scanned:	8		
# Scans:	336		

E8.1 Bird Survey – Landed Bird Observations

At LIFs, there was a total of 818 observations of landed waterbirds (dabblers, divers, waders, and gulls) consisting of 26 species, across 4,051 surveys. Total area surveyed was 90,006 ha and 0.009 bird per ha were observed. There was a mean of 0.20 landed waterbirds observed per survey amongst all LIFs, ranging from 0 at six of the LIFs, to 0.75 at Base Mine Lake and 0.27 at South West Sands Storage. The most commonly observed species were Mallards (23%), Ring-necked Ducks (10%), Canada Goose (8%), and Herring Gulls (18%).

Table E-5: Bird Survey Observations at Syncrude 2015

Bird Survey Observations – Total Landed (Includes Oiled)									
LIF	**Station**	**Dabblers**	**Divers**	**Unknown Waterfowl**	**Waders**	**Gulls**	**Non-target Guilds**	**Unknown Bird**	**Total**
45 Dump	45 Dump_1	2	0	0	0	144	0	0	146
691 PH	691 PH_1	5	0	0	0	0	0	0	5
AEPNE	AEPNE_1	6	28	0	0	0	0	0	34
	AEPNE_2	0	0	0	0	0	0	0	0
AEPNW	AEPNW_1	0	0	0	0	0	0	0	0
AEPS	AEPS_1	0	0	0	0	0	0	1	1
	AEPS_2	3	0	22	0	0	0	0	25
ASB	ASB_1	6	36	0	0	4	0	0	46
	ASB_2	3	28	2	0	0	0	0	33
	ASB_3	2	2	0	0	0	0	0	4
EFF	EFF_1	0	0	0	0	0	0	0	0
EIP	EIP_1	0	0	0	0	0	0	0	0
MLSB	MLSB_1	0	0	0	0	0	0	0	0
	MLSB_2	0	0	0	0	0	0	0	0
	MLSB_3	0	0	0	0	0	0	0	0
NMSPW	NMSPW_1	1	6	0	1	3	0	0	11
	NMSPW_2	0	0	0	0	0	0	0	0
	NMSPW_3	0	0	0	0	0	0	0	0
RCW	RCW_1	0	0	0	0	0	0	0	0
SWIP	SWIP_1	1	0	0	0	0	0	0	1
	SWIP_2	0	0	0	0	1	0	0	1
SWSS	SWSS_1	1	0	6	0	10	0	0	17
	SWSS_2	3	40	22	0	0	0	0	65
	SWSS_2a	0	0	0	0	0	0	0	0
	SWSS_5	46	0	0	0	1	0	0	47
	SWSS_3	0	31	0	0	0	0	0	31
	SWSS_4	1	18	0	2	0	0	0	21
WIP	WIP_1	142	13	14	15	0	4	0	188
	WIP_2	1	0	0	0	0	0	0	1
	WIP_3	89	13	10	17	12	0	0	141
Total		**312**	**215**	**76**	**35**	**175**	**4**	**1**	**818**

Base Mine Lake (West-In Pit) had the highest number of bird observations with a total of 330 occurrences, accounting for 40% of Syncrude's total landed bird observations. Base Mine Lake is situated within a reclamation area and is currently transitioning to become a freshwater pond, this transition has created suitable habitat for wildlife and is likely a leading contributor to the increased number of waterfowl landings. Seventy percent of the birds witnessed were identified as members of the foraging guild 'dabblers'.

South West Sands Storage had the second highest number of recorded bird landings with 181 sightings. Of the sightings, 51 belonged to the 'dabblers' guild and 89 belonged to the 'divers' guild. Bird sightings have increased by approximately 77% in comparison to the previous year; however this may be attributed to two factors: the inclusion of an additional monitoring station due to elevated water levels and an increase in pond surface area, as well as improved access to stations adjacent to suitable bird habitat.

Based on the number of bird sightings recorded at 45 Dump, data suggests that the area is commonly frequented by birds; however this number misrepresents the amount of bird activity that actually occurred there in 2015, as 144 of the 146 sightings belong to one large flock of gulls. Few landings were recorded at 45 Dump in 2015 and the reduction in sightings may be attributed to decreased water levels and aquatic vegetation.

Aurora Settling Basin saw a drastic decline in bird occurrences in 2015 with only 83 observations which is a significant change when compared to 2014's record of 254. An increase in operational pond activity may have led to the decline in landed waterfowl as equipment may have acted as a deterrent to dissuade birds from the area.

In the 2015 monitoring season there were no reported landings on MLSB. This is a noticeable change from the previous seasons. In the previous year one of the MLSB monitoring stations became encompassed in coke halfway through the season; The monitoring of a newly formed coke beach yielded a higher than expected number of landed shorebirds and waders. Since there was no more open water for one MLSB station, and due to access issues, some monitoring stations at MLSB were relocated to different areas of the pond for 2015. There is significantly less surface area of water due to coke storage, as well as an increased presence of mobile equipment on the pond surface compared to past seasons; this could potentially lead to reduced mortalities and reduced sightings.

Aurora East Pit South is a newly commissioned LIF and 2015 was the first year it was monitored in the OSBCMP. In total, 26 bird sightings were recorded. The majority were identified as 'unknown ducks' and this was likely due to the distance between observer and LIF. OSBCMP protocol recommends a 200m distance between observer and LIF boundary, however restricted access made that distance unattainable during the 2015 season.

Effluent pond is located in an active area within the plant. Since it is a high traffic area frequented by workers and vehicles it seems an unlikely place for bird landings to occur. Over the last two seasons, zero target species have been observed during the scheduled bird monitoring.

The remainder of the LIFs monitored had minimal bird contact. The number of bird sightings has declined overall in comparison to previous years.

E8.2 Migration and Residency

Landed birds were classified as being either migrant or seasonal-resident, based on behaviour and observer's perception of behaviour; some indicators of resident status may be observing the same bird, in the same area, on consecutive days or witnessing a family group with non-flight capable juveniles. Determining migrant versus seasonal-resident status is subjective and is highly based on observers experience level and the behaviour that they observe. Observers unable to make the distinction between migrant or seasonal-resident had the option to enter residency status as unknown in the OSBCMP database.

Table E-6: Observations of Resident Species at Syncrude 2015

LIF	Station	Guild	Species	Conservation Status	Adult	Young	Oiled*
45 Dump	45 Dump_1	Gull	Herring Gull		143	0	0
691 PH	691 PH_1	Dabbles	Mallard		3	0	0
AEPNE	AEPN-E_1	Dabbles	Northern Shoveler		5	0	0
		Dives	Ring-necked Duck		5	0	0
			Unknown Diver		6	0	0
	AEPNE_2	N/A	N/A		0	0	0
AEPNW	AEPNW_1	N/A	N/A		0	0	0
AEPS	AEPS_1	N/A	N/A		0	0	0
	AEPS_2	N/A	N/A		0	0	0
ASB	ASB_1	Dives	Ring-necked Duck		25	0	0
			Unknown Scaup		2	0	0
	ASB_2	Dabbles	Northern Pintail	Sensitive	3	0	0
		Dives	Horned Grebe	Sensitive	6	0	0
			Ring-necked Duck		12	0	0
			Unknown Diver		2	0	0
			Unknown Scaup		4	0	0
	ASB_3	Dives	Canvasback		2	0	0
EFF	EFF_1	N/A	N/A		0	0	0
EIP	EIP_1	N/A	N/A		0	0	0
MLSB	MLSB_1	N/A	N/A		0	0	0
	MLSB_2	N/A	N/A		0	0	0
	MLSB_3	N/A	N/A		0	0	0
NMSPW	NMSPW_1	Dabbles	American Wigeon		1	0	0
	NMSPW_2	N/A	N/A		0	0	0
	NMSPW_3	N/A	N/A		0	0	0
RCW	RCW_1	N/A	N/A		0	0	0
SWIP	SWIP_1	N/A	N/A		0	0	0
SWIP	SWIP_2	Gull	Unknown White-headed Gull		1	0	0
SWSS	SWSS_1	Gull	Unknown Gull		10	0	0
	SWSS_2	Dives	Lesser Scaup	Sensitive	13	0	0
	SWSS_2a	N/A	N/A		0	0	0
	SWSS_5	Gull	Herring Gull		1	0	0
	SWSS_3	N/A	N/A		0	0	0
	SWSS_4	Dabbles	Northern Shoveler		1	0	0
		Wades	American Avocet		2	0	0

LIF	Station	Guild	Species	Conservation Status	Adult	Young	Oiled*
WIP	WIP_1	Dabbles	American Green-winged Teal	Sensitive	5	0	0
			American Wigeon		9	0	0
			Canada Goose		9	0	0
			Mallard		26	25	0
			Northern Shoveler		19	0	0
		Dives	American Coot		1	0	0
			Lesser Scaup	Sensitive	6	0	0
			Ring-necked Duck		4	0	0
			Unknown Scaup		2	0	0
		Unknown Waterfowl	Unknown Duck		3	5	0
		Non-target	Common Raven		4	0	0
	WIP_2	Dabbles	Canada Goose		1	0	0
	WIP_3	Dabbles	American Green-winged Teal	Sensitive	11	0	0
			Blue-winged Teal		2	0	0
			Mallard		24	7	0
			Northern Shoveler		5	0	0
			Unknown Dabbler		1	0	0
		Dives	American Coot		0	1	0
			Common Goldeneye		4	0	0
		Wades	Killdeer		2	0	0
			Lesser Yellowlegs		6	0	0
			Unknown Sandpiper		7	0	0
		Gull	Herring Gull		1	0	0
			Unknown Gull		5	0	0
				Total	**404**	**38**	**0**

Notes:
Individual live birds, especially seasonal residents, may be observed on multiple days and thus counted more than once.
* Oiled birds are included in the number of adult/young.

Observers at Syncrude identified over half (54%) of bird landings as belonging to seasonal-residents. Of the 442 seasonal-residents documented, 143 belonged to one flock of Herring gulls that were recorded at Syncrude on a single occasion. After speaking with the observer who documented the landing, it was determined that the individual believed that the gulls were residents of the area and not Syncrude mine itself. The observer assumed they were residents due to species and time of year observed (September 25th, 2015).

The remainder of birds identified as seasonal-residents included 261 adults and 38 juveniles. The majority of these birds were observed landed at Base Mine Lake; 60% of adult birds and 100% of juveniles were recorded there. This may be due to the effects of reclamation, as Base Mine Lake is currently transitioning into a freshwater pond. Base Mine Lake is not the only body of water in the area, and surrounding freshwater ponds may also be attractive to waterfowl.

E8.3 Mortality Search – Bird Oilings and Mortalities

One mortality was discovered during 2873 km of watercraft transect surveys, 645 fixed radius scans and 90 small LIF searches that covered a total search area of 49,426 ha; however, 9 mortalities were discovered incidentally and are represented in parenthesis in Table E-7. Mortalities included 7 species, Mallards (3), Red-necked Grebe (2), Franklin Gull (1), Canvasback (1), Canada Goose (1) and American Coot (1).

Table E-7: Mortality Search Observations at Syncrude 2015

LIF	Lightly Oiled	Moderately Oiled	Dead/Euthanized or Heavily Oiled		Total Oiled	
			Not Collected	Collected	Not Collected	Collected
45 Dump	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
691 PH	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
AEPNE	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
AEPNW	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
AEPS	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
ASB	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
EFF	0 (0)	0 (0)	0 (0)	0 (1)	0 (0)	0 (0)
EIP	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
MLSB	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
NMSPW	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
RCW	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
SWIP	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	1 (0)
SWSS	0 (0)	0 (0)	0 (0)	0 (3)	0 (0)	0 (2)
WIP	0 (0)	0 (0)	0 (0)	0 (3)	0 (0)	0 (0)
Total	**0 (0)**	**0 (0)**	**0 (0)**	**1 (9)**	**0 (0)**	**1 (9)**

Notes:
Numbers in parentheses are incidental observations by mortality search personnel.
Individual live birds may be observed on multiple days and thus counted more than once.

Many hours were spent conducting bird mortality searches and only one bird was detected during formal monitoring; however this is not unusual as former mortality searches have accounted for the discovery of only one oiled duck as well (2014). Almost all documented mortalities were incidental observations reported by either BET or operators working in the area. Outside of the regular monitoring program, 31 Great Blue Herons were incidentally discovered in an unmonitored sump. The herons were heavily oiled and 31 mortalities occurred.

Oiled birds resulting in mortalities ranged from 40-100% oiled, all birds were either captured alive and euthanized under the direction of Fish and Wildlife division of Alberta Environment and Parks or they were dead at the time of observation and recovered.

Base Mine Lake was the LIF that accounted for the greatest number of mortalities (3) during the OSBCMP monitoring season, followed by South West-In Pit (2), South West Sands Storage (1) and Effluent (1).

Overall, bird mortalities at Syncrude have declined in comparison to previous years.

E8.4 Quick Scans

Eight LIFs ranging in size from 0.31 ha to 1.79 ha were included in the Quick Scan monitoring. A total of 336 searches were conducted and 110 birds were observed landed within the survey areas. Zero mortalities were observed; however, two landed birds were discovered slightly oiled at 7-02 (FFT).

Table E-8: Quick Scan Effort and Observations at Syncrude 2015

LIF	Scans	Protocol Requirements (%)*	Dabblers	Divers	Unknown Waterfowl	Waders	Gulls	Non-target Guilds	Total Landed	Total Oiled**	Lightly Oiled	Moderately Oiled	Dead/ Euthanized or Heavily Oiled
4-84 (Fusion Yard)	44	86	43	10	0	0	0	0	**53**	**0**	0	0	0
7-01 (FFT)	40	78	2	0	0	0	0	0	**2**	**0**	0	0	0
7-02 (FFT)	42	82	51	0	0	0	0	0	**51**	**2**	2	0	0
AN Emergency Dump	40	78	0	0	0	0	0	0	**0**	**0**	0	0	0
ASB Seepage Sump MR	40	78	0	0	0	0	0	0	**0**	**0**	0	0	0
Bechtel Sump	43	84	0	0	0	0	0	0	**0**	**0**	0	0	0
Bitumen Sump	43	84	0	2	0	0	0	0	**2**	**0**	0	0	0
PWCS	44	86	0	2	0	0	0	0	**2**	**0**	0	0	0
Total	**336**	**82**	**96**	**14**	**0**	**0**	**0**	**0**	**110**	**2**	**0**	**0**	**0**

Notes:

* LIFs were to be scanned twice per week, from April 16 to July 6 and July 25 to October 31.

** Oiled birds are included in number landed.

E8.5 Species of Conservation Concern

During surveys, there was a total of 81 observations of landed waterfowl listed under the *Species at Risk Act* (Government of Canada 2015). Species observed are represented in Table E-9 and consist of American Green-winged Teal (34), Northern Pintail (3), Horned Grebe (16), Lesser Scaup (28) and Great Blue Heron (31). There were no mortalities observed concerning species of conservation concern during the OSBCMP season.

Table E-9: Observation of Species of Conservation Concern During Bird Surveys, Mortality Searches and Quick Scans at Syncrude 2015

Guild	Species	Conservation Status	Total Landed	Total Oiled*	Lightly Oiled	Moderately Oiled	Dead/Euthanized or Heavily Oiled
Dabbles	American Green-winged Teal	Sensitive	34 (3)	0 (3)	0 (3)	0 (0)	0 (0)
	Northern Pintail	Sensitive	3 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Dives	Horned Grebe	Sensitive	16 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Lesser Scaup	Sensitive	28 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Waders	Great Blue Heron	Sensitive	0 (31)	0 (31)	0 (0)	0 (0)	0 (31)
		Total	**81 (34)**	**0 (34)**	**0 (3)**	**0 (0)**	**0 (31)**

Notes:
Numbers in parentheses are incidental observations.
Individual live birds may be observed on multiple days and thus counted more than once.
* Oiled birds are included in number landed.

E9.0 SITE-LEVEL RECOMMENDATIONS FOR 2016

Continuous improvement is fundamental to all aspects of Syncrude's oil sands operations and will be applied to enhance our waterfowl protection practices in 2016. Site level recommendations under consideration include in-house deterrent data analyses, new environmental remediation techniques and an assessment of soft deposit areas.

Syncrude's Wildlife Advisor will compile information on all recorded bird activity on LIFs. Data analyses will be conducted to determine trends concerning bird contact and deterrent placement. The outcomes will be applied to Syncrude's deterrent deployment plan.

New environmental remediation techniques are being explored. Base Mine Lake previously known as West In-Pit) is in the process of reclamation and is transitioning to a fresh water lake.