

# **OIL SANDS BIRD CONTACT MONITORING PROGRAM**

## **2014 ANNUAL REPORT**

**Prepared for:**

**Alberta Energy Regulator and  
Alberta Environment and Sustainable Resource Development**

**March 2015**

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## **OIL SANDS BIRD CONTACT MONITORING PROGRAM 2014 ANNUAL REPORT**

### **1. INTRODUCTION**

**Prepared for:**

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

**March 13, 2015**

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## **1.0 INTRODUCTION**

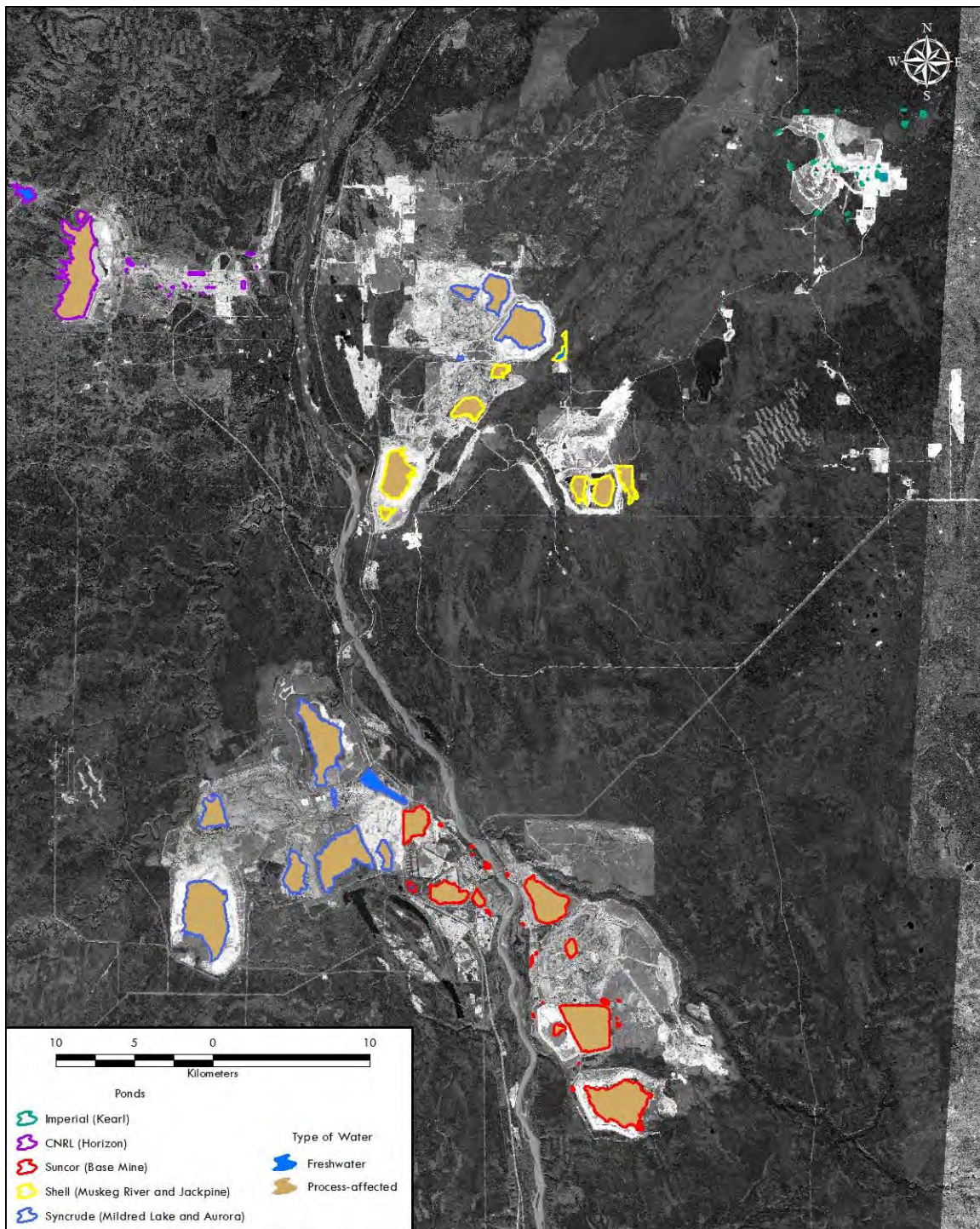
### **1.1 Context**

The Oil Sands Bird Contact Monitoring Program (OSBCMP) was initiated in 2011, with the early objective of establishing a standardized protocol for monitoring of bird landings at process-affected ponds at the five oil sands mine operations in northeastern Alberta. In each subsequent year, the data were analysed and challenges experienced were evaluated, and the protocol amended to improve data quality and consistency in procedures across sites. Through the period of 2011 to early 2014, responsibility for the protocol and for the integration and analyses of data collected within the program rested with the University of Alberta's Research on Avian Protection Program (RAPP), led by Dr. Colleen Cassady St. Clair. The history of events leading to the establishment of the OSBCMP is described in detail in St. Clair (2014a).

Data and outcomes from each of the 2011, 2012 and 2013 programs are presented in St. Clair et al. (2012, 2013 and 2014b, respectively). Submission of the St. Clair reports to Alberta Environment and Sustainable Resource Development (AESRD) in 2012 and 2013 (for the 2011 and 2012 programs, respectively) fulfilled the relevant environmental operating approval conditions for each operator. In early 2014, for the 2013 program year, each operator provided separate reports to regulatory agencies, as the final RAPP report was generated for a different purpose, the satisfaction of a court order (R v. Syncrude Canada Ltd. 2010) relating to the landing of waterfowl on Syncrude's Aurora Settling Pond in 2008.

In early 2014, the responsibility for management of the OSBCMP transferred to Owl Moon Environmental Inc. (OMEI); this responsibility includes protocol oversight, data management and reporting. In the latter regard, this report provides to the Alberta Energy Regulator and AESRD the submissions of each of the operators (Chapters 2 to 6), together with an integration of information and data in a regional synthesis (Chapter 7). Submission of this report to regulatory agencies is, therefore, intended to fulfill the approval requirements associated with the five mining operations – Canadian Natural Resources Ltd. (Canadian Natural), Imperial Oil Canada Limited, Shell Canada Limited, Syncrude Canada Ltd., and Suncor Energy Inc. (Figure 1.1).

The intent of the program is to quantify bird landings and mortalities at process-affected ponds at 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. It is important to note that, in these early stages of the program, meeting this intent requires that the protocol remain open for improvement as differences among sites challenge the ability to fully standardize the procedures within the protocol. While the OSBCMP remains in a nascent stage, improved standardization across sites within each year provides for a means of evaluating bird contacts and mortalities across the oil sands mining industry at a regional scale. Landings at process-affected ponds and mortalities due to bitumen contact over time remain difficult to quantify as a consequence of annual changes to the protocol. Discussion of trends has been deferred, pending a better understanding of the compatibility of data from year-to-year and across sites within each year.



**Figure 1.1: Process-affected and Freshwater Ponds at the Five Mine Sites included in the OSBCMP**

## 1.2 Objectives

The OSBCMP arose out of the legal proceedings following the landing of a large number of waterfowl on a Syncrude tailings pond in 2008. The resulting court order specified four objectives to be addressed by the RAPP:

1. Collect information on bird use and deterrence practices in the oil sands region and review avian deterrents in this and other industries.
2. Conduct field studies and supporting analyses.
3. Integrate with and support the development of a standardized monitoring program.
4. Recommend best practices for bird protection by the mineable oil sands industry.

While the OSBCMP includes activities that contribute to achievement of these four objectives, the third has been a primary focus in the 2011 to 2014 period. Standardization of monitoring practices using an appropriate monitoring design is critical in quantifying bird landings and mortalities, and while significant steps have been made towards achieving standardization, the OSBCMP protocol is updated prior to each monitoring season. The monitoring activities in 2014 followed the procedures in the 2014 OSBCMP protocol (St. Clair et al. 2014b).

The five objectives of the OSBCMP are to:

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.

To date, the OSBCMP has focused on objectives 1 to 4, with the majority of effort dedicated to developing a standardized method of estimating the numbers of birds contacting process-affected ponds and the proportion of these birds dying as a consequence of contact with residual bitumen in the ponds.

Oil sands operators employ a variety of techniques to deter birds from landing. Deterrents typically emit auditory or visual stimuli, or a combination of the two. As part of their environmental approvals, oil sands operators are obliged to submit a Waterfowl Protection Plan (or Bird Protection Plan), which specifies how they will monitor the number of birds coming in contact with their tailings ponds and how they will endeavour to minimize those contacts. To the extent permitted by the data, guidance to operators to improve deterrent effectiveness has been provided, and this contributes to meeting the fifth objective.

### **1.3 Protocol Overview**

The OSBCMP monitoring protocol has been developed to detect avian landings and mortalities related to oil sands process-affected ponds and to do so in a standardized manner. The protocol is designed primarily for species that are more likely to come in contact with process-affected ponds. This is formalized by designating target species, defined as those that dabble, dive, or wade as a primary means of foraging. In contrast, non-target guilds are those that forage primarily by pecking at the ground, gleaning fruit or insects from vegetation, are aerial insectivores, the raptor groups, and scavenging species. The program includes two survey components – bird contact monitoring and mortality searches, and incidental observations. These are described in detail in St. Clair et al. (2014b).

#### **1.3.1 Bird Contact Monitoring**

The unit of monitoring is the survey area, defined as the visible area of the pond within a 500-m radius to an altitude of 100 m, observed from a designated survey station. One survey location is required for small ponds ( $\leq 150$  ha), and monitoring at a small pond occurs over a period of 10 minutes. Two or more survey locations are required at ponds larger than 150 ha, the number of locations being dependent on the size of the pond. Landed and flying birds within the survey area/altitude are counted and identified during a 30-minute observation period at survey locations on the largest ponds ( $> 1,000$  ha). Small ponds at which the risk of bird oiling is low are monitored once per week, while all other process-affected ponds in the program are monitored six times per week. Freshwater ponds are monitored for 10 minutes, twice weekly. Within the survey area, birds landed or flying over were counted and identified at a minimum to guild, and to species if possible.

At each site, bird contact monitoring occurred on six days per week, from April 16 to July 6 (spring season) and July 25 to October 31 (fall season) each year. The order of ponds was varied each day to the extent practical within site safety and operational constraints, and as constrained by weather conditions. Ponds missed during the 6-day period (weather or safety constraints) are monitored on the seventh day (the Comparison Day). Also on the Comparison Day, a series of Inter-observer Variation surveys were conducted, which were used to characterize variability among observers at a site.

#### **1.3.2 Mortality Searches**

Bitumen on feathers can impede flight, buoyancy, thermoregulation, and foraging, and can result in bird death. Once in each 2-week period through the season, a transect of a length equal to the circumference of each large pond was searched to for the presence of dead birds. Searches were conducted by boat, vehicle (truck, ARGO) or on foot. Search effort was quantified by time spent searching (hours), and by either distance (m) or area (ha) searched, depending on the pond and the operator.

Observations of an oiled bird by any person at any time resulted in efforts to capture the bird. Capture and euthanization procedures are site-specific, conducted under regulatory approval and permit requirements that are separate from the data collection procedures within the OSBCMP protocol. Captured, oiled birds were euthanized as instructed by AESRD personnel. Euthanized oiled birds were included as mortalities.

### **1.3.3 Incidental Observations**

Birds observed outside of the formal bird contact monitoring program could be recorded in the database as incidental observations. Broadly interpreted, incidental observations could be recorded anywhere on the site at any time during the monitoring day. From the inception of the program through July 2014, observers were encouraged to record incidental observations with an emphasis on species of conservation concern and species that had not been previously recorded or had been recorded in low numbers through the season. However, the resulting incidental observations database was highly variable, reflecting the interests and priorities of observers rather than the product of a standardized procedure for recording bird observations.

Following a government-industry workshop in July 2014, the incidental observation procedure was clarified, focusing observers on recording of birds representing species of conservation concern that were at elevated risk of bitumen contact. This did not change the protocol, rather, it represented an enhancement in standardization across operating facilities and among observers, while retaining an emphasis on the species of conservation concern component of the OSBCMP.

### **1.3.4 Data Collection and Management**

The majority of bird contact monitoring and incidental observation data were entered in real-time into electronic tablets using customized data entry forms. Upon submission of a completed survey, the data were automatically uploaded into the program database through a cellular network.

Similarly, a custom data entry form was available for use during mortality searches, and data acquired at some sites were entered into the database using this facility. However, because of restrictions associated with the use of electronic devices in industrial operating areas (a restriction for safety reasons) and the harsher conditions often experienced on a boat on water, mortality search data were recorded using paper forms and later entered into the program database.

Data were extracted from the database and returned to the operator for quality assurance/quality control (QA/QC) on a 2-week cycle through the 2014 season. At the end of the season, OMEI personnel combined the corrected files into a single database (one each for bird survey, mortality search, and incidental observations) and conducted a full QA/QC review. Operators addressed questions arising from this QA/QC, resulting in a final set of data files for use by each operator in generating this report. The original, raw data submitted during the season has been retained in an unaltered form, available for future use should one or more modified files be found to be in error, or compromised (e.g., corrupted).

## **1.4 Weather**

The landing events in 2008, 2010 and November 2014 illustrate the strong influence of weather conditions on the number of landings and mortalities that occur on process-affected ponds (St. Clair et al. 2011). In particular, strong and variable winds, precipitation, dense cloud cover, and darkness were identified as contributors to the bird landing event in October 2010. The April 2008 bird landing event occurred during a late winter storm following a period of unseasonably warm weather. Although not a specific requirement of the protocol, weather data have been acquired, and an attempt has been made to correlate bird observations and mortalities with periods of adverse weather during the 2014 monitoring season. This is discussed in a regional context (Section 7.0), based on Environment Canada weather station data (Fort McMurray) and the observations from the five monitoring sites. Each of the individual operator sections also includes a discussion of the November 2014 landing event, which occurred after the October 31, 2014 conclusion of the formal OSBCMP monitoring program.

## **1.5 Documents Cited**

- R. v. Syncrude Canada Ltd. (2010) ABPC 229. Retrieved January 26, 2015 from <http://www.canlii.org/en/ab/abpc/doc/2010/2010abpc229/2010abpc229.pdf>
- St. Clair C.C., Habib T., Shore B. (2011) Spatial and temporal correlates of mass bird mortality in oil sands tailings ponds. Prepared for Alberta Environment. 61 pp.
- St. Clair C.C., Habib T., Loots S., Ball J., McCallum C. (2012) 2011 Annual Report of the Regional Bird Monitoring Program for the Oil Sands Region. Research on Avian Protection Project, Department of Biological Sciences, University of Alberta, Edmonton; 144 p.
- 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 p.
- St. Clair C.C. (2014a) Final Report of the Research on Avian Protection Project (2010–2014). Research on Avian Protection Project, Department of Biological Sciences, University of Alberta, Edmonton; Prepared for Alberta Justice; 95 p.
- St. Clair C.C., Loots S., Ronconi R.A. (2014b) 2014 Protocol – Oil sands Bird Contact Monitoring Program. Research on Avian Protection Project, Department of Biological Sciences, University of Alberta, Edmonton; 50 p.



**OIL SANDS BIRD CONTACT MONITORING PROGRAM  
HORIZON OIL SANDS – CANADIAN NATURAL RESOURCES LIMITED  
2014 ANNUAL REPORT**

**Prepared for:  
Canadian Natural Resources Limited**

March 13, 2015



March 15, 2015

Alberta Energy Regulator  
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Industrial Engineer, Mining Authorizations

**Via email [EPEA.Reports@aer.ca](mailto: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 approval, Canadian Natural Resources Limited (Canadian Natural) hereby submits the 2014 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 do not hesitate to contact me at (780) 824-2076.

Sincerely,

**CANADIAN NATURAL RESOURCES LIMITED**

A handwritten signature in black ink, reading "Joanne Hogg".

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

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## 2.0 CANADIAN NATURAL RESOURCES LIMITED (HORIZON)

### 2.1 Summary

In accordance with the Oil Sands Bird Contact Monitoring Program (OSBCMP) regional protocol, 18 process-affected ponds and one freshwater lake were monitored at Canadian Natural Resources Limited's (Canadian Natural) Horizon Oil Sands Mine, during the spring (April 16 to July 6) and fall (July 25 to October 31) periods.

#### 2.1.1 Bird Landings and Mortalities at Process-affected Ponds

At process-affected ponds, there was a total 6,411 observations of landed waterbirds (dabblers, divers, waders, and gulls) of 50 species, across 2,177 surveys (Tables 2.1 and 2.2). Surveys covered 90 to 100% (0.1 to 25.8 ha) of each pond, except at the Tailings pond, where four survey stations covered in total 10% (100.2 ha) of the pond. There was a mean of 2.2 landed waterbirds per survey across ponds, ranging from zero at seven of the ponds, to 7.2 at Dyke 10 Runoff pond and 26.8 at Basal Water Storage pond. The most common species were Mallards, Greater Scaup, Eared Grebe, and Ring-necked Ducks.

No mortalities were found during 84.5 h of standardized searching across the 18 ponds. However, 31 mortalities were found incidentally, 27 of which occurred at the Tailings pond. Mortalities included 13 species, notably Eared Grebe (7 birds), Franklin's Gulls (5 birds) and American Coots (4 birds).

**Table 2.1: Monitoring Effort at Process-affected Ponds at Horizon in 2014**

| Bird Surveys                        |                                            |                 |       |                 |
|-------------------------------------|--------------------------------------------|-----------------|-------|-----------------|
| # Ponds Surveyed                    | 18                                         |                 |       |                 |
| # 10-min Surveys Conducted          | 1,598                                      |                 |       |                 |
| # 30-min Surveys Conducted          | 579                                        |                 |       |                 |
| Mortality Searches                  |                                            |                 |       |                 |
| # Ponds Searched                    | 18                                         |                 |       |                 |
| # Searches                          | 244 (17 focused and 227 transect searches) |                 |       |                 |
| Search Method                       | Boat                                       | Walk            | Truck | Total           |
| Total Time Searched                 | 9.8 h                                      | 69.8 h          | 4.9 h | 84.5 h          |
| Distance/Area Searched <sup>1</sup> | 101 km                                     | 137 km<br>13 ha | 21 km | 259 km<br>13 ha |

**Note:**

<sup>1</sup> For each search, either distance or area counted towards effort.

**Table 2.2: Bird Observations at Process-affected Ponds at Horizon in 2014**

|                      | Waterbirds |           |                   |            |                  |            | Non-target Guilds |           |                   |            |                  |            |
|----------------------|------------|-----------|-------------------|------------|------------------|------------|-------------------|-----------|-------------------|------------|------------------|------------|
|                      | Landed     | Flew Over | Contacted Bitumen |            | Mortality        |            | Landed            | Flew over | Contacted Bitumen |            | Mortality        |            |
|                      |            |           | Bird Survey       | Incidental | Mortality Search | Incidental |                   |           | Bird Survey       | Incidental | Mortality Search | Incidental |
| # Birds <sup>1</sup> | 6,411      | 1,969     | 127               | 11         | 0                | 31         | 534               | 4,208     | 0                 | 0          | 0                | 0          |
| # Species            | 50         | 24        | 14                | 5          | 0                | 13         | 26                | 30        | 0                 | 0          | 0                | 0          |

**Note:**

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times.

### 2.1.2 Bird Landings at a Freshwater Lake

A total of 981 landed waterbirds (31 species) were observed during 52 surveys (Table 2.3) at Compensation Lake (mean = 18.9 birds per survey). Surveys covered 26% (20 ha) of the lake. Three birds that must have contacted bitumen at another location were observed at Compensation Lake in early August: two Franklin's Gull (20 to 30% oiled) and a California Gull (30% oiled) (Table 2.4).

**Table 2.3: Monitoring Effort at a Freshwater Lake at Horizon in 2014**

| Bird Surveys               |    |
|----------------------------|----|
| # Ponds Surveyed           | 1  |
| # 10-min Surveys Conducted | 52 |
| # 30-min Surveys Conducted | 0  |

**Table 2.4: Bird Observations at a Freshwater Lake at Horizon in 2014**

|                      | Waterbirds |           |                   |            |                        | Non-target Guilds |           |                   |            |                        |
|----------------------|------------|-----------|-------------------|------------|------------------------|-------------------|-----------|-------------------|------------|------------------------|
|                      | Landed     | Flew Over | Contacted Bitumen |            | Mortality (Incidental) | Landed            | Flew over | Contacted Bitumen |            | Mortality (Incidental) |
|                      |            |           | Bird Survey       | Incidental |                        |                   |           | Bird Survey       | Incidental |                        |
| # Birds <sup>1</sup> | 981        | 175       | 3                 | 0          | 0                      | 39                | 125       | 0                 | 0          | 0                      |
| # Species            | 31         | 10        | 2                 | 0          | 0                      | 8                 | 12        | 0                 | 0          | 0                      |

**Note:**

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times.

### 2.1.3 Standardized Monitoring

Bird surveys were conducted as per the protocol, aside from the following details. Surveys were usually conducted earlier in the day in the mining areas (including the Tailings pond) due to afternoon access restrictions, than were surveys in areas around the extraction and upgrader areas. The timing of surveys at individual survey locations was randomized within these constraints, and survey timing was not correlated with the number of birds observed. The Tailings pond's southwest station could not be accessed in wet conditions due to impassable road conditions, and no alternative stations could be established, resulting in 21% missed surveys at that station. The missed surveys were interspersed throughout the monitoring period, increasing the confidence interval around the mean numbers of birds observed at this station compared to other stations. Mortality searches were conducted in accordance with the regional protocol.

### 2.1.4 Species of Conservation Concern

During surveys, six waterbird species of conservation concern were observed landed at five of the 18 process-affected ponds (Table 2.5): Basal Water Storage (mean = 1.61 birds per survey), Dyke 10 Runoff (0.53), Coke Runoff (0.10), Tailings (0.09), and Recycle Water (0.02). Four species of conservation concern were found incidentally as mortalities: two Green-winged Teal, a Lesser Scaup, a Horned Grebe, and a White-winged Scoter.

**Table 2.5: Number of Observations of Birds of Conservation Concern at Process-affected Ponds at Horizon in 2014**

| Species                  | Landed <sup>1</sup> |            | Flew Over <sup>1</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|--------------------------|---------------------|------------|------------------------|--------------------------------|------------|------------------|------------|
|                          | Bird Survey         | Incidental | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>        |                     |            |                        |                                |            |                  |            |
| Green-winged Teal        | 236                 | 35         | 71                     |                                |            |                  | 2          |
| Northern Pintail         | 91                  | 4          | 25                     |                                |            |                  |            |
| Lesser Scaup             | 51                  |            |                        |                                |            |                  | 1          |
| American White Pelican   | 10                  |            |                        |                                |            |                  |            |
| Horned Grebe             | 8                   |            |                        |                                |            |                  | 1          |
| Pied-billed Grebe        | 1                   |            |                        |                                |            |                  |            |
| White-winged Scoter      |                     |            |                        |                                |            |                  | 1          |
| Sandhill Crane           |                     | 14         | 12                     |                                |            |                  |            |
| Sora                     |                     | 1          |                        |                                |            |                  |            |
| Great Blue Heron         |                     |            | 1                      |                                |            |                  |            |
| Osprey                   |                     |            | 1                      |                                |            |                  |            |
| <b>Non-target Guilds</b> |                     |            |                        |                                |            |                  |            |
| Barn Swallow             | 35                  |            | 1,161                  |                                |            |                  |            |
| American Kestrel         | 7                   |            | 29                     |                                |            |                  |            |
| Sharp-tailed Grouse      | 2                   |            | 17                     |                                |            |                  |            |
| Northern Harrier         | 1                   |            | 27                     |                                |            |                  |            |
| Bank Swallow             |                     |            | 36                     |                                |            |                  |            |
| Peregrine Falcon         |                     |            | 1                      |                                |            |                  |            |

**Note:**

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times.

### **2.1.5 Adaptive Management**

As in 2013, hazing activities were conducted as needed throughout the 2014 season. New deterrents in 2014 included two falcon kites and six radar-activated floating deterrent units (FDUs) that combine three different audio deterrents and a robotic falcon, all deployed at the Tailings pond. Five habitat protection booms were deployed in the spring or summer on the west side of the Tailings pond, and a year-round containment boom was added to Storm Water pond in June 2014. In August 2014, herbicide was applied on the west side of the Tailings pond and around Recycle Water pond, and in September vegetation was mechanically removed around Dyke 10 Runoff pond. As in 2013, hazing activities were conducted as needed throughout the 2014 season.

Survey stations that became inaccessible during the season due to construction (PMP1, PMP3 and TMP1) were replaced with stations established nearby (PMP5, PMP6 and TMP2, respectively).

## **2.2 Introduction**

### **2.2.1 Site**

The Canadian Natural Horizon Oil Sands Mine is located approximately 70 km north of Fort McMurray. Conditions 4.9.1 to 4.9.4 in the EPEA Approval for the Horizon Mine (149968-00-01) require that Canadian Natural develop and implement a Waterbird Protection Plan. Canadian Natural's participation in the OSBCMP fulfils these requirements, and this Chapter of the report is submitted in fulfilment of Condition 4.9.4.

In 2014, 18 process-affected ponds covering a total of 1,086 ha were monitored as part of the OSBCMP. The same 18 ponds have been monitored since the initiation of the program in 2011. They consist of a Tailings pond with fluids covering 1,013 ha, Basal Water Storage pond (28 ha), which contains saline water, Recycle Water pond (18 ha), and 15 smaller process-affected ponds (Figure 2.1). A freshwater lake, Compensation Lake (77 ha), was also monitored as part of the program.

### **2.2.2 Personnel**

A Canadian Natural Horizon Mine Wetlands & Aquatics Lead and Bird Deterrent Coordinator oversee the implementation and coordination of the OSBCMP program at Horizon Oil Sands. Avian biologists conducted bird surveys and data verification, and occasionally hazed landed birds. Personnel qualifications included at minimum enrollment in or completion of a biology or ecology-related degree, or multiple years of field experience in waterfowl identification. New hires were trained and oriented on site for at least one week, including site-specific safety certifications, mine driving, bird survey protocol, bird identification, use of electronic tablets for data collection, and use of hazing pistols. Canadian Natural summer students assisted in completing the comparison surveys for the inter-observer variability (IOV) study.

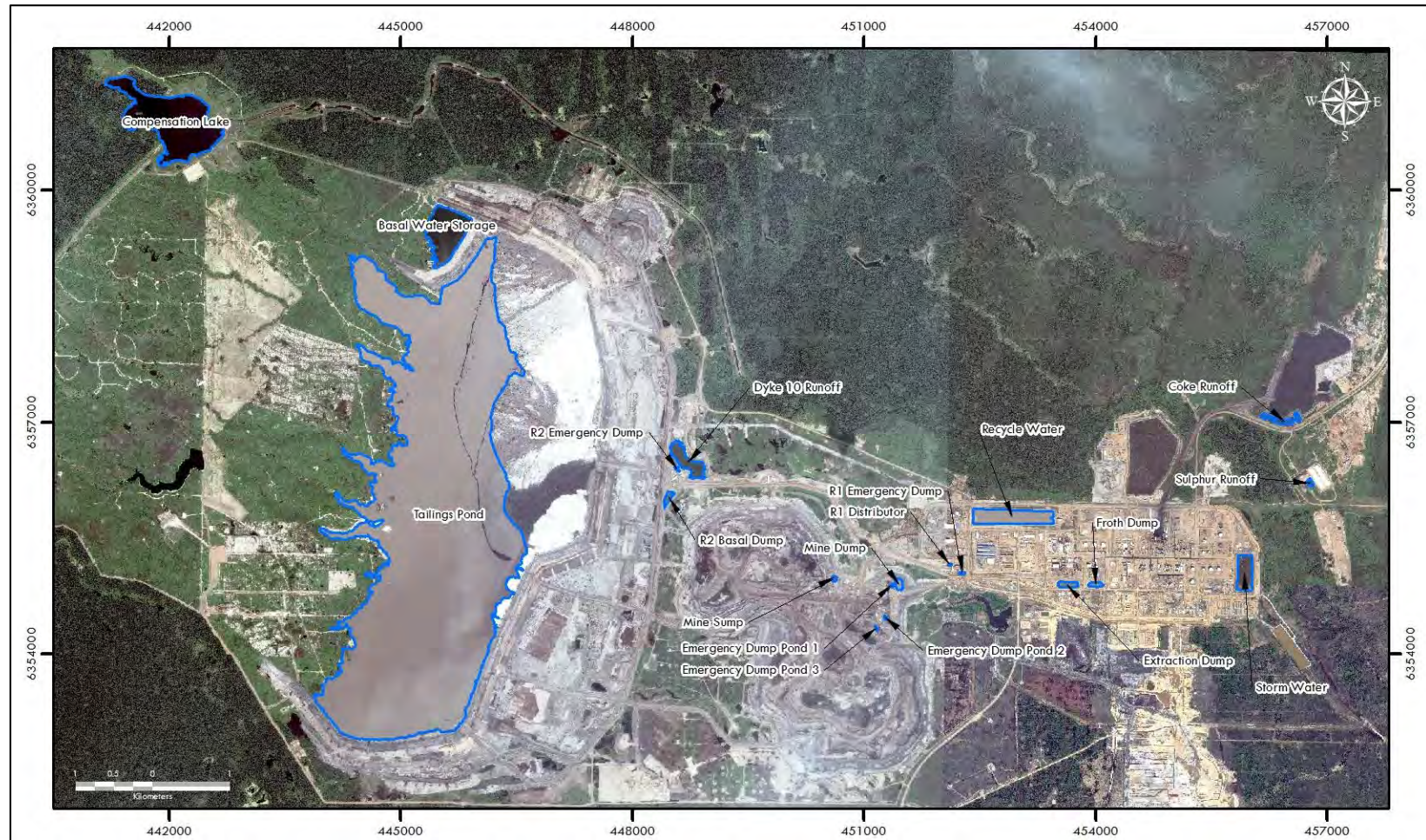


Figure 2.1: Eighteen Process-affected Ponds and a Compensation Lake at Horizon Oil Sands (2014)

A specialized team maintained deterrents, conducted mortality searches, hazed landed birds, and captured oiled birds. New crew members typically spent at least two shifts (a total of 28 days on site) before they were responsible for leading a crew and conducting mortality searches on their own.

At Canadian Natural, the interval between the fall and spring migrations (July 7 to 24) was used as an investigative period aimed at evaluating and improving bird deterrence practices.

### **2.2.3 Management of Avian Attractants and Control of Hazards**

In August 2014, 710 ha of land along the west shore of the Tailings pond was sprayed aerially with a mixture of Navius, Vision Max, OnSite, and Hasten. A mixture of Navius, Vision Max and OnSite was also applied to 2.2 ha of vegetation surrounding the Recycle Water pond in August 2014. Between September 3 and 16, vegetation was removed from approximately 7 ha along the shore of Dyke 10 Runoff pond, using a Caterpillar D6 bulldozer. The area will be sprayed with herbicide in spring 2015 to prevent regrowth.

Year-round containment booms surround discharge points at Dyke 10 Runoff and Recycle Water ponds. Another boom was deployed at Storm Water pond on June 11, 2014 and will also remain in place year round. At the Tailings pond, a 4-km boom intended to contain bitumen from the tailings discharge lines was in place from May 5 to November 3. In addition, five short habitat booms were deployed along the west shore of the Tailings pond between May 6 and July 26 and decommissioned between October 21 and 30. These habitat booms were used to add protection to areas where waterfowl family groups were observed and areas with habitat attractants.

### **2.2.4 Avian Deterrents**

A total of 162 audio-only deterrents, 150 visual-only deterrents, and 18 combined units of audio and visual deterrents were deployed at process-affected ponds in 2014 (Tables 2.6 and 2.7; Appendix 2.A). The combined deterrents were activated by a radar detection system (*Merlin Detect and Deter*<sup>TM</sup>) customized for the Horizon Oil Sands site. Three surveillance radars, each capable of detecting birds to a maximum distance of 2.8 km (DeTect 2014), triggered deterrents located in the corresponding guard zone through wireless signal when the software identified moving objects as targets (birds). A horizontal radar provided coverage of Basal Water Storage pond and the north part of the Tailings pond, a horizontal radar was also located on the south shore of the Tailings pond, and a radar with horizontal and vertical capability was located on the east shore of the Tailings pond. On two occasions the bird deterrent system reverted to random activation as a backup process during failure of the on-demand radar activation system. During the night of September 28, the north radar defaulted to battery power; the radar antenna stopped rotating and the linked deterrent units switched to random activation until maintenance the following morning. On October 2, the south radar went offline due to a system failure, and all linked units switched to random activation. The east radar was reconfigured on October 7 to provide coverage of the south part of the Tailings pond while the south radar was not functional.

**Table 2.6: Avian Deterrents Deployed at Horizon (as of Fall 2014)**

| <b>Deterrent Name</b>         | <b>Description</b>                                                                                                                                                                                                                                                                     | <b>Stimuli</b>   | <b>Sound Intensity at 1 m</b> | <b>Activation Control</b> | <b>Placement</b> | <b>Location [Number]</b>                                |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------------|---------------------------|------------------|---------------------------------------------------------|
| AHD-Laser Unit                | Combines three to six acoustic hailing devices (long range acoustic devices 100x or Hyperspike HS-18) facing different directions, and two eye-safe (Class 3) green lasers for night deterrence                                                                                        | Audio and Visual | 152 to 156 dB                 | Radar                     | Land             | Tailings Pond [10]<br>Basal Water Storage [1]           |
| FDU (Floating Deterrent Unit) | Combines a Robop robotic falcon effigy with internal speaker, Bird Guard 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 and Visual | 90 to 120 dB                  | Radar                     | Floating         | Tailings Pond [7]                                       |
| Cannon                        | Zon LP propane bird scare cannons                                                                                                                                                                                                                                                      | Audio            | 120 dB                        | Random                    | Land             | All ponds except Froth Dump [159 in total]              |
| <i>Merlin Harrier</i> System  | Uses thermal surveillance cameras to detect birds near the pond surface, and triggers the closest of the 10 linked cannons                                                                                                                                                             | Audio            | 120 dB                        | Motion sensor             | Land             | Recycle Water                                           |
| Bird Guard                    | Distress call generator                                                                                                                                                                                                                                                                | Audio            | 110 dB                        | Random                    | Land             | Dyke 10 Runoff<br>R2 Basal Dump<br>Storm Water          |
| Human Effigy                  | Human effigies dressed as workers                                                                                                                                                                                                                                                      | Visual           | -                             | -                         | Land             | All ponds except Sulphur Runoff [135 in total]          |
| Eagle Effigy                  | Plastic eagle                                                                                                                                                                                                                                                                          | Visual           | -                             | -                         | Land             | Basal Water Storage<br>Dyke 10 Runoff<br>Mine Dump Pond |
| Falcon Kite                   | Falcon kite attached by cable to a pole; emulates the flight of a falcon                                                                                                                                                                                                               | Visual           | -                             | -                         | Land             | Dyke 10 Runoff<br>Tailings Pond                         |
| Mylar Tape                    | Crackling reflective tape, attached to a string in strips of 30 to 60 cm in length                                                                                                                                                                                                     | Visual           | -                             | -                         | Over beaches     | Dyke 10 Runoff<br>R2 Basal Dump<br>Storm Water          |

**Table 2.7: Number of Avian Radars and Deterrents at Process-affected Ponds at Horizon (as of Fall 2014)**

| Pond Name             | Pond Area<br>(over water; ha) | Number of Radars | Combined Audio and Visual Deterrent |                      |            |          | Audio-only Deterrent |          |            |                      | Visual-only Deterrent |          |            |                      | Total      |                       |
|-----------------------|-------------------------------|------------------|-------------------------------------|----------------------|------------|----------|----------------------|----------|------------|----------------------|-----------------------|----------|------------|----------------------|------------|-----------------------|
|                       |                               |                  | Linked to Radar                     |                      | Not Linked |          | Linked to Radar      |          | Not Linked |                      | Linked to Radar       |          | Not Linked |                      | Units      | Density<br>(units/ha) |
|                       |                               |                  | Floating <sup>a</sup>               | On Land <sup>b</sup> | Floating   | On Land  | Floating             | On Land  | Floating   | On Land <sup>c</sup> | Floating              | On Land  | Floating   | On Land <sup>d</sup> |            |                       |
| Basal Water Storage   | 27.99                         | 1                |                                     | 1                    |            |          |                      |          |            | 7                    |                       |          |            | 8                    | 16         | 0.6                   |
| Coke Runoff           | 2.69                          |                  |                                     |                      |            |          |                      |          |            | 7                    |                       |          |            | 11                   | 18         | 6.7                   |
| Dyke 10 Runoff        | 8.99                          |                  |                                     |                      |            |          |                      |          |            | 13                   |                       |          |            | 10                   | 23         | 2.6                   |
| Emergency Dump Pond 1 | 0.12                          |                  |                                     |                      |            |          |                      |          |            | 1                    |                       |          |            | 1                    | 2          | 16.7                  |
| Emergency Dump Pond 2 | 0.13                          |                  |                                     |                      |            |          |                      |          |            | 1                    |                       |          |            | 1                    | 2          | 15.4                  |
| Emergency Dump Pond 3 | 0.10                          |                  |                                     |                      |            |          |                      |          |            | 2                    |                       |          |            | 2                    | 4          | 40.0                  |
| Extraction Dump       | 1.67                          |                  |                                     |                      |            |          |                      |          |            | 2                    |                       |          |            | 5                    | 7          | 4.2                   |
| Froth Dump            | 0.95                          |                  |                                     |                      |            |          |                      |          |            |                      |                       |          |            | 4                    | 4          | 4.2                   |
| Mine Dump             | 1.19                          |                  |                                     |                      |            |          |                      |          |            | 2                    |                       |          |            | 7                    | 9          | 7.6                   |
| Mine Sump             | 0.38                          |                  |                                     |                      |            |          |                      |          |            | 2                    |                       |          |            | 1                    | 3          | 7.9                   |
| R1 Distributor        | 0.10                          |                  |                                     |                      |            |          |                      |          |            | 1                    |                       |          |            | 1                    | 2          | 20.0                  |
| R1 Emergency Dump     | 0.17                          |                  |                                     |                      |            |          |                      |          |            | 1                    |                       |          |            | 1                    | 2          | 11.8                  |
| R2 Basal Dump         | 1.26                          |                  |                                     |                      |            |          |                      |          |            | 5                    |                       |          |            | 3                    | 8          | 6.3                   |
| R2 Emergency Dump     | 0.12                          |                  |                                     |                      |            |          |                      |          |            | 2                    |                       |          |            | 2                    | 4          | 33.3                  |
| Recycle Water         | 18.22                         |                  |                                     |                      |            |          |                      |          |            | 10                   |                       |          |            | 10                   | 20         | 1.1                   |
| Storm Water           | 8.27                          |                  |                                     |                      |            |          |                      |          |            | 9                    |                       |          |            | 7                    | 16         | 1.9                   |
| Sulphur Runoff        | 0.57                          |                  |                                     |                      |            |          |                      |          |            | 2                    |                       |          |            |                      | 2          | 3.5                   |
| Tailings Pond         | 1,013.40                      | 3                | 7                                   | 10                   |            |          |                      |          |            | 95                   |                       |          |            | 76                   | 188        | 0.2                   |
| <b>Total</b>          | <b>1,086.32</b>               | <b>3*</b>        | <b>7</b>                            | <b>11</b>            | <b>0</b>   | <b>0</b> | <b>0</b>             | <b>0</b> | <b>0</b>   | <b>162</b>           | <b>0</b>              | <b>0</b> | <b>0</b>   | <b>150</b>           | <b>330</b> | <b>0.3</b>            |

**Notes:**

Deterrent types: **a** = FDUs; **b** = AHD-laser Units; **c** = Cannons, Bird Guards; **d** = Human Effigies, Eagle Effigies, Falcon Kites, Mylar Tape.

\* One radar provided coverage of both Basal Water Storage and the Tailings Pond.

Combined deterrents consisted of acoustic hailing devices (AHD) paired with lasers for night deterrence, and FDU. The AHD-laser combinations were mounted as 11 separate units (10 at the Tailings pond and one at Basal Water Storage pond), comprising in total 42 long range acoustic devices, 18 Hyperspike speakers, and 22 lasers. 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 a target (bird) was detected within a guard zone, sounds projected from the acoustic deterrents were selected from the library of recordings with 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. The recording played within each threat level was randomly selected by computer algorithm. To minimize habituation, the escalating sequence restarted and continued looping through the randomly selected sounds and ended when the target was no longer detected. The 11 AHD-laser units were deployed on March 25 and decommissioned between November 11 and 13. Some units were moved occasionally through the season to gain line of sight and improve connection with the radar, or were moved temporarily while building up the dyke along the edge of the Tailings pond.

FDUs included a robotic falcon with a rotating head and flapping wings, emitting Peregrine Falcon calls, a bird distress call generator with an omni-directional speaker, and a scare cannon. The seven units were deployed at the Tailings pond on May 16 and decommissioned on November 1, except for one unit that flipped and became submerged during a storm on July 30 and remained out of service.

At the Tailings pond, 100 cannons were deployed between March 28 and April 11. Five were removed due to damage or construction, 12 were removed between October 12 and 25 due to high water levels, 82 were removed between November 2 and 15 for winter storage, and the status of one cannon was unknown. At the other process-affected ponds, a total of 54 cannons were deployed between March 26 and 28 and removed between November 10 and 23. Ten additional cannons are in place year-round at Recycle Water pond; they are linked to an on-demand system (*Merlin Harrier*; DeTect) that detects movement (birds) above the pond surface using infrared cameras with motion sensors, and triggers the appropriate cannon. Each camera covers a different area of the pond, and masks on the sensors eliminate detection of movement in areas subject to human activity (roads) or wind-blown vegetation, preventing unnecessary cannon firing.

Bird Guards (at Dyke 10 Runoff, Storm Water, and R2 Basal ponds) and eagle effigies (at Dyke 10 Runoff, Basal Water Storage, and Mine Dump ponds) were deployed between March 24 and April 15, and remained in place until November 10-15. The 135 human effigies are in place year-round. A falcon kite was deployed on the west shore of the Tailings pond and another at Dyke 10 Runoff pond between September 10 and October 21. Strings of Mylar tape were placed over beaches at Dyke 10 Runoff, R2 Basal Dump, and Storm Water ponds between June 15 and October 18. The Mylar Tape at R2 Basal Dump is still in place because the posts were frozen in the ground and could not be removed.

### **2.2.5 Hazing Procedures**

Hazing activities were conducted at process-affected ponds as needed, from April to November. Crews responsible for hazing and maintaining deterrents visited the Tailings pond daily and checked Dyke 10 Runoff, Storm Water, Recycle Water, Coke Runoff, R2 Basal Dump ponds, and R2 Emergency Dump ponds every second day. The remaining process-affected ponds on site were visited at least once per week. While at ponds, the crew scanned surrounding areas for birds while performing routine maintenance of the deterrents. Observers responsible for the live bird surveys occasionally hazed birds after the completion of a survey, depending on accessibility by foot or truck, work permit and time restrictions, and safety considerations. Observers systematically communicated the location of landed birds to the nearest hazing crew for additional hazing effort where required. This approach aimed to haze birds more promptly in order to prevent birds from habituating to the area, prevent them from attracting more birds, and minimize oiling risk.

Each team carried two short-range hazing pistols that fired pyrotechnic scare cartridges (bangers, screamers and whistlers) and a 300-m range CAPA® launcher that fired 18-mm cartridges producing a loud detonation. Hazing activities were conducted by airboat, outboard boat, amphibious all-terrain vehicle (Argo), or on foot, depending on location and weather. The airboat was the most effective hazing device on the Tailings pond, as expected from previous studies (Marsh et al. 1991). On stormy days and other days when airboats could not be used on the Tailings pond, ground-based hazing effort was focused on areas where higher bird activity was observed, including areas along the west shore of the Tailings pond.

Crews selected a hazing strategy on a case-by-case basis, taking into account the relative risk posed to birds at different ponds and potential for pushing fatigued birds into more hazardous areas. Moulting birds unable to fly were not hazed, nor were family groups with flightless broods. Family groups may be relocated, as was attempted at the Tailings pond in 2013, but these birds are difficult to capture, and relocation is not always successful.

Hazing efforts were directed primarily at waterfowl, as shorebirds tend to run along or continuously circle back to the shore instead of leaving the area. Hazing methods were most effective on dabblers. Divers, in particular grebe species, often escape the perceived threat by diving. The most effective hazing method currently employed at Horizon for diving birds is to briefly harass birds to encourage them to leave the area, and then cease hazing for a period of one to two hours. When hazing personnel returns to the area the birds have typically left the area but if they remain another hazing attempt is made. This cycle is repeated until the bird leaves, continuing will compromise the bird health (e.g., fatigue), or it becomes unsafe for personnel. Diving birds, if healthy, are expected to leave within two hazing cycles.

### **2.3 Methods**

Monitoring was conducted in accordance with the 2014 regional protocol (St. Clair et al. 2014), from April 16 to July 6 (82 days; spring), and July 25 to October 31 (99 days; fall). Any deviations or adaptations to the methods are detailed in sections below. Mortalities, oiled birds, species of conservation concern, and incidental observations were documented and reported as

per protocol and governmental regulations. The period between the end of the spring monitoring period and the beginning of the fall monitoring period (July 7 to 24) was used to investigate potential improvements to the deterrent systems and monitoring program.

### **2.3.1 Pond Characteristics**

A geospatial analyst delineated pond characteristics in a Geographic Information System, using a satellite image taken on May 1, 2014. Ground-truthing information provided by field personnel helped with accurately identifying and categorizing features visible on the image. Pond and island areas were measured, as well as vegetated and total shoreline length. Emergent vegetation could not be identified from the image and was included as a qualitative characteristic only. The presence of vegetated areas adjacent to ponds, sinuous shorelines, and mudflats or gradual sandy or pebbly beaches was also qualitatively assessed. Floating bitumen was estimated in two ways: from the spring satellite image and in the field throughout the monitoring season as part of the bird survey protocol.

### **2.3.2 Bird Surveys**

Eight of the 18 process-affected ponds were considered of lower monitoring priority because of their small size (0.1 to 1.3 ha), low amount or absence of avian attractants such as vegetation, beaches, islands, or sinuous shorelines, regular human activity nearby, and because no landed waterbirds or mortalities were observed in 2013. Although there is potential for floating bitumen on these ponds, the potential for bird oiling or mortality is low due to the low probability of birds landing. As per the protocol, bird surveys were conducted once per week at these low priority ponds, six days per week at other process-affected ponds, and twice per week at Compensation Lake.

On occasion, some stations could not be monitored due to deteriorated roads, blocked access by berms or heavy machinery, or time constraints. Mondays were chosen as the “Comparison Day” (per protocol definition) and used to conduct bird surveys at these missed stations. Other tasks completed on the Comparison Day included data verification, additional orientation and training as necessary, maintenance, communication, coordination, administrative tasks, comparison surveys for the IOV study, and testing deterrent sound files.

Bird surveys were conducted between 7 a.m. and 6 p.m. (2 to 12 hours after sunrise) in April to June, and between 6 a.m. and 5 p.m. (0 to 11 hours after sunrise) in July to October. In the spring, the daily work permits could not be obtained earlier in the morning; however, changes in the permitting schedule and procedure in early July enabled crews to start monitoring earlier. Throughout the year, each station was surveyed in at least seven different 1-hour periods of the day (in terms of hours after sunrise) and most stations were surveyed in at least 10 different periods of the day. However, the timing of surveys were biased for some stations in order to prioritize morning surveys on the west side of the site, where most birds occurred and ensure that crews were off the mining roads and back to the plant site before sunset, a mandatory safety procedure. Thus, the Tailings, Basal Water Storage, R2 Basal Dump, Dyke 10 Runoff,

and R2 Emergency Dump ponds were most often surveyed 0 to 6 hours after sunrise, whereas Recycle Water, Sulphur Runoff, Storm Water, Extraction Dump, and Coke Runoff ponds were usually surveyed 6 to 12 hours after sunrise. For the eight ponds surveyed once per week and Compensation Lake, the time of day of surveys was randomized to a greater degree.

Each monitored pond had one station surveyed for 10 minutes, except the large Tailings pond, which had four stations surveyed for 30 minutes each (Appendix 2.A). At the start of the fall monitoring period, on July 25, PMP1 was replaced due to sand build-up on the pond within the survey area and road access issues; the replacement station (PMP5) was established to the west. Similarly, TMP1 was replaced with TMP2, established nearby, because the original access road became a heavy hauler road. On October 11, PMP3 was replaced due to the siphon line being moved; although the station was only moved 35 m, the vantage point changed and the new station was named PMP6.

During a survey, birds observed landed on the pond surface, islands and shores within 500 m of the survey station, or flew within 100 m above the survey area were identified and counted. Shores consisted of areas along shorelines that could be reached by effluent or changing fluid levels. Birds were identified as oiled if 5 to 100% of the body surface was oiled, usually when some feathers on the underside, the breast, or the bill were matted or speckled with a black sticky substance.

Bird surveys were conducted by a team of two. In April and early May, some of the small ponds that typically have few or no birds were monitored by single observers to improve efficiency of the daily schedule; however, starting on May 8 site safety personnel required that all surveys be conducted in pairs due to safety concerns regarding possible wildlife interactions. One person conducted the survey using a waterproof Leica Apo-Televid 65 spotting scope on a tripod and 10x50 binoculars, and the other person recorded data on an electronic tablet (iPad) using electronic forms built by the University of Alberta using the Device Magic application. After each survey, the completed data forms were immediately uploaded (via 3G cellphone network) into the regional database, through a cloud-based server.

### **2.3.3 Inter-observer Variability (IOV)**

IOV comparison surveys were conducted simultaneously by two teams at the same survey station, ensuring that teams covered the same survey area but could not hear or react to the other team's observations. Each team was formed by a regular observer, conducting the survey following the regular bird survey protocol, and a Canadian Natural summer student who entered the data into the electronic form. After each survey, teams compared results and discussed potential causes of variability. Five regular observers each participated in at least four surveys and up to 17 surveys, in three different combinations of observer pairs (dictated by the shift schedule). According to the regional protocol, comparison surveys were to be conducted at large ponds (ponds with at least two survey stations). Only the Tailings pond met the size criterion; however, the second largest pond, Basal Water Storage, was also included because

the regular presence of birds on the pond offered a good opportunity for observer comparison. In total, 22 comparison surveys were conducted. Five comparison surveys had no bird observations (neither flying nor landed, by any observer) and were excluded from the analysis to avoid biasing the results towards zero variability.

For each comparison survey, the relative percent difference (RPD) of the number of birds and number of species observed was calculated for landed birds and birds that flew over, using the following formula:

$$RPD_{\#observations} = \frac{|x_1 - x_2|}{\bar{x}} * 100$$

where

$x_1$  is the number of observations from Observer 1,  $x_2$  is the number of observations from Observer 2, and  $\bar{x}$  is the mean of the number of observations from both observers. The mean number of observations provides the reference value against which the two sets of observations are compared, assuming that the real number is likely between Observer 1 and Observer 2's results.

From each pair of surveys, the survey conducted by the team lead was retained for inclusion in the formal bird survey dataset.

#### **2.3.4 Mortality Searches**

Mortality searches were conducted at all monitored process-affected ponds at two-week intervals, between 6 a.m. and 11 p.m., and usually between 7 a.m. and 4 p.m. Search effort was measured in terms of area at Sulphur Runoff pond, and in terms of distance for all other ponds. All searches were route-based (transects), except at the Tailings pond where focused searches were also conducted in areas with vegetation, bays, bitumen, or where mortalities were previously found.

Mortality searches were completed once for each pond during a crew's two-week shift. The transects for all of the ponds excluding the Tailings pond followed the shoreline around the entire pond except at locations where infrastructure made a portion of the shoreline inaccessible or it was unsafe for survey personnel. On the smaller ponds, the mortality searches were conducted by one member of the crew by walking the shoreline and scanning the surface of the water from various locations, while the other crew member conducted deterrent maintenance. As a safety precaution, both crew members conducted mortality searches on the larger ponds together. The Sulphur Runoff pond was observed from one location because the pond has a large berm and fence around it making the pond not visible around much of the perimeter.

Three transects running north-south on the Tailings Pond were designated using mapping software to ensure they were equally spaced and covered the majority of the pond. Transects were loaded on to the crew's GPS units for them to follow while performing the search. Transects were followed the majority of the time and were only deviated from when the area could not be traversed by boat due to floating bitumen mats or the boom (only an issue when airboats were unavailable and outboards were being used). For the focused area searches, three areas were selected at the beginning of the year based on experience from 2013 of where

the problem areas were on the Tailings pond. These areas were searched every two weeks as well, primarily by boat. The shoreline was walked in areas where it was safe to do so and time allowed. Areas were added, removed or changed as the habitat on the Tailings pond changed over the course of the season, location of floating bitumen mats, and where bird activity was being observed. These changes ensured that surveys were conducted in areas where there was a higher probability that birds had become oiled or had died.

Two boats are required on the tailings pond at all times for the bird deterrent program with one boat acting as the work boat and the other following behind and acting as a safety boat. Observations from both boat operators were included in the search data.

### **2.3.5 Incidental Observations and Reporting**

Incidental observations included birds detected between April and October outside of formal bird surveys or mortality searches. Birds counted were: 1) oiled, dead, or euthanized; or 2) species of conservation concern in contact with a process-affected pond.

Observers reported landed birds, whether observed incidentally or during surveys, immediately to hazing crews for hazing or capturing of oiled birds. Oiled birds were immediately reported to the Horizon Regulatory and Environment on-call personnel who then contacted AESRD for their recommendation; typically permission to euthanize was granted. Observers also reported oiled birds and landed species of conservation concern as part of a daily email update sent to the Horizon Waterbird Protection Program contact list, including details about the location, species, number of birds, and percent of the body surface oiled.

Workers on site are required to report sightings of birds on process-affected ponds and other wildlife at the project site to the on-call Horizon Regulatory & Environmental cellphone number.

## **2.4 Results**

### **2.4.1 Pond Characteristics**

Geospatial analysis guided by ground-truthing information enabled measurement of pond area over water and islands. However, characteristics such as vegetation, narrow beaches or mudflats, and floating bitumen can be difficult to identify or quantify from satellite imagery, especially for small ponds, and the results will depend on the date of the image. Hence, for some characteristics qualitative estimates from field observations are more informative, even though visibility of the entire area for large ponds may be limited. Quantitative and qualitative pond characteristics are summarized in Tables 2.8 and 2.9.

**Table 2.8: Characteristics of Survey Stations Monitored at Horizon in 2014**

| Pond Name             | Survey Station ID | Survey Area<br>(over water; ha) | Island (ha) | Emergent<br>Vegetation | Shoreline (m) |       |
|-----------------------|-------------------|---------------------------------|-------------|------------------------|---------------|-------|
|                       |                   |                                 |             |                        | Vegetated     | Total |
| Basal Water Storage   | TMP1*             | 20.2                            | 0           | Y                      | 247           | 1,240 |
|                       | TMP2              | 25.8                            | 0           | Y                      | 619           | 1,793 |
|                       | Station Total     | 25.8                            | 0           | Y                      | 619           | 1,793 |
| Coke Runoff           | FMP1              | 2.7                             | 0           | Y                      | 305           | 1,422 |
| Dyke 10 Runoff        | NMP1              | 9.0                             | 0           | N                      | 1,225         | 1,851 |
| Extraction Dump       | IMP1              | 1.7                             | 0           | N                      | 0             | 634   |
| R2 Basal Dump         | SMP1              | 1.3                             | 0           | N                      | 0             | 576   |
| R2 Emergency Dump     | MMP1              | 0.1                             | 0           | N                      | 0             | 171   |
| Recycle Water         | AMP1              | 16.4                            | 0           | N                      | 0             | 2,089 |
| Storm Water           | EMP1              | 8.3                             | 0           | N                      | 0             | 1,263 |
| Sulphur Runoff        | CMP1              | 0.6                             | 0           | N                      | 0             | 305   |
| Tailings Pond         | PMP1*             | 32.4                            | 0           | N                      | 0             | 1,564 |
|                       | PMP5              | 41.7                            | 0           | Y                      | 1,025         | 1,304 |
|                       | PMP2              | 0                               | 0           | N                      | 0             | 0     |
|                       | PMP3              | 24.8                            | 0           | N                      | 0             | 1,055 |
|                       | PMP6*             | 23.0                            | 0           | N                      | 0             | 1,030 |
|                       | PMP4              | 33.7                            | 0.55        | Y                      | 1,966         | 1,966 |
|                       | Stations Total    | 100.2                           | 0.55        | Y                      | 2,991         | 4,325 |
| Emergency Dump Pond 1 | JMP1              | 0.1                             | 0           | N                      | 0             | 137   |
| Emergency Dump Pond 2 | LMP1              | 0.1                             | 0           | N                      | 0             | 158   |
| Emergency Dump Pond 3 | QMP1              | 0.1                             | 0           | N                      | 0             | 166   |
| Froth Dump            | OMP1              | 1.0                             | 0           | N                      | 0             | 459   |
| Mine Dump             | KMP1              | 1.3                             | 0           | N                      | 0             | 472   |
| Mine Sump             | RMP1              | 0.4                             | 0           | N                      | 0             | 233   |
| R1 Distributor        | HMP1              | 0.1                             | 0           | N                      | 0             | 129   |
| R1 Emergency Dump     | GMP1              | 0.2                             | 0           | N                      | 0             | 201   |
| Compensation Lake     | ZMP1              | 20.0                            | 0.01        | Y                      | 1,179         | 1,179 |

**Notes:**

Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.

\* Not included in total (the station from each original/replacement pair that had the most surveys was used for deriving totals).

**Table 2.9: Characteristics of Ponds Monitored at Horizon in 2014**

| Pond Name<br>(Year of Origin) | Pond<br>Content <sup>1</sup> | Bitumen Cover                                   |                 | Pond Area <sup>3</sup><br>(over water; ha) | Island<br>(ha) <sup>3</sup> | Emergent<br>Vegetation <sup>2</sup> | Shoreline (m) |        |
|-------------------------------|------------------------------|-------------------------------------------------|-----------------|--------------------------------------------|-----------------------------|-------------------------------------|---------------|--------|
|                               |                              | % of Water Surface <sup>2</sup><br>Mode [Range] | ha <sup>3</sup> |                                            |                             |                                     | Veg.          | Total  |
| Basal Water Storage (2011)    | SW                           | 0                                               | 0               | 28.0                                       | 0.04                        | Y                                   | 1,493         | 2,850  |
| Coke Runoff (2008)            | PA                           | 0 [0 to 1-5]                                    | 0               | 2.7                                        | 0                           | Y                                   | 305           | 1,422  |
| Dyke 10 Runoff (2008)         | PA                           | 0 [0 to 1-5]                                    | 0               | 9.0                                        | 0                           | N                                   | 1,215         | 1,851  |
| Extraction Dump (2008)        | PA                           | 1-5 [0 to 16-25]                                | 0               | 1.7                                        | 0                           | N                                   | 0             | 634    |
| R2 Basal Dump (2010)          | PA                           | 0 [0 to 1-5]                                    | 0               | 1.3                                        | 0                           | N                                   | 0             | 576    |
| R2 Emergency Dump (2008)      | PA                           | 0 [0 to 16-25]                                  | 0               | 0.1                                        | 0                           | N                                   | 0             | 171    |
| Recycle Water (2008)          | PA                           | 1-5 [0 to 1-25]                                 | 0               | 18.2                                       | 0                           | N                                   | 0             | 2,483  |
| Storm Water (2008)            | PA                           | 0 [0 to 6-15]                                   | 0               | 8.3                                        | 0                           | N                                   | 0             | 1,263  |
| Sulphur Runoff (2008)         | PA                           | 0 [0 to 1-5]                                    | 0               | 0.6                                        | 0                           | N                                   | 0             | 305    |
| Tailings Pond (2008)          | PA                           | 1-5 [1-5 to 16-25]                              | 8.83            | 1,013.4                                    | 2.89                        | Y                                   | 17,729        | 29,115 |
| Emergency Dump Pond 1 (2008)  | PA                           | 76-100 [0 to 76-100]                            | 0               | 0.1                                        | 0                           | N                                   | 0             | 137    |
| Emergency Dump Pond 2 (2008)  | PA                           | 1-5 [1-5 to 76-100]                             | 0               | 0.1                                        | 0                           | N                                   | 0             | 158    |
| Emergency Dump Pond 3 (2011)  | PA                           | 6-15 [0 to 76-100]                              | 0               | 0.1                                        | 0                           | N                                   | 0             | 166    |
| Froth Dump (2008)             | PA                           | 1-25 [0 to 26-50]                               | 0               | 1.0                                        | 0                           | N                                   | 0             | 459    |
| Mine Dump (2008)              | PA                           | 1-5 [0 to 26-50]                                | 0.05            | 1.3                                        | 0                           | N                                   | 0             | 472    |
| Mine Sump (2010)              | PA                           | 0 [0 to 16-25]                                  | 0               | 0.4                                        | 0                           | N                                   | 0             | 233    |
| R1 Distributor (2008)         | PA                           | 0 [0 to 6-15]                                   | 0               | 0.1                                        | 0                           | N                                   | 0             | 129    |
| R1 Emergency Dump (2008)      | PA                           | 1-5 [1-5 to 76-100]                             | 0               | 0.2                                        | 0                           | N                                   | 0             | 201    |
| Compensation Lake             | FW                           | 0                                               | 0               | 77.5                                       | 0.28                        | Y                                   | 5,637         | 5,637  |

**Notes:**

Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.

<sup>1</sup> SW: saline water; PA: process-affected; FW: freshwater.

<sup>2</sup> Observed on site in April-Oct.

<sup>3</sup> Estimated from a satellite image taken on May 1, 2014.

Of the process-affected ponds, the Tailings and Basal Water Storage ponds were the largest and had the most diverse and abundant avian habitat attractants, including sinuous shorelines along their west shores and the presence of vegetation, islands, and beaches or mudflats. The eight ponds of lower monitoring priority were small (0.1 to 1.3 ha) and had no habitat attractive to birds, except at Mine Dump pond where a small sandy area occurred on the south side and grassy vegetation covered the adjacent slopes on the north and east sides of the pond. Ponds of lower monitoring priority were also closer to human activity, such as machinery and operations, compared to other process-affected ponds.

All of the monitored process-affected ponds had the potential to contain bitumen, except Basal Water Storage, Coke Runoff pond, and R2 Basal Dump pond. Floating bitumen was consistently observed at the Tailings pond (100% of days surveyed), R1 Emergency Dump and Emergency Dump ponds 1, 2 and 3 (92 to 100%), and Mine Dump (88%), Extraction Dump (72%), Froth Dump (58%), Recycle Water (57%), Mine Sump (36%), and Storm Water (35%) ponds. At the four remaining ponds, floating bitumen was observed less often (between 1 and 14% of days surveyed, depending on the pond).

## **2.4.2 Bird Observations**

### **2.4.2.1 Survey Effort**

All stations were surveyed as per the protocol from April to October, except for PMP4 on the southwest shore of the Tailings pond, where 33 surveys (21% of scheduled surveys at that station) were missed due to unusable roads (Tables 2.10 and 2.11); neither PMP4 nor any other alternative location could be reached because the access road along the west shore of the Tailings pond was rendered unusable by precipitation and runoff. Access was generally attempted by the crew and failed (48% of missed surveys), or was denied by the permitting office (38% of missed surveys) when roads were deemed unsafe. The other missed surveys were due to delays preventing the crew from completing all surveys within 12 hours (9% of missed surveys), or access being blocked by a berm, heavy machinery, or road closure (5% of missed surveys).

Survey areas encompassed the entire water surface of ponds, except at the Tailings pond, where the four regular stations covered 10% of the water surface, Recycle Water (90%), Basal Water Storage (92%), and Compensation Lake (26%).

Within the above access and safety constraints, stations where birds were more likely to occur were generally surveyed earlier in the day (see Methods, Section 2.3.2). There was no evident trend between time of day and number of waterbirds landed (Appendix 2.B).

**Table 2.10: Bird Survey Effort by Station at Horizon in 2014**

| Pond Name             | Survey Duration (min) | Survey Station ID | Survey Area (over water; ha) | # Surveys Conducted in 2014 |
|-----------------------|-----------------------|-------------------|------------------------------|-----------------------------|
| Basal Water Storage   | 10                    | TMP1*             | 20.2                         | 69                          |
|                       |                       | TMP2              | 25.8                         | 84                          |
| Coke Runoff           | 10                    | FMP1              | 2.7                          | 154                         |
| Dyke 10 Runoff        | 10                    | NMP1              | 9.0                          | 156                         |
| Extraction Dump       | 10                    | IMP1              | 1.7                          | 155                         |
| R2 Basal Dump         | 10                    | SMP1              | 1.3                          | 157                         |
| R2 Emergency Dump     | 10                    | MMP1              | 0.1                          | 154                         |
| Recycle Water         | 10                    | AMP1              | 16.4                         | 154                         |
| Storm Water           | 10                    | EMP1              | 8.3                          | 155                         |
| Sulphur Runoff        | 10                    | CMP1              | 0.6                          | 154                         |
| Tailings Pond         | 30                    | PMP1*             | 32.4                         | 71                          |
|                       |                       | PMP5              | 41.7                         | 82                          |
|                       |                       | PMP2              | 0                            | 148                         |
|                       |                       | PMP3              | 24.8                         | 132                         |
|                       |                       | PMP6*             | 23.0                         | 18                          |
|                       |                       | PMP4              | 33.7                         | 122                         |
| Emergency Dump Pond 1 | 10                    | JMP1              | 0.1                          | 26                          |
| Emergency Dump Pond 2 | 10                    | LMP1              | 0.1                          | 25                          |
| Emergency Dump Pond 3 | 10                    | QMP1              | 0.1                          | 26                          |
| Froth Dump            | 10                    | OMP1              | 1.0                          | 26                          |
| Mine Dump             | 10                    | KMP1              | 1.3                          | 26                          |
| Mine Sump             | 10                    | RMP1              | 0.4                          | 25                          |
| R1 Distributor        | 10                    | HMP1              | 0.1                          | 26                          |
| R1 Emergency Dump     | 10                    | GMP1              | 0.2                          | 26                          |
| Compensation Lake     | 10                    | ZMP1              | 20.0                         | 52                          |

**Notes:**

Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.

\* Station from each original/replacement pair that had the least surveys.

**Table 2.11: Bird Survey Effort by Pond at Horizon in 2014**

| Pond Name             | # Survey Stations | Survey Area (over water; ha) | Survey Area as % of Pond Area (over water; ha) | Duration of Surveys (min) | Scheduled Monitoring Frequency (days/week) | # Surveys Conducted in 2014 | % Days with all scheduled surveys conducted |
|-----------------------|-------------------|------------------------------|------------------------------------------------|---------------------------|--------------------------------------------|-----------------------------|---------------------------------------------|
| Basal Water Storage   | 1                 | 25.8                         | 92                                             | 10                        | 6                                          | 153                         | 99                                          |
| Coke Runoff           | 1                 | 2.7                          | 100                                            | 10                        | 6                                          | 154                         | 99                                          |
| Dyke 10 Runoff        | 1                 | 9.0                          | 100                                            | 10                        | 6                                          | 156                         | 100                                         |
| Extraction Dump       | 1                 | 1.7                          | 100                                            | 10                        | 6                                          | 155                         | 100                                         |
| R2 Basal Dump         | 1                 | 1.3                          | 100                                            | 10                        | 6                                          | 157                         | 100                                         |
| R2 Emergency Dump     | 1                 | 0.1                          | 100                                            | 10                        | 6                                          | 154                         | 99                                          |
| Recycle Water         | 1                 | 16.4                         | 90                                             | 10                        | 6                                          | 154                         | 99                                          |
| Storm Water           | 1                 | 8.3                          | 100                                            | 10                        | 6                                          | 155                         | 100                                         |
| Sulphur Runoff        | 1                 | 0.6                          | 100                                            | 10                        | 6                                          | 154                         | 99                                          |
| Tailings Pond         | 4                 | 100.2                        | 10                                             | 30                        | 6                                          | 573                         | 77                                          |
| Emergency Dump Pond 1 | 1                 | 0.1                          | 100                                            | 10                        | 1                                          | 26                          | 100                                         |
| Emergency Dump Pond 2 | 1                 | 0.1                          | 100                                            | 10                        | 1                                          | 25                          | 96                                          |
| Emergency Dump Pond 3 | 1                 | 0.1                          | 100                                            | 10                        | 1                                          | 26                          | 100                                         |
| Froth Dump            | 1                 | 1.0                          | 100                                            | 10                        | 1                                          | 26                          | 100                                         |
| Mine Dump             | 1                 | 1.3                          | 100                                            | 10                        | 1                                          | 26                          | 100                                         |
| Mine Sump             | 1                 | 0.4                          | 100                                            | 10                        | 1                                          | 25                          | 96                                          |
| R1 Distributor        | 1                 | 0.1                          | 100                                            | 10                        | 1                                          | 26                          | 100                                         |
| R1 Emergency Dump     | 1                 | 0.2                          | 100                                            | 10                        | 1                                          | 26                          | 100                                         |
| Compensation Lake     | 1                 | 20.0                         | 26                                             | 10                        | 2                                          | 52                          | 100                                         |

**Note:**

Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.

#### **2.4.2.2 Survey Results**

At process-affected ponds, there was a total of 6,945 observations of landed birds, 92% of which were waterbirds, and 6,177 observations of birds flying within the survey area, 31% of which were waterbirds (Table 2.12). The most common landed guild were divers (Greater Scaup, Eared Grebe, Ring-necked Duck), followed by dabblers (Mallard, Canada Goose, Northern Shoveler), waders (Red-necked Phalarope, Lesser Yellowlegs, Spotted Sandpiper), non-target (Common Raven, Snow Bunting, American Pipit), and gulls (Franklin's Gull, Herring Gull, Bonaparte's Gull) (Appendix 2.C).

Basal Water Storage pond had by far the highest number of landed waterbirds per survey (26.8), followed by Compensation Lake (18.8), Dyke 10 Runoff pond (7.2), and the Tailings pond's southwest station PMP4 (2.6) (Table 2.13, Figure 2.2). Waders were also regularly observed at the PMP2 station and at Storm Water and Coke Runoff ponds. None of the ponds of lower monitoring priority had landed birds except Mine Dump, where two Greater Yellowlegs were observed on September 8.

There were 127 observations of birds that had contacted bitumen (2% of all observations of landed waterbirds), including 21 species (Table 2.19). Most were shorebirds and gulls that were 5 to 10% oiled, usually on their underside (Table 2.14, Appendix 2.D). Fifteen birds were 40 to 80% oiled: 12 gulls, 2 ducks and one sandpiper. All oiled birds were reported for hazing or capture. However, birds could be difficult to find, capture, or haze successfully; thus some birds were likely observed in more than one survey. Observations of oiled birds during surveys occurred primarily at Basal Water Storage pond, PMP4, PMP2, Storm Water pond, R2 Basal Dump pond, and Compensation Lake (Table 2.13, Figure 2.3). Thirty-six percent of oiled birds observed during surveys were at ponds that did not have floating bitumen, indicating that some birds contacted bitumen elsewhere and then flew to the pond, or walked from a pond nearby. For example, an 80% oiled unknown duck observed at Basal Water Storage on October 1 likely walked from the nearby Tailings pond, where floating bitumen occurred.

Broods were observed on 39 occasions between June and August at process-affected ponds: Dyke 10 Runoff pond (27 observations), Storm Water pond (6), Basal Water Storage pond (4), Coke Runoff pond (1), and at the PMP4 station at the Tailings pond (1) (Table 2.15). Three observations also occurred at Compensation Lake: Canada goose (2) and Red-breasted Merganser (1).

**Table 2.12: Number of Bird Observations by Pond and Guild at Horizon in 2014<sup>1</sup>**

| Pond Name                             | Dabblers     |            | Divers       |           | Waders       |            | Gulls      |           | Non-target |              | Total <sup>2</sup> |              |
|---------------------------------------|--------------|------------|--------------|-----------|--------------|------------|------------|-----------|------------|--------------|--------------------|--------------|
|                                       | Landed       | Flew Over  | Landed       | Flew Over | Landed       | Flew Over  | Landed     | Flew Over | Landed     | Flew Over    | Landed             | Flew Over    |
| Basal Water Storage                   | 1,415        | 88         | 1,958        | 2         | 531          | 163        | 100        | 20        | 23         | 146          | 4,122              | 489          |
| Coke Runoff                           | 75           | 49         | 99           | 3         | 102          | 6          |            |           | 18         | 96           | 297                | 204          |
| Dyke 10 Runoff                        | 282          | 3          | 491          | 2         | 324          | 22         |            | 3         | 36         | 611          | 1,164              | 641          |
| Extraction Dump                       |              |            |              |           | 1            |            |            |           | 4          | 83           | 5                  | 83           |
| R2 Basal Dump                         |              | 8          |              |           | 26           | 2          | 2          | 1         | 4          | 203          | 32                 | 216          |
| R2 Emergency Dump                     |              |            |              | 1         | 35           | 6          |            |           | 52         | 513          | 87                 | 521          |
| Recycle Water                         | 5            | 3          | 21           |           | 41           | 2          | 2          | 3         | 20         | 94           | 89                 | 102          |
| Storm Water                           | 28           | 2          | 43           | 1         | 104          | 1          |            | 3         | 10         | 290          | 185                | 297          |
| Sulphur Runoff                        |              | 1          |              |           | 4            | 2          |            |           | 7          | 100          | 11                 | 103          |
| Tailings Pond                         | 154          | 805        | 21           | 16        | 394          | 431        | 21         | 30        | 360        | 2,027        | 951                | 3,474        |
| Emergency Dump Pond 1                 |              |            |              |           |              |            |            |           |            | 4            |                    | 4            |
| Emergency Dump Pond 2                 |              |            |              |           |              |            |            |           |            |              |                    |              |
| Emergency Dump Pond 3                 |              | 1          |              |           |              |            |            |           |            | 1            |                    | 2            |
| Froth Dump                            |              |            |              |           |              |            |            |           |            | 12           |                    | 12           |
| Mine Dump                             |              | 1          |              |           | 2            |            |            |           |            | 10           | 2                  | 11           |
| Mine Sump                             |              |            |              |           |              |            |            |           |            | 3            |                    | 3            |
| R1 Distributor                        |              |            |              |           |              |            |            |           |            | 9            |                    | 9            |
| R1 Emergency Dump                     |              |            |              |           |              |            |            |           |            | 6            |                    | 6            |
| <b>Total (Process-affected Ponds)</b> | <b>1,959</b> | <b>961</b> | <b>2,633</b> | <b>25</b> | <b>1,564</b> | <b>635</b> | <b>125</b> | <b>60</b> | <b>534</b> | <b>4,208</b> | <b>6,945</b>       | <b>6,177</b> |
| Compensation Lake                     | 266          | 140        | 575          | 9         | 33           | 2          | 98         | 16        | 39         | 125          | 1,020              | 300          |

**Notes:**

Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times.

<sup>2</sup> Includes unknown duck species (which may be dabblers or divers).

**Table 2.13: Mean Number of Landed Birds per Survey at Horizon in 2014**

| Pond Name                         | Survey Station ID        | Dabblers    | Divers      | Waders      | Gulls       | Non-target Guilds | All Guilds <sup>1</sup> |
|-----------------------------------|--------------------------|-------------|-------------|-------------|-------------|-------------------|-------------------------|
| Basal Water Storage               | TMP1                     | 9.23        | 25.87       | 0.62        | 0.29        | 0.07              | 37.36                   |
|                                   | TMP2                     | 9.26        | 2.06        | 5.81        | 0.95        | 0.21              | 18.38                   |
|                                   | Mean across surveys      | 9.25        | 12.80       | 3.47        | 0.65        | 0.15              | 26.94                   |
| Coke Runoff                       | FMP1                     | 0.49        | 0.64        | 0.66        | 0           | 0.12              | 1.93                    |
| Dyke 10 Runoff                    | NMP1                     | 1.81        | 3.15        | 2.08        | 0           | 0.23              | 7.46                    |
| Extraction Dump                   | IMP1                     | 0           | 0           | 0.01        | 0           | 0.03              | 0.03                    |
| R2 Basal Dump                     | SMP1                     | 0           | 0           | 0.17        | 0.01        | 0.03              | 0.20                    |
| R2 Emergency Dump                 | MMP1                     | 0           | 0           | 0.23        | 0           | 0.34              | 0.56                    |
| Recycle Water                     | AMP1                     | 0.03        | 0.14        | 0.27        | 0.01        | 0.13              | 0.58                    |
| Storm Water                       | EMP1                     | 0.18        | 0.28        | 0.67        | 0           | 0.06              | 1.19                    |
| Sulphur Runoff                    | CMP1                     | 0           | 0           | 0.03        | 0           | 0.05              | 0.07                    |
| Tailings Pond                     | PMP1                     | 0.14        | 0.18        | 0.15        | 0           | 1.17              | 1.65                    |
|                                   | PMP5                     | 0.16        | 0           | 0.11        | 0.01        | 0.57              | 0.85                    |
|                                   | PMP2                     | 0           | 0           | 1.24        | 0.09        | 0.58              | 1.91                    |
|                                   | PMP3                     | 0.08        | 0.05        | 0           | 0.05        | 0.05              | 0.21                    |
|                                   | PMP6                     | 0           | 0           | 0           | 0           | 0                 | 0                       |
|                                   | PMP4                     | 0.99        | 0.02        | 1.57        | 0           | 1.13              | 3.71                    |
|                                   | Mean across surveys      | 0.27        | 0.04        | 0.69        | 0.04        | 0.63              | 1.66                    |
| Emergency Dump Pond 1             | JMP1                     | 0           | 0           | 0           | 0           | 0                 | 0                       |
| Emergency Dump Pond 2             | LMP1                     | 0           | 0           | 0           | 0           | 0                 | 0                       |
| Emergency Dump Pond 3             | QMP1                     | 0           | 0           | 0           | 0           | 0                 | 0                       |
| Froth Dump                        | OMP1                     | 0           | 0           | 0           | 0           | 0                 | 0                       |
| Mine Dump                         | KMP1                     | 0           | 0           | 0.08        | 0           | 0                 | 0.08                    |
| Mine Sump                         | RMP1                     | 0           | 0           | 0           | 0           | 0                 | 0                       |
| R1 Distributor                    | HMP1                     | 0           | 0           | 0           | 0           | 0                 | 0                       |
| R1 Emergency Dump                 | GMP1                     | 0           | 0           | 0           | 0           | 0                 | 0                       |
| <b>All Process-affected Ponds</b> | <b>Mean across ponds</b> | <b>0.67</b> | <b>0.95</b> | <b>0.46</b> | <b>0.04</b> | <b>0.10</b>       | <b>2.26</b>             |
| Compensation Lake                 | ZMP1                     | 5.12        | 11.06       | 0.63        | 1.88        | 0.75              | 19.62                   |

**Notes:**

Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.

<sup>1</sup> Includes unknown duck species (which may be dabblers or divers).

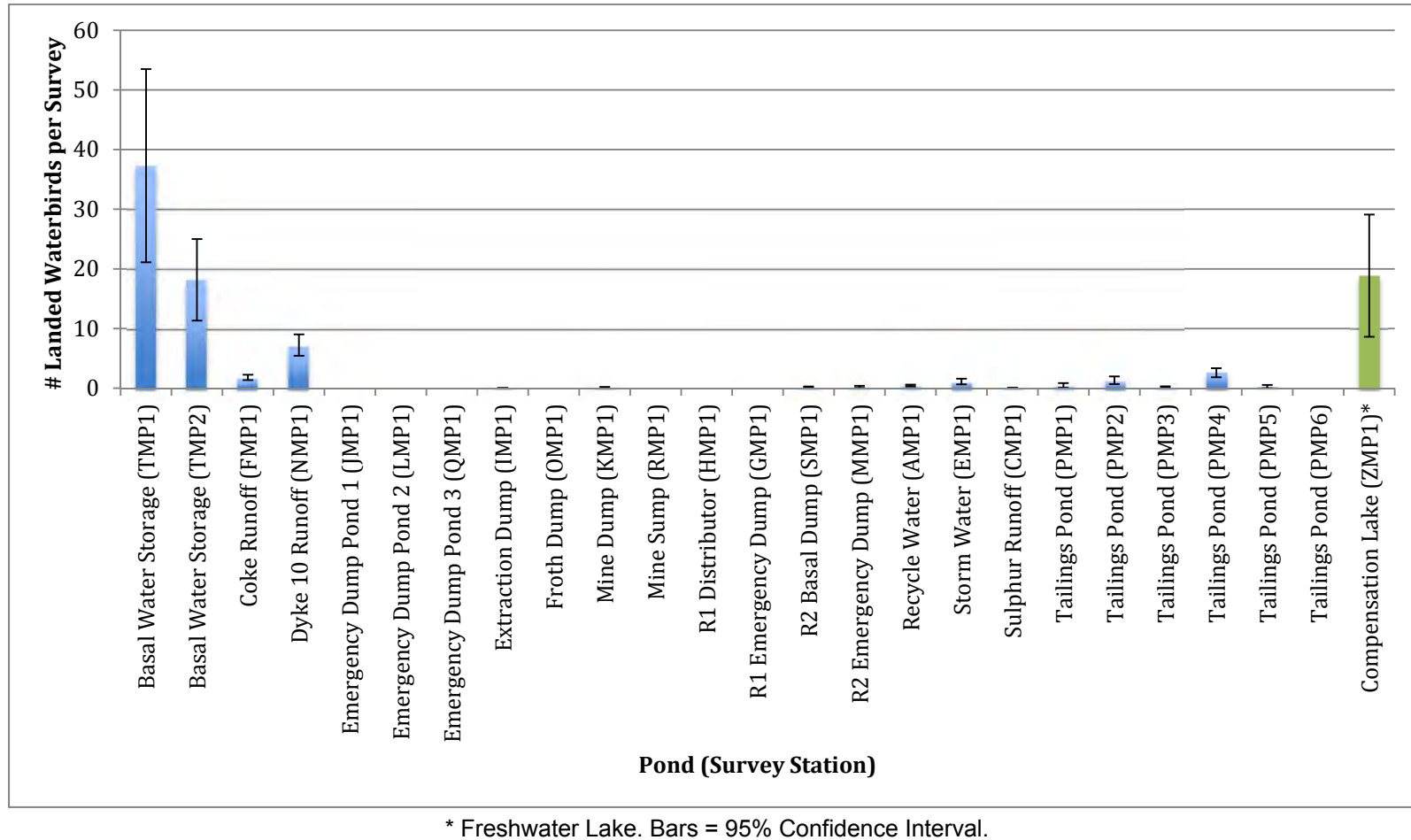
**Table 2.14: Mean Number of Oiled Birds per Survey at Horizon in 2014**

| Pond Name                         | Survey Station ID        | Dabblers         | Divers       | Waders       | Gulls        | Non-target Guilds | All Guilds <sup>1</sup> |
|-----------------------------------|--------------------------|------------------|--------------|--------------|--------------|-------------------|-------------------------|
| Basal Water Storage               | TMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
|                                   | TMP2                     | 0                | 0.012        | 0.083        | 0.26         | 0                 | 0.357                   |
|                                   | Mean across surveys      | 0                | 0.007        | 0.046        | 0.14         | 0                 | 0.196                   |
| Coke Runoff                       | FMP1                     | 0                | 0            | 0.013        | 0            | 0                 | 0.013                   |
| Dyke 10 Runoff                    | NMP1                     | 0                | 0            | 0.019        | 0            | 0                 | 0.019                   |
| Extraction Dump                   | IMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| R2 Basal Dump                     | SMP1                     | 0                | 0            | 0.051        | 0.01         | 0                 | 0.064                   |
| R2 Emergency Dump                 | MMP1                     | 0                | 0            | 0.013        | 0            | 0                 | 0.013                   |
| Recycle Water                     | AMP1                     | 0                | 0.013        | 0.039        | 0            | 0                 | 0.052                   |
| Storm Water                       | EMP1                     | 0                | 0            | 0.071        | 0            | 0                 | 0.071                   |
| Sulphur Runoff                    | CMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| Tailings Pond                     | PMP1                     | 0.042            | 0            | 0            | 0            | 0                 | 0.042                   |
|                                   | PMP5                     | 0.024            | 0            | 0            | 0.01         | 0                 | 0.037                   |
|                                   | PMP2                     | 0                | 0            | 0.115        | 0.02         | 0                 | 0.135                   |
|                                   | PMP3                     | 0                | 0            | 0            | 0.04         | 0                 | 0.038                   |
|                                   | PMP6                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
|                                   | PMP4                     | 0                | 0            | 0.246        | 0            | 0                 | 0.246                   |
|                                   | Mean across surveys      | 0.009            | 0            | 0.082        | 0.02         | 0                 | 0.101                   |
| Emergency Dump Pond 1             | JMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| Emergency Dump Pond 2             | LMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| Emergency Dump Pond 3             | QMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| Froth Dump                        | OMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| Mine Dump                         | KMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| Mine Sump                         | RMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| R1 Distributor                    | HMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| R1 Emergency Dump                 | GMP1                     | 0                | 0            | 0            | 0            | 0                 | 0                       |
| <b>All Process-affected Ponds</b> | <b>Mean across ponds</b> | <b>&lt;0.001</b> | <b>0.001</b> | <b>0.019</b> | <b>0.010</b> | <b>0</b>          | <b>0.030</b>            |
| Compensation Lake                 | ZMP1                     | 0                | 0            | 0            | 0.058        | 0                 | 0.058                   |

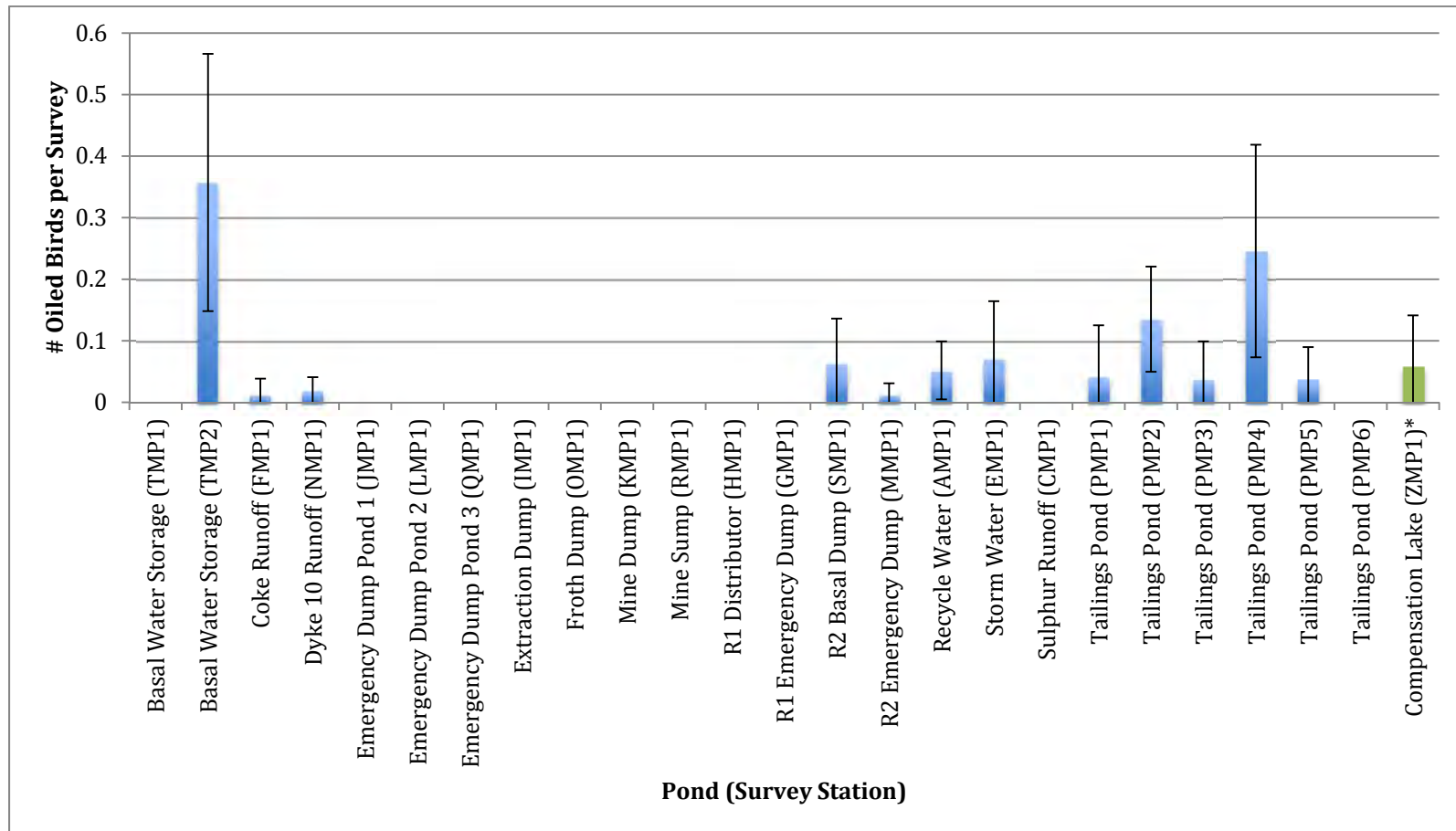
**Notes:**

Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.

<sup>1</sup> Includes unknown duck species (which may be dabblers or divers).



**Figure 2.2: Mean Number of Landed Waterbirds per Survey at Horizon in 2014**



\* Freshwater Lake. Bars = 95% Confidence Intervals.

**Figure 2.3: Mean Number of Oiled Birds per Survey at Horizon in 2014**

**Table 2.15: Brood Observations by Species at Process-affected Ponds at Horizon in 2014**

| Species/Species Group | # Brood Observations <sup>1</sup>             |
|-----------------------|-----------------------------------------------|
| Mallard               | 13 (Dyke 10 Runoff, Basal Water Storage)      |
| Ring-necked Duck      | 12 (Dyke 10 Runoff, Strom Water)              |
| Green-winged Teal     | 4 (Dyke 10 Runoff, Basal Water Storage, PMP4) |
| UNK Dabbling Duck     | 3 (Dyke 10 Runoff)                            |
| UNK Scaup             | 2 (Dyke 10 Runoff)                            |
| American Wigeon       | 1 (Dyke 10 Runoff)                            |
| Canada Goose          | 1 (Basal Water Storage)                       |
| Canvasback            | 1 (Storm Water)                               |
| Spotted Sandpiper     | 1 (Coke Runoff)                               |
| UNK Duck              | 1 (Dyke 10 Runoff)                            |

**Notes:**

Pink shading: Species of Conservation Concern.

<sup>1</sup> Each brood may contain one to multiple chicks; broods may be observed repeatedly across surveys and thus be counted multiple times.

### 2.4.3 Inter-observer Variability (IOV)

Observations during IOV surveys ranged from 0 to 20 birds (0 to 6 species) for landed birds, and 0 to 63 birds (0 to 4 species) for birds that flew over. The RPD between observers varied from 0 to 200% (Table 2.16). Although a 200% difference seems high, in all cases, this difference represented  $\leq 3$  observations but led to a high RPD due to the small number of birds present.

Observers attempted to identify causes of variability after the completion of each comparison survey. They included systematic causes, such as differences in distance estimates for delineating the survey area (which covers a 500-m radius and 100-m altitude), and more stochastic causes such as some birds being visible only briefly or intermittently (e.g., birds moving in or out of vegetation), combined with different scanning approaches (e.g., starting right to left versus starting left to right). Other potential causes included, in a few cases, differences in survey equipment (make and model of binoculars or scope), slightly different vantage points or fields of vision between the two teams, or some students requiring more assistance with data entry.

**Table 2.16: Inter-observer Variability in Terms of Relative Percent Difference at Horizon in 2014, for Surveys during which at least One Bird was Observed as Landed or Flying Over**

| Survey Station | Comparison Survey ID | Landed                                |                                    | Flew Over                             |                                    |
|----------------|----------------------|---------------------------------------|------------------------------------|---------------------------------------|------------------------------------|
|                |                      | RPD (%) in Number of Individual Birds | RPD (%) in Number of Avian Species | RPD (%) in Number of Individual Birds | RPD (%) in Number of Avian Species |
| PMP1           | 2                    | –                                     | –                                  | 0                                     | 0                                  |
|                | 6                    | –                                     | –                                  | 67                                    | 67                                 |
| PMP5           | 11                   | 0                                     | 0                                  | 0                                     | 0                                  |
|                | 14                   | –                                     | –                                  | 0                                     | 0                                  |
|                | 17                   | 120                                   | 0                                  | 21                                    | 40                                 |
| PMP2           | 7                    | –                                     | –                                  | 200                                   | 200                                |
|                | 9                    | 9                                     | 0                                  | 0                                     | 0                                  |
|                | 12                   | 111                                   | 0                                  | 200                                   | 200                                |
|                | 15                   | –                                     | –                                  | 0                                     | 0                                  |
| PMP3           | 3                    | –                                     | –                                  | 67                                    | 0                                  |
| PMP4           | 1                    | 0                                     | 0                                  | 67                                    | 67                                 |
|                | 4                    | 200                                   | 200                                | –                                     | –                                  |
|                | 10                   | 0                                     | 0                                  | 0                                     | 0                                  |
|                | 13                   | 40                                    | 0                                  | 167                                   | 120                                |
|                | 16                   | 200                                   | 200                                | 38                                    | 29                                 |
| TMP1           | 5                    | 29                                    | 86                                 | 200                                   | 200                                |
|                | 8                    | 11                                    | 18                                 | –                                     | –                                  |

**Note:**

Dash = no birds were observed by either observer.

Skill levels in species identification did not appear to be a major source of variability, as differences were primarily in the number of birds seen rather than in species identification. The option to select species groups in the entry forms enables observers to be conservative in case of uncertainty. Assuming that the observers were looking at the same landed bird, the species identification differences were: Greater vs. Lesser Yellowlegs, unknown dabbling duck vs. unknown duck, Lesser Yellowlegs vs. unknown Yellowlegs, and Green-winged Teal vs. unknown dabbling duck; and for flying birds: Barn Swallow vs. unknown Swallow, and unknown Yellowlegs vs. unknown shorebird.

#### 2.4.4 Mortalities

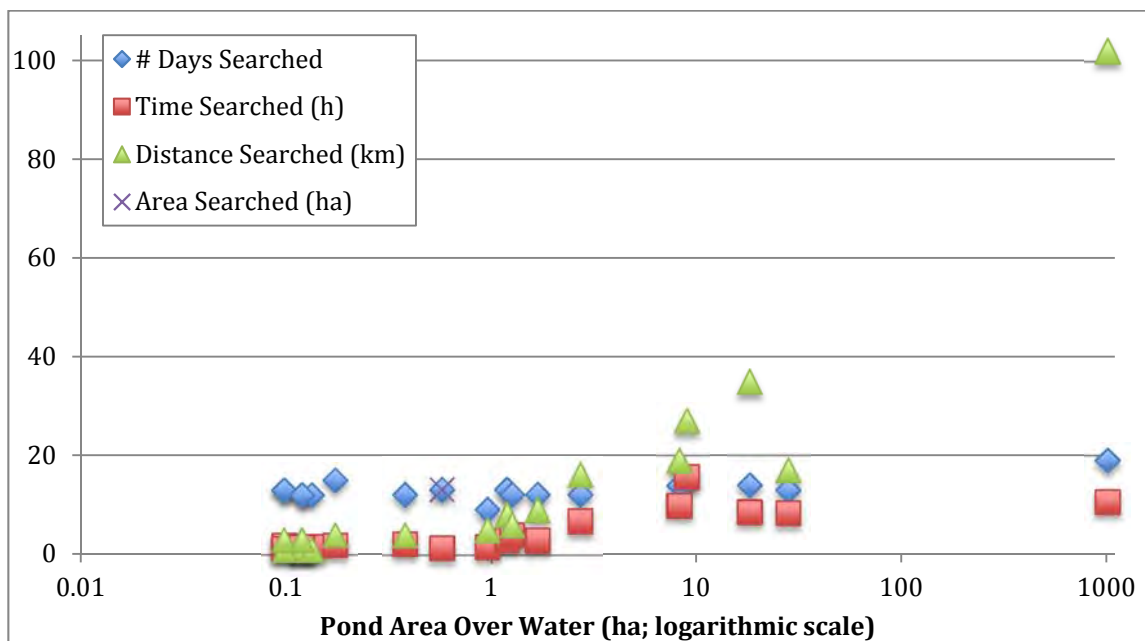
Mortality search effort is detailed in Table 2.17 and Figure 2.4. The Tailings pond was searched over much greater distances, but search duration was of the same order as other ponds, because searches were conducted on boats instead of on foot (average of 5.4 km and 34 min per day searched).

**Table 2.17: Mortality Search Effort at Horizon in 2014<sup>1</sup>**

| Pond Name             | # Days Searched | Boat       |            |          | Walk        |            |           | Truck      |           |          | Total       |            |           |
|-----------------------|-----------------|------------|------------|----------|-------------|------------|-----------|------------|-----------|----------|-------------|------------|-----------|
|                       |                 | h          | km         | ha       | h           | km         | ha        | h          | km        | ha       | h           | km         | ha        |
| Basal Water Storage   | 13              |            |            |          | 8.4         | 17         |           |            |           |          | 8.4         | 17         | 0         |
| Coke Runoff           | 12              |            |            |          | 6.7         | 16         |           |            |           |          | 6.7         | 16         | 0         |
| Dyke 10 Runoff        | 15              |            |            |          | 15.7        | 27         |           |            |           |          | 15.7        | 27         | 0         |
| Extraction Dump       | 12              | 0.2        | 1          |          | 2.7         | 8          |           |            |           |          | 2.9         | 9          | 0         |
| R2 Basal Dump         | 12              |            |            |          | 4.0         | 6          |           |            |           |          | 4.0         | 6          | 0         |
| R2 Emergency Dump     | 12              |            |            |          | 1.5         | 3          |           |            |           |          | 1.5         | 3          | 0         |
| Recycle Water         | 14              |            |            |          | 4.8         | 15         |           | 3.8        | 20        |          | 8.6         | 35         | 0         |
| Storm Water           | 14              |            |            |          | 8.8         | 18         |           | 1.1        | 1         |          | 9.9         | 19         | 0         |
| Sulphur Runoff        | 13              |            |            |          | 1.4         |            | 13        |            |           |          | 1.4         | 0          | 13        |
| Tailings Pond         | 19              | 9.6        | 101        |          | 1.1         | 1          |           |            |           |          | 10.7        | 102        | 0         |
| Emergency Dump Pond 1 | 12              |            |            |          | 1.1         | 1          |           |            |           |          | 1.1         | 1          | 0         |
| Emergency Dump Pond 2 | 12              |            |            |          | 1.6         | 1          |           |            |           |          | 1.6         | 1          | 0         |
| Emergency Dump Pond 3 | 13              |            |            |          | 1.9         | 1          |           |            |           |          | 1.9         | 1          | 0         |
| Froth Dump            | 9               |            |            |          | 1.6         | 5          |           |            |           |          | 1.6         | 5          | 0         |
| Mine Dump             | 13              |            |            |          | 3.0         | 8          |           |            |           |          | 3.0         | 8          | 0         |
| Mine Sump             | 12              |            |            |          | 2.2         | 4          |           |            |           |          | 2.2         | 4          | 0         |
| R1 Distributor        | 13              |            |            |          | 1.3         | 3          |           |            |           |          | 1.3         | 3          | 0         |
| R1 Emergency Dump     | 15              |            |            |          | 1.9         | 4          |           |            |           |          | 1.9         | 4          | 0         |
| <b>Total</b>          |                 | <b>9.8</b> | <b>101</b> | <b>0</b> | <b>69.8</b> | <b>137</b> | <b>13</b> | <b>4.9</b> | <b>21</b> | <b>0</b> | <b>84.5</b> | <b>260</b> | <b>13</b> |

**Note:**

<sup>1</sup> Includes route-based and focused transects; for each search, either distance or area counted towards effort.



**Figure 2.4: Relationship Between Pond Size (area over water), Mortality Search Effort, and Mortality Search Results (no mortalities were found during mortality searches)**

No mortalities were found during mortality searches. However, 31 mortalities were found incidentally between April and October, mainly during hazing activities (Table 2.18). Fourteen mortalities occurred in the spring (between May 7 and 31), 13 in the fall (between August 1 and October 8), and one each on July 26 and 27 during the interval between the spring and fall monitoring periods. Mortalities consisted of 21 divers, 5 dabblers, and 5 gulls (Table 2.19, Figures 2.5 and 2.6). Mortalities were 5 to 100% oiled (average 75%); 21 were captured alive and euthanized, five could not be captured or were unrecovered, four were found dead, and one died during the capture attempt (Appendix 2.D). Most mortalities were found at the Tailings pond, in areas where floating bitumen tended to accumulate: along the west shoreline, along the boom, and in the southeast corner (Figure 2.7). One unknown diving duck (100% oiled) was found at Mine Dump pond on September 11.

#### 2.4.5 Species of Conservation Concern

Bird surveys and incidental observations at process-affected ponds included nine landed waterbird species of conservation concern: Green-winged Teal (271 landed and two mortalities), Northern Pintail (95 landed), Lesser Scaup (51 landed and one mortality), Sandhill Crane (14 landed), American White Pelican (10 landed), Horned Grebe (eight landed and one mortality), White-winged Scoter (one mortality), Pied-billed Grebe (one landed), and Sora (one landed) (Table 2.20, Appendix 2.C). Four species of conservation concern from non-target guilds also landed, none of which were oiled or mortalities: Barn Swallow (35), American Kestrel (7), Sharp-tailed Grouse (2), and Northern Harrier (1).

**Table 2.18: Number of Mortalities by Pond at Horizon in 2014**

| Pond Name                             | Mortality Search | Incidental | Total     |
|---------------------------------------|------------------|------------|-----------|
| Basal Water Storage                   | 0                | 1          | 1         |
| Coke Runoff                           | 0                | 0          | 0         |
| Dyke 10 Runoff                        | 0                | 1          | 1         |
| Extraction Dump                       | 0                | 0          | 0         |
| R2 Basal Dump                         | 0                | 0          | 0         |
| R2 Emergency Dump                     | 0                | 0          | 0         |
| Recycle Water                         | 0                | 1          | 1         |
| Storm Water                           | 0                | 0          | 0         |
| Sulphur Runoff                        | 0                | 0          | 0         |
| Tailings Pond                         | 0                | 27         | 27        |
| Emergency Dump Pond 1                 | 0                | 0          | 0         |
| Emergency Dump Pond 2                 | 0                | 0          | 0         |
| Emergency Dump Pond 3                 | 0                | 0          | 0         |
| Froth Dump                            | 0                | 0          | 0         |
| Mine Dump                             | 0                | 1          | 1         |
| Mine Sump                             | 0                | 0          | 0         |
| R1 Distributor                        | 0                | 0          | 0         |
| R1 Emergency Dump                     | 0                | 0          | 0         |
| <b>Total (Process-affected Ponds)</b> | <b>0</b>         | <b>31</b>  | <b>31</b> |
| Compensation Lake                     | N/A              | 0          | 0         |

**Notes:**

Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.  
Does not include November 2014 landing event (Appendix 2.E).

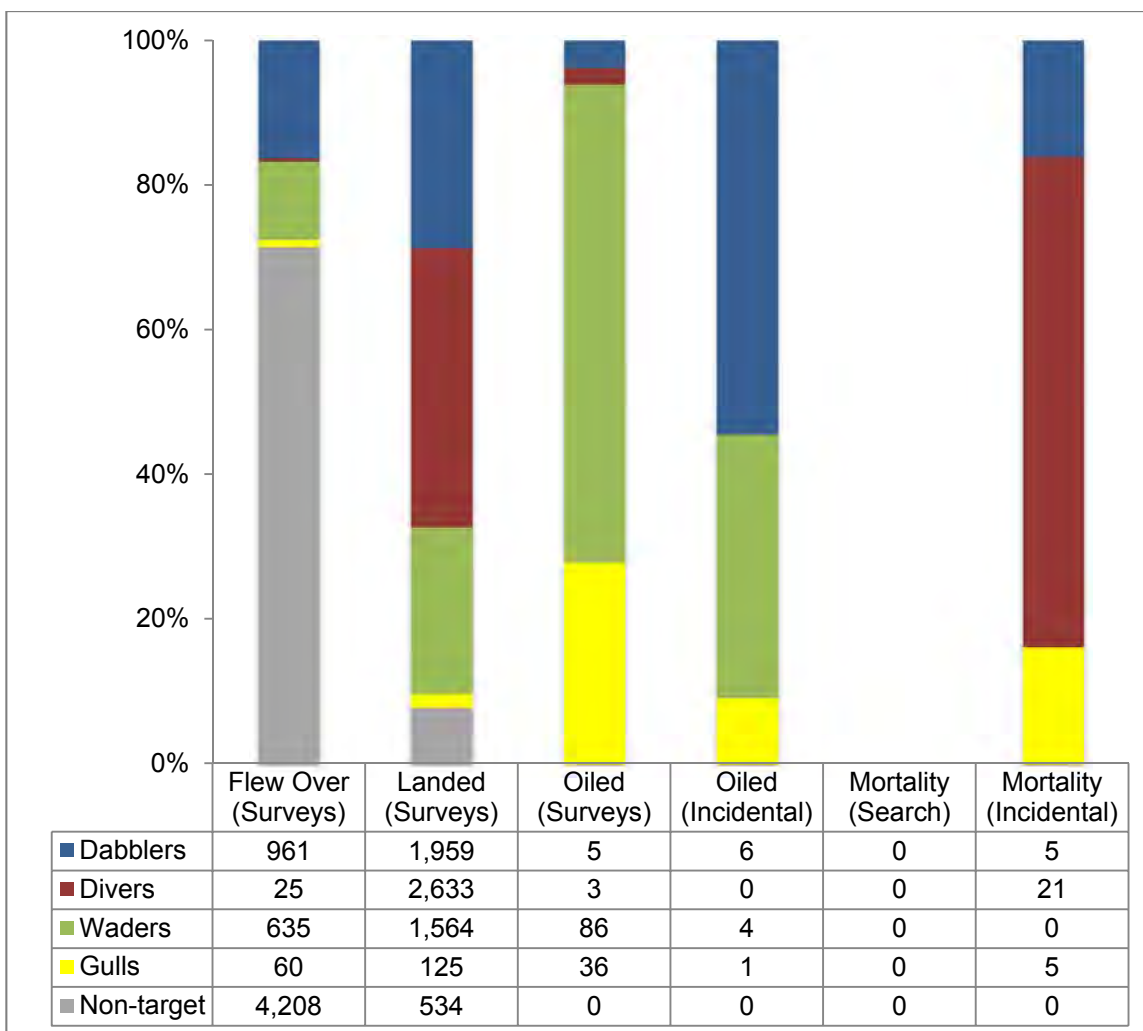
**Table 2.19: Number of Observations of Oiling and Mortalities, by Species, at Horizon in 2014**

| Species/Species Group <sup>2</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|------------------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>                  |                                |            |                  |            |
| Lesser Yellowlegs                  | 34                             | 1          |                  |            |
| Franklin's Gull                    | 23                             | 1          |                  | 5          |
| Baird's Sandpiper                  | 23                             |            |                  |            |
| Spotted Sandpiper                  | 10                             |            |                  |            |
| Semipalmated Sandpiper             | 6                              | 1          |                  |            |
| Canada Goose                       | 3                              | 2          |                  | 1          |
| Greater Yellowlegs                 | 3                              |            |                  |            |
| Semipalmated Plover                | 3                              |            |                  |            |
| Unknown Black-headed Gull          | 3                              |            |                  |            |
| Unknown White-headed Gull          | 3                              |            |                  |            |
| Unknown Calidris Sandpiper         | 2                              | 2          |                  |            |
| Herring Gull                       | 2                              |            |                  |            |
| Mallard                            | 2                              |            |                  |            |
| Sanderling                         | 2                              |            |                  |            |
| Unknown Gull                       | 2                              |            |                  |            |
| Unknown Duck                       | 1                              |            |                  | 1          |
| Ring-necked Duck                   | 1                              |            |                  | 1          |
| Unknown Scaup                      | 1                              |            |                  | 1          |
| Killdeer                           | 1                              |            |                  |            |
| Red-necked Phalarope               | 1                              |            |                  |            |
| Unknown Dowitcher                  | 1                              |            |                  |            |
| Eared Grebe                        |                                |            |                  | 7          |
| American Coot                      |                                |            |                  | 4          |
| Common Goldeneye                   |                                |            |                  | 2          |
| Green-winged Teal                  |                                |            |                  | 2          |
| Northern Shoveler                  |                                | 4          |                  | 1          |
| Horned Grebe                       |                                |            |                  | 1          |
| Lesser Scaup                       |                                |            |                  | 1          |
| Long-tailed Duck                   |                                |            |                  | 1          |
| Ruddy Duck                         |                                |            |                  | 1          |
| White-winged Scoter                |                                |            |                  | 1          |
| Unknown Diving Duck                |                                |            |                  | 1          |
| <b>Non-target Guilds</b>           |                                |            |                  |            |
| (none)                             |                                |            |                  |            |
| <b>Total</b>                       | <b>127</b>                     | <b>11</b>  | <b>0</b>         | <b>31</b>  |

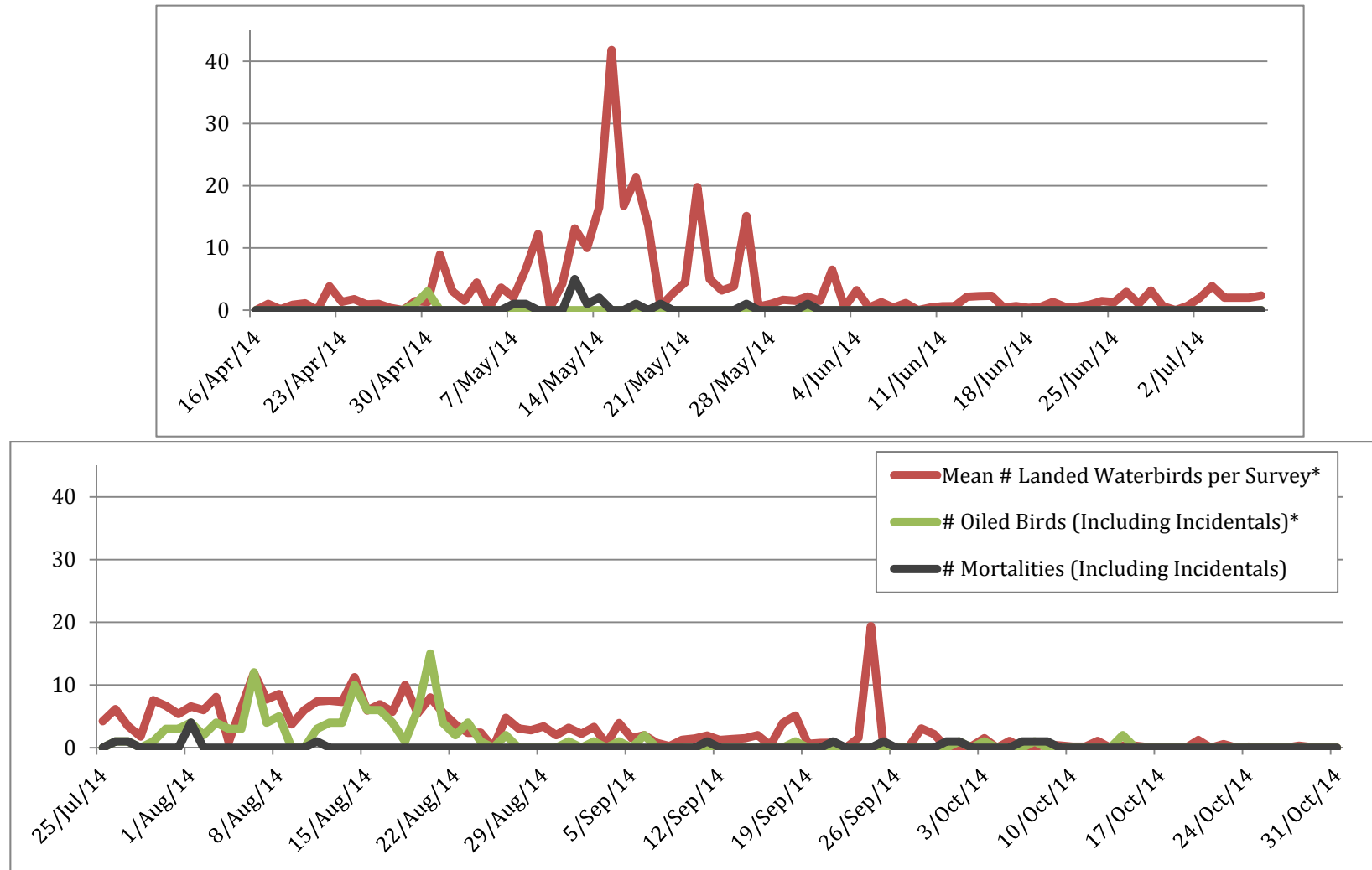
**Notes:**

<sup>1</sup> Individual birds may be observed on multiple days or also observed as mortalities, and thus be counted multiple times.

<sup>2</sup> Pink shading: Species of Conservation Concern.



**Figure 2.5: Proportion of each Guild for Birds that Flew Over or Landed at Process-affected Ponds, Contacted Bitumen, or Died at Horizon in 2014**



\* Individual birds may be observed repeatedly during consecutive days.

**Figure 2.6: Timing of Bird Landings, Oiling, and Mortalities in Spring (top) and Fall (bottom) 2014 at Horizon**

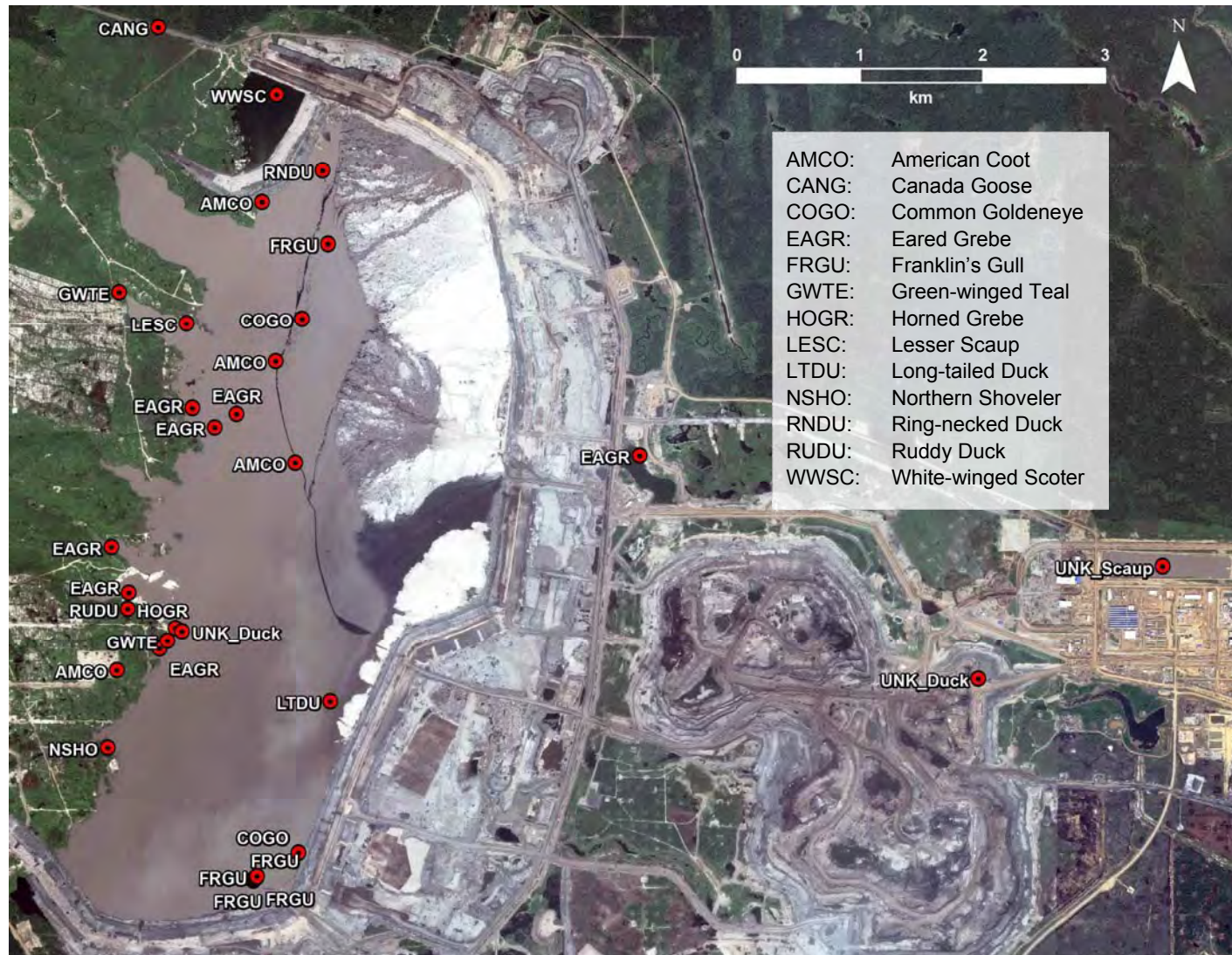


Figure 2.7: Location of 31 Pond-related Mortalities Found Incidentally at Horizon in April-October 2014

**Table 2.20: Summary of Bird Survey, Mortality and Incidental Results by Pond at Horizon in 2014**

| Pond Name                         | Pond Area<br>(over water;<br>ha) | Potential<br>Attractants <sup>1,2</sup> | % Days<br>with<br>Floating<br>Bitumen<br>Present <sup>1</sup> | Mean # Landed Waterbirds<br>per Survey |             |             |             | # Species<br>Landed |                                      | # Obser-<br>vations of<br>Oiled Birds |            | #<br>Mortalities    |            |
|-----------------------------------|----------------------------------|-----------------------------------------|---------------------------------------------------------------|----------------------------------------|-------------|-------------|-------------|---------------------|--------------------------------------|---------------------------------------|------------|---------------------|------------|
|                                   |                                  |                                         |                                                               | Dabblers                               | Divers      | Waders      | Gulls       | Total <sup>3</sup>  | Conservation<br>Concern <sup>4</sup> | Per Survey                            | Incidental | Mortality<br>Search | Incidental |
| Tailings Pond                     | 1,013.40                         | I, V, A, B, S                           | 100                                                           | 0.27                                   | 0.04        | 0.69        | 0.04        | 45                  | 7                                    | 0.106                                 | 6          | 0                   | 27         |
| Basal Water Storage               | 27.99                            | I, V, A, B, S                           | 0                                                             | 9.25                                   | 12.80       | 3.47        | 0.65        | 46                  | 5                                    | 0.196                                 | 4          | 0                   | 1          |
| Recycle Water                     | 18.22                            | A, B                                    | 57                                                            | 0.03                                   | 0.14        | 0.27        | 0.01        | 15                  | 2                                    | 0.052                                 | 0          | 0                   | 1          |
| Dyke 10 Runoff                    | 8.99                             | A, V, B, S                              | 10                                                            | 1.81                                   | 3.15        | 2.08        | 0           | 32                  | 3                                    | 0.019                                 | 0          | 0                   | 1          |
| Storm Water                       | 8.27                             | A, B                                    | 35                                                            | 0.18                                   | 0.28        | 0.67        | 0           | 24                  | 1                                    | 0.071                                 | 0          | 0                   | 0          |
| Coke Runoff                       | 2.69                             | V, B                                    | 0                                                             | 0.49                                   | 0.64        | 0.66        | 0           | 20                  | 1                                    | 0.013                                 | 0          | 0                   | 0          |
| Extraction Dump                   | 1.67                             |                                         | 72                                                            | 0                                      | 0           | 0.01        | 0           | 1                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| R2 Basal Dump                     | 1.26                             | B                                       | 0                                                             | 0                                      | 0           | 0.17        | 0.01        | 10                  | 0                                    | 0.064                                 | 0          | 0                   | 0          |
| Mine Dump                         | 1.19                             | A, B                                    | 88                                                            | 0                                      | 0           | 0.08        | 0           | 1                   | 0                                    | 0                                     | 0          | 0                   | 1          |
| Froth Dump                        | 0.95                             |                                         | 58                                                            | 0                                      | 0           | 0           | 0           | 0                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| Sulphur Runoff                    | 0.57                             | A                                       | 7                                                             | 0                                      | 0           | 0.03        | 0           | 4                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| Mine Sump                         | 0.38                             |                                         | 36                                                            | 0                                      | 0           | 0           | 0           | 0                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| R1 Emergency Dump                 | 0.17                             |                                         | 100                                                           | 0                                      | 0           | 0           | 0           | 0                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| Emergency Dump Pond 2             | 0.13                             |                                         | 100                                                           | 0                                      | 0           | 0           | 0           | 0                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| R2 Emergency Dump                 | 0.12                             |                                         | 14                                                            | 0                                      | 0           | 0.23        | 0           | 13                  | 2                                    | 0.013                                 | 0          | 0                   | 0          |
| Emergency Dump Pond 1             | 0.12                             |                                         | 92                                                            | 0                                      | 0           | 0           | 0           | 0                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| R1 Distributor                    | 0.10                             |                                         | 8                                                             | 0                                      | 0           | 0           | 0           | 0                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| Emergency Dump Pond 3             | 0.10                             |                                         | 96                                                            | 0                                      | 0           | 0           | 0           | 0                   | 0                                    | 0                                     | 0          | 0                   | 0          |
| <b>All Process-affected Ponds</b> |                                  |                                         |                                                               | <b>0.67</b>                            | <b>0.95</b> | <b>0.46</b> | <b>0.04</b> | <b>76</b>           | <b>10</b>                            | <b>0.030</b>                          | <b>11</b>  | <b>0</b>            | <b>31</b>  |
| Compensation Lake                 | 77.48                            | I, V, A, B, S                           | 0                                                             | 5.12                                   | 11.06       | 0.63        | 1.88        | 39                  | 6                                    | 0.058                                 | 0          | N/A                 | 0          |

- Notes:**  
 Grey shading: pond of lower monitoring priority; Blue shading: freshwater lake.  
<sup>1</sup> Observed on site in April-Oct.  
<sup>2</sup> I: islands; V: emergent or shoreline vegetation; A: vegetated area adjacent to the pond; B: mudflat or gradual sandy or pebbly beach, S: sinuous shoreline.  
<sup>3</sup> During bird surveys.  
<sup>4</sup> Includes incidental observations.

## **2.5 Discussion**

### **2.5.1 Bird Contacts**

Of the 6,411 observations of waterbirds landed at process-affected ponds at the Horizon Oil Sands site in 2014, 41% were divers, 31% dabblers, 24% waders, 2% gulls, and 2% unknown duck species (which could be divers or dabblers). While the survey effort and total number of observations was very similar in 2013, the species composition has shifted. In 2013, 22% of landed waterbirds were divers, 24% dabblers, 47% waders, 5% gulls, and <1% unknown duck species.

Survey effort (frequency, timing and surface area) in 2013 was comparable to 2014. Excluding gulls (because they were not categorized as waterbirds in 2013), the mean number of landed waterbirds per survey at process-affected ponds was similar in 2013 and 2014 (2.5 compared to 2.1), whereas at Compensation Lake the mean increased from 11.6 to 17.0 birds per survey.

The mean number of landed waterbirds at Basal Water Storage pond increased substantially, from 14.1 to 26.1, especially for dabblers and divers. Basal Water Storage pond continues to have the highest number of landed birds per survey across all ponds at Horizon. There is no risk of oiling at this pond, as it does not contain bitumen. The relatively high numbers are due to a combination of habitat attractants, including deep water for diving birds, emergent vegetation and shallow areas for dabblers, and some mudflat areas for waders. Another factor contributing to the high numbers of bird landings is that hazing was not conducted at Basal Water Storage pond, because hazed birds would potentially move to the nearby Tailings pond where floating bitumen may occur, and the potential presence of hydrogen sulfide compromises the safety of personnel.

The mean number of landed birds also increased at Dyke 10 Runoff pond, from 2.5 in 2013 to 7.2 in 2014, for every guild and in particular divers. Similarly to 2013, most observations of waterfowl broods in 2014 occurred at Dyke 10 Runoff pond. The removal of vegetation in September 2014 and proposed control of regrowth for 2015 is expected to decrease the attractiveness of the Dyke 10 Runoff pond to waterfowl.

At the Tailings pond, the mean number of landed birds decreased from 4.5 in 2013 to 1.0 birds per survey in 2014. It is important to note that the mean number of landed birds at the Tailings pond varied across stations in both years. The mean at PMP2, on the east side of the Tailings pond, increased from 0.1 in 2013 to 1.2 in 2014 due to an increase in the number of waders. Although the AHD-laser unit was still in place near that station, the amount of operational activities in the area decreased during the season, likely increasing the attractiveness of the beach area to shorebirds. At the northwest station (PMP1), the mean number of landed birds decreased from 11.4 birds per survey in 2013 to 0.5 in spring 2014, and then to 0.3 in fall 2014 at the replacement station (PMP5). The mean number of landed birds also decreased at the southwest station (PMP4), from 6.0 to 2.6. The southeast station, PMP3, and its replacement since October 2014, PMP6, remained the stations with the fewest birds at the Tailings pond (0.1 at PMP3 in 2013 and 2014 and 0 at PMP6), although mortalities were found in this area.

As in 2013, gulls were the least common of the water-associated guilds; they were more often observed at the Compensation Lake station, followed by Basal Water Storage pond. Compensation Lake also attracts diving birds, but provides minimal habitat for shorebirds.

The Tailings pond had the highest number of species of conservation concern: seven species, compared to five species at Basal Water Storage pond and three species at Dyke 10 Runoff pond, and also had the most mortalities (four species compared to one at Basal water Storage pond), but numbers of landed birds of conservation concern were highest at Basal Water Storage pond (1.61 birds of conservation concern per survey), followed by Dyke 10 Runoff pond (0.53), Coke Runoff pond (0.10), Tailings pond (0.09), and Recycle Water pond (0.02). Green-winged Teal (listed as Sensitive in Alberta) were widespread, with broods observed at Dyke 10 Runoff, Basal Water Storage, and the Tailings ponds. Northern Pintail (Sensitive) occurred most often at Basal Water Storage pond, and Lesser Scaup (Sensitive) at Dyke 10 Runoff pond. Six species of conservation concern were observed at Compensation Lake, but this cumulative total should not be compared to process-affected ponds, which were surveyed three times more often, increasing the likelihood of detecting species.

Breeding habitat potentially occurred at or near ponds where broods were observed during bird surveys: Dyke 10 Runoff, Storm Water, Basal Water Storage, and the Tailings ponds for waterfowl (Mallard, Ring-necked Duck, Green-winged Teal, American Widgeon, Canada Goose, Canvasback), and Coke Runoff for shorebirds (Spotted Sandpiper). Ponds at Horizon were searched between the spring and fall monitoring periods. Young were then observed at the Tailings pond (Northern Shoveler, Mallard), Coke Runoff pond (Common Goldeneye), Dyke 10 Runoff pond (Mallard), and Basal Water Storage pond (Mallard). The presence of family groups suggests that some birds resided on site during the summer and were likely recorded during multiple surveys, especially between June and August. Summer resident birds within the survey areas may be counted during multiple surveys. Thus, the numbers of bird observations reported may be elevated due to multiple counts of the same birds (Appendix 2.F). Vegetation control on the west side of the Tailing pond and at Dyke 10 Runoff pond should contribute to minimize resident birds and family groups in those areas in 2015.

### **2.5.2 Mortalities and Oiling**

Mortality and oiling of birds in 2014 were generally consistent with those reported annually since the initiation of the program in 2011, with the Tailings pond representing the most problematic area for waterbirds due to its large size, presence of habitat attractants, and occurrence of floating bitumen. Twenty-five and 31 pond-related mortalities were found incidentally in 2013 and 2014, respectively. During formal searches, one mortality was found in 2013, and none in 2014. During standardized bird surveys in 2013 and 2014, respectively 3% and 2% of observations of landed waterbirds had contacted bitumen.

No mortalities were found at any of the process-affected ponds during 85 h of standardized searching over a distance of 260 km, mostly by foot and by boat. The number of incidental mortalities found likely resulted from the consistent presence of deterrent maintenance crews on ponds and particularly the presence of hazing personnel in boats. Most mortalities (27 of 31) were found at the Tailings pond in areas where floating bitumen and, in many cases, habitat

attractants were present. The locations on the Tailings pond where mortalities occurred potentially represent areas where birds encountered bitumen or where oiled waterfowl attempted to take refuge, rather than areas where dead birds drifted, as most birds were found alive and severely oiled, limiting their mobility. Most (68%) of mortalities were diving birds, which was also the guild most commonly observed as landed during bird surveys. Although gulls represented only 2% of landed waterbirds during surveys, they represented 16% of mortalities.

As in 2013, oiled birds observed most frequently during bird surveys were shorebirds (86 observations) and gulls (36 observations) and most had small patches of bitumen on their underside. Gulls were disproportionately likely to be observed oiled, with 29% of landed gulls identified as oiled, compared to 5% of landed shorebirds. During a survey at the Tailings pond (PMP3) on August 1, four Franklin's Gulls were seen landing on a floating mat of bitumen and became 85 to 95% oiled, indicating that these birds were unable to identify the floating bitumen as hazardous. The birds were immediately reported and the same day, two were captured and euthanized and two had already died. The number of oiled birds observed during surveys appeared to be correlated with the total number of birds observed rather than the proximity of floating bitumen. Many of the observations of oiled birds occurred at ponds without floating bitumen, as most were able to fly. The ability to identify bitumen on lightly oiled birds may be station-dependent, depending on the proximity of the observers to the birds and opportunities to view the birds' underside, for example when birds were on shores or islands, or preening.

### **2.5.3 Monitoring Protocol**

At seven of the eight ponds of lower monitoring priority, no landed waterbirds, oiled birds or mortalities were observed, even though the presence of workers near the ponds increased the likelihood of birds being found and reported. The eighth pond, Mine Dump, is the largest of these low priority ponds, and a small beach on the south side and grassy vegetation on the north and east sides could potentially act as attractants. Two Greater Yellowlegs were observed during a survey on September 8. Removal of the small beach area would likely prevent future landings of shorebirds. In addition, a 100% oiled unknown diving duck was found incidentally on September 11. The bird was likely injured or disoriented before landing, as the area within which this pond is located has high human activity and is unlikely to normally attract waterfowl. The bird was noticed by a worker in the area and reported to capture personnel.

Survey effort was consistent across survey stations, except at PMP4 where 33 surveys (21% of scheduled surveys at that station) were missed due to unusable roads. Access to the west side of the Tailings pond by truck is limited due to the primitive roads degrading with precipitation and runoff. Establishing an alternative survey location along the west side of the pond was therefore not possible, as no alternative access was available. Survey areas covered the entire process-affected pond surfaces over water, except at Basal Water Storage pond (92%), Recycle Water pond (90%) and the Tailings pond (10%), where ponds were too large to be entirely encompassed within the 500-m radius of the survey area. The survey area at Basal Water Storage pond may slightly underestimate numbers of birds, as all of the excluded area is along the sinuous vegetated shoreline on the west side. However, given that only 8% of the area is excluded, the bias is not expected to be substantial. The survey area at Recycle Water pond is likely representative of the entire pond, or could slightly overestimate bird numbers since the

excluded area, near the effluent and boom, is visible to observers and birds were rarely or never seen there. The location of the survey station is appropriate, as moving the station westward would exclude a small portion on the east side of the pond from the survey area. Few birds were observed at Recycle Water pond (0.4 landed waterbirds per survey), and numbers would likely be almost identical if the entire pond was included within the survey area. The survey areas at the Tailings pond have the greatest potential for having low representativeness. For example, survey areas underrepresent the open water in the center of the pond. The total survey area (all regular stations combined) includes 17% of the total pond vegetated shoreline (15% of the total pond shoreline), and 8% of the total pond beach area, and there is no certainty that these areas are representative of similar habitats outside of the survey areas. In addition, the pond is large and each section likely has a different set of factors influencing bird numbers. These factors may change from day to day, for example heavy machinery operating at the east side of the pond may dictate where shorebird activity occurs at different periods of the season. Survey areas may not capture these influences. Representativeness of the survey area at Compensation Lake (which covers 26% of the pond) is difficult to assess without better knowledge of the entire lake; different areas of the lake could provide habitat for different species or attract birds in different numbers.

Results from the IOV study indicated that systematic error could occur during data collection due to differences between observers. Comparison surveys should be used as training sessions at the beginning of monitoring periods to identify and minimize sources of systematic error.

The implementation of one flexible day per week, the “Comparison Day”, was greatly beneficial to conducting the program at Horizon. It enables personnel to conduct bird surveys at stations that were missed during the previous week if any, data verification, additional orientation and training as necessary, maintenance of vehicles and material, communication, coordination, administrative tasks, and comparison surveys for the IOV study.

## 2.6 Documents Cited

DeTect (2014) MERLIN *Detect and Deter*<sup>TM</sup>, Horizon Oil Sands Project, Data Report for 2013. Prepared for Canadian Natural Resources Limited. DeTect Inc., Panama City, Florida, USA. February 2013, 44 pp. [Confidential report made available by Canadian Natural Resources Limited for use in this project only].

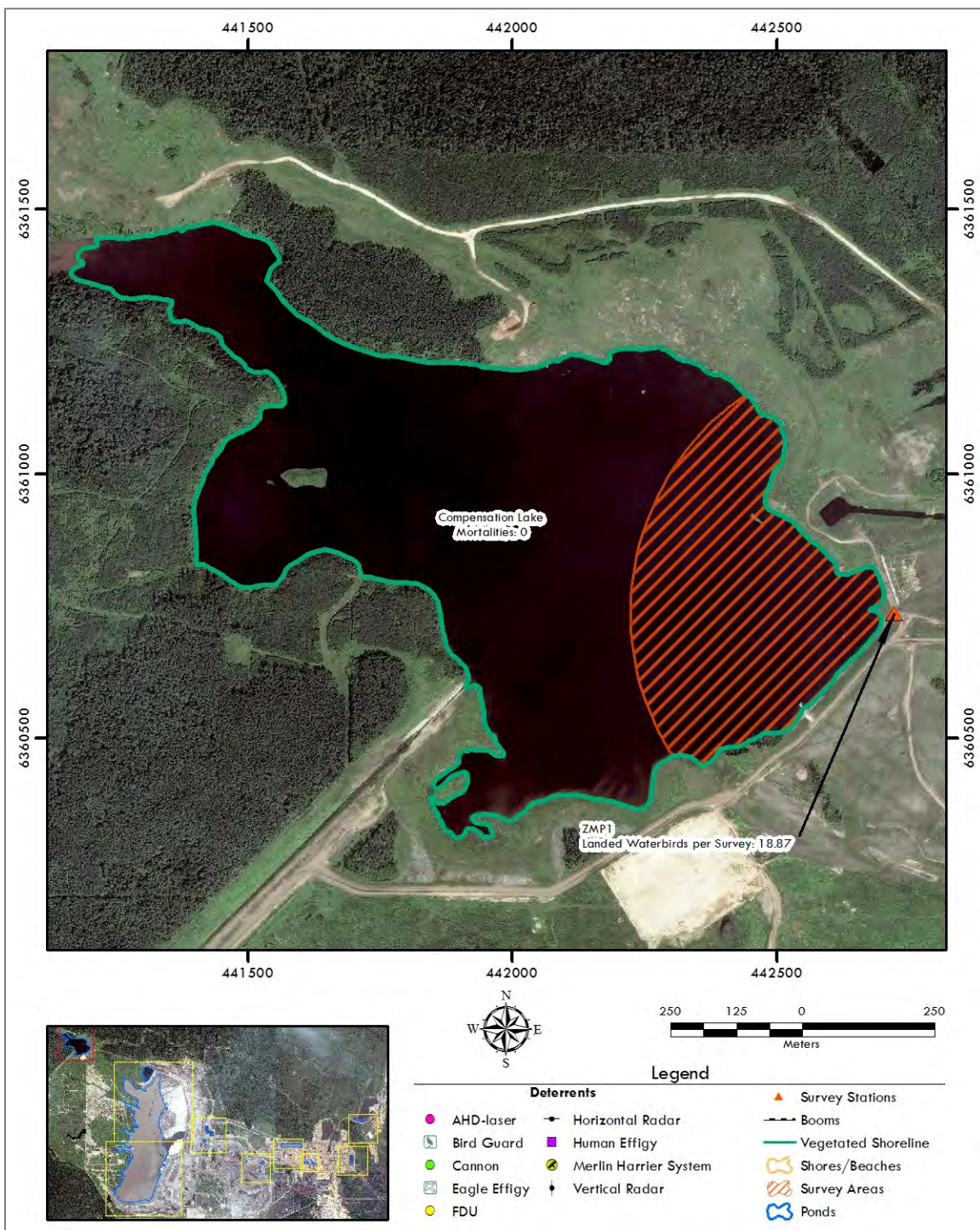
Marsh R.E., Erickson W.A., Salmon T.P. (1991) Bird hazing and frightening methods and techniques (with emphasis on containment ponds). Other Publications in Wildlife Management. Paper 51.

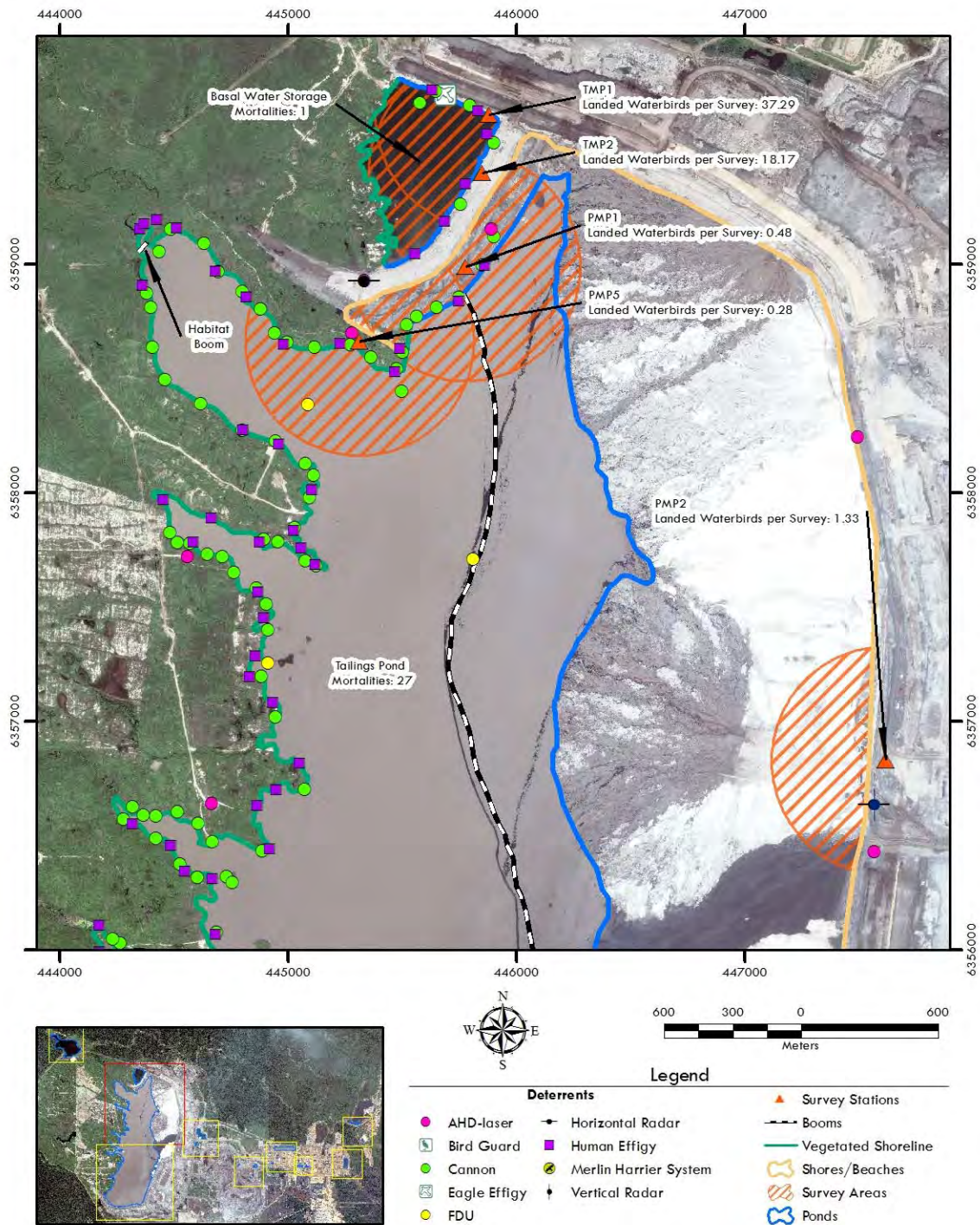
St. Clair C.C., Loots S., Ronconi R.A. (2014) 2014 Protocol – Oil Sands Bird Contact Monitoring Program. Department of Biological Sciences, University of Alberta. Prepared for Oil Sands Operators and Alberta Environment and Sustainable Resource Development. April 2014, 50 pp.

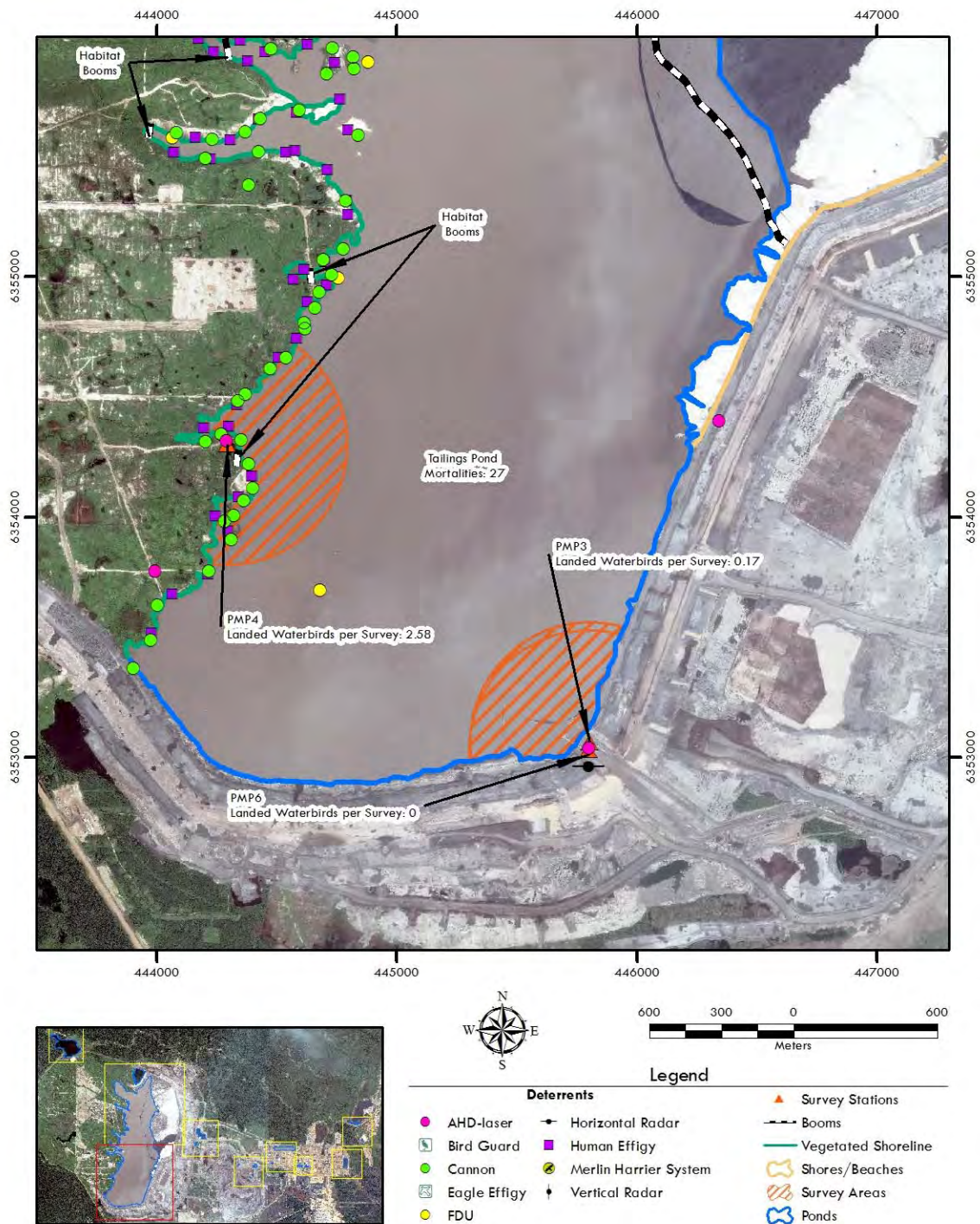
## **2.7 Appendices 2.A to 2.F**

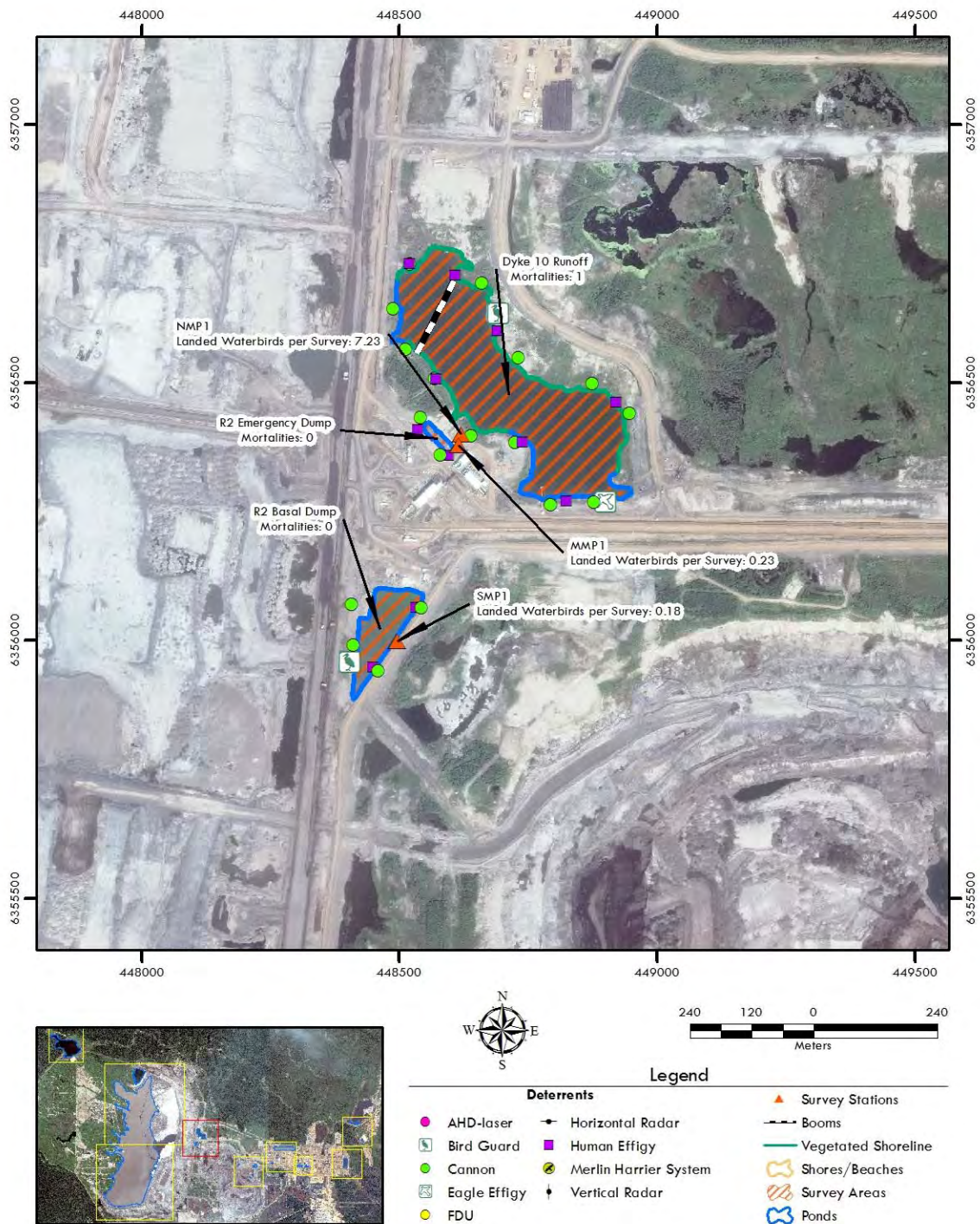
## Appendix 2.A: Location of Deterrents, Booms, Survey Stations, and Survey Areas at Horizon Ponds in 2014

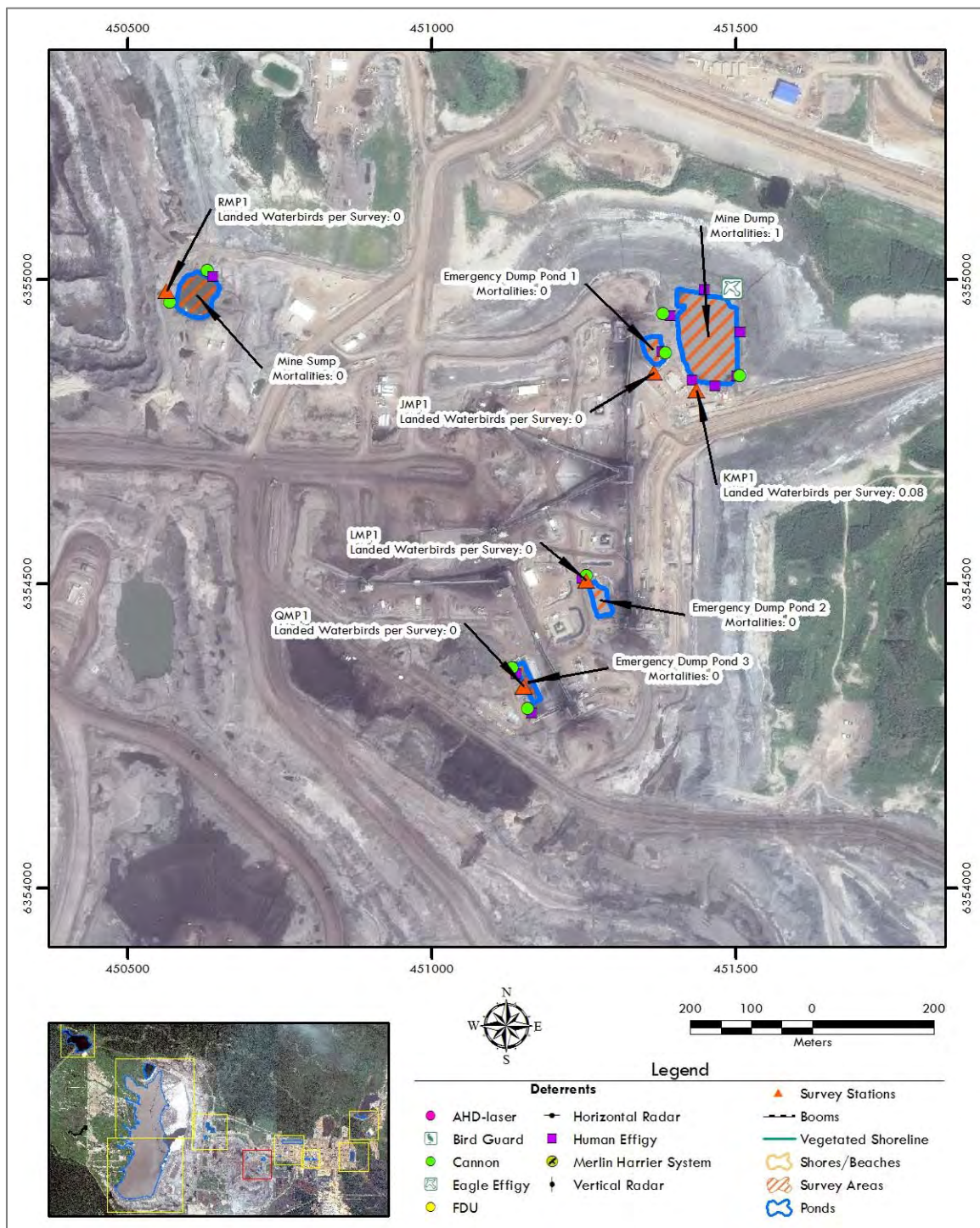
Note: Pond labels show the number of mortalities (all found incidentally) during April-October 2014. The survey station labels show the mean number of landed waterbirds per survey.

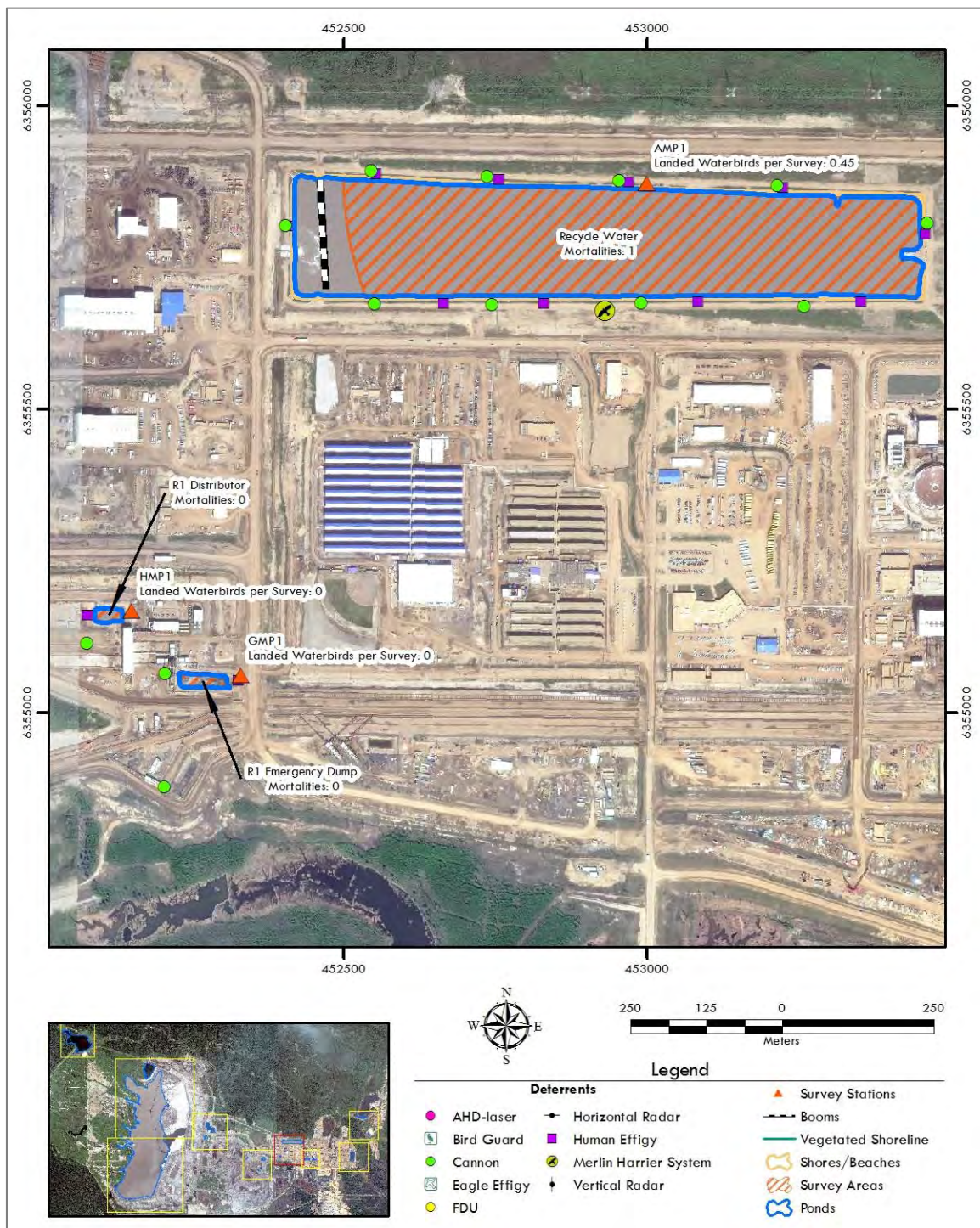


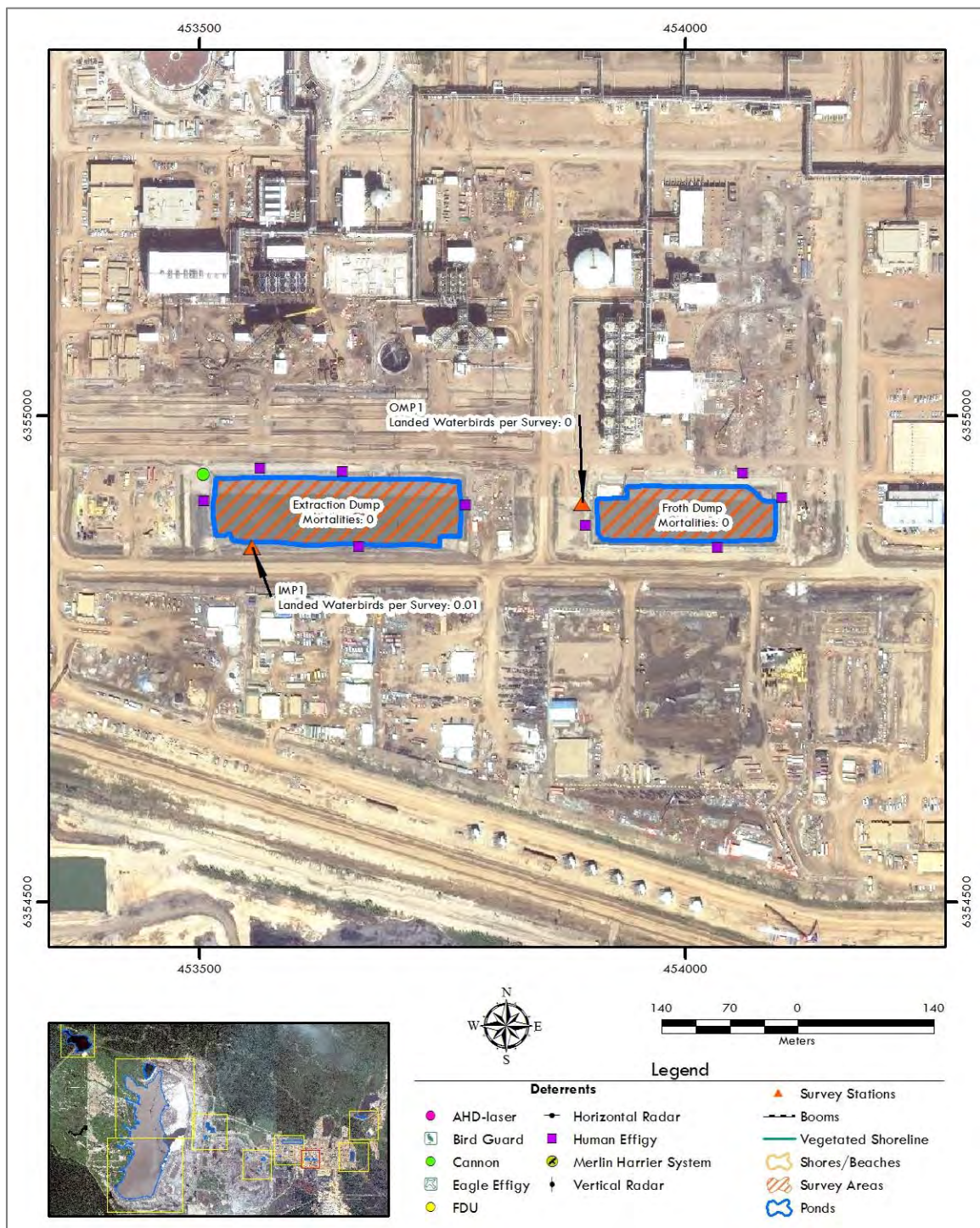


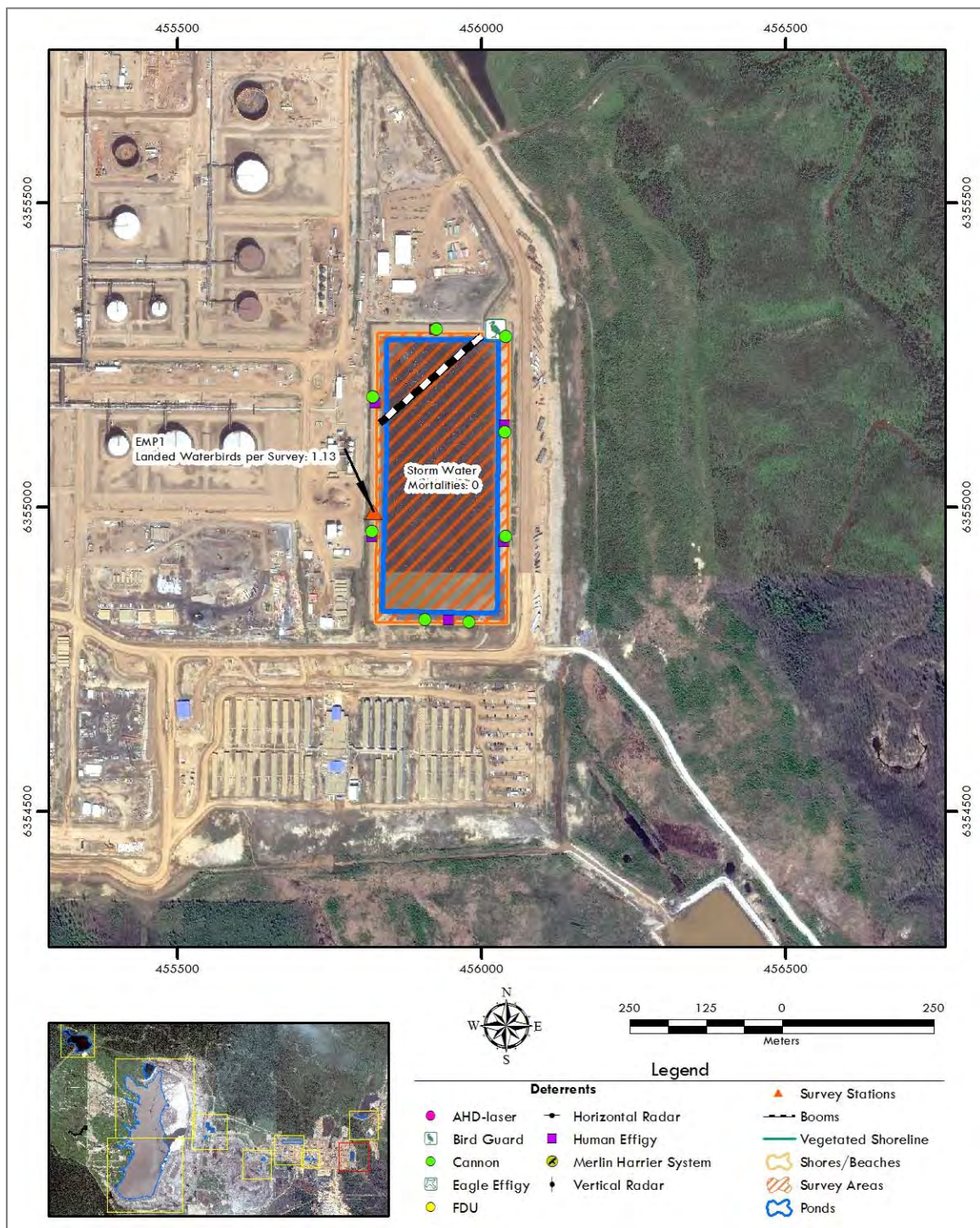


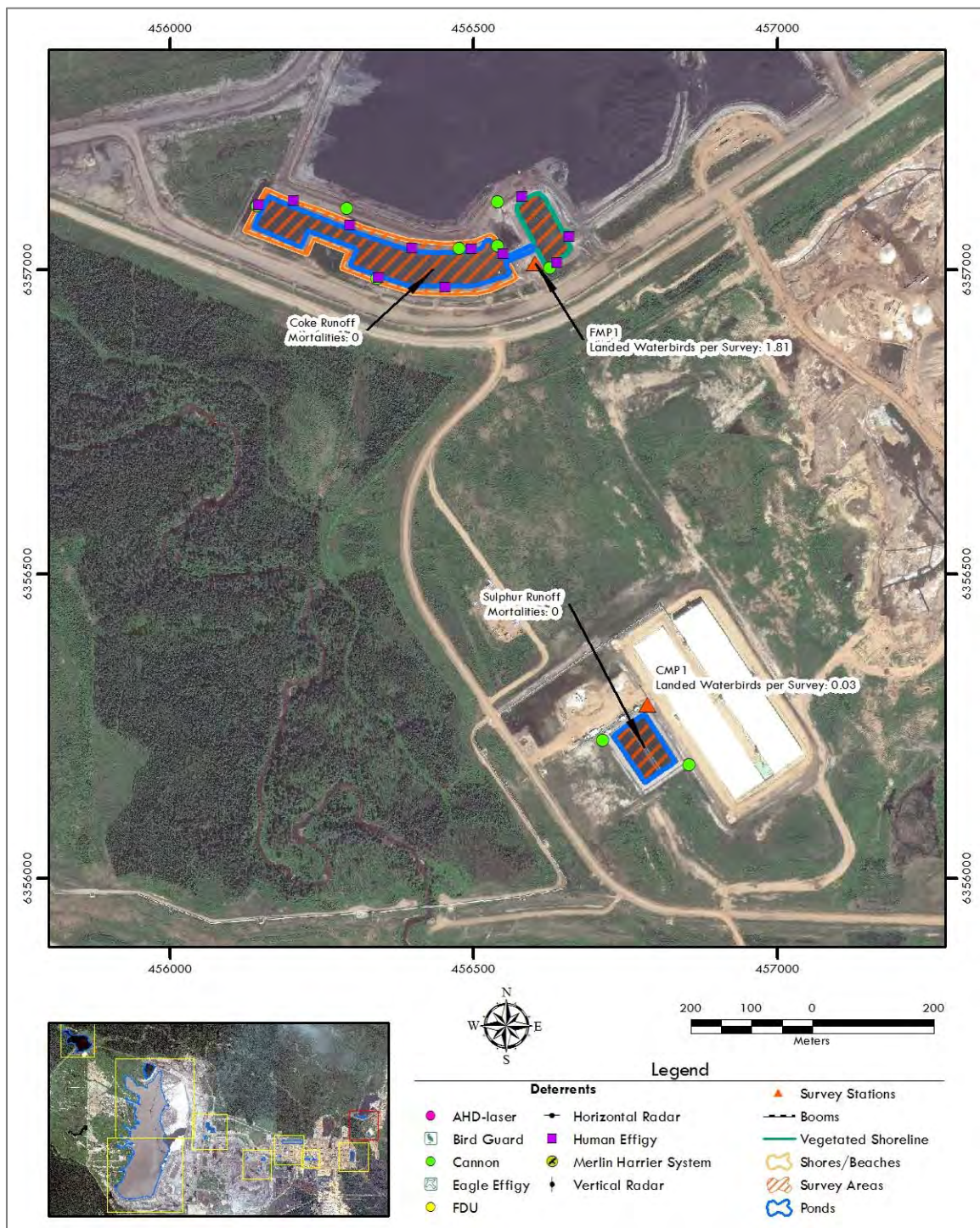






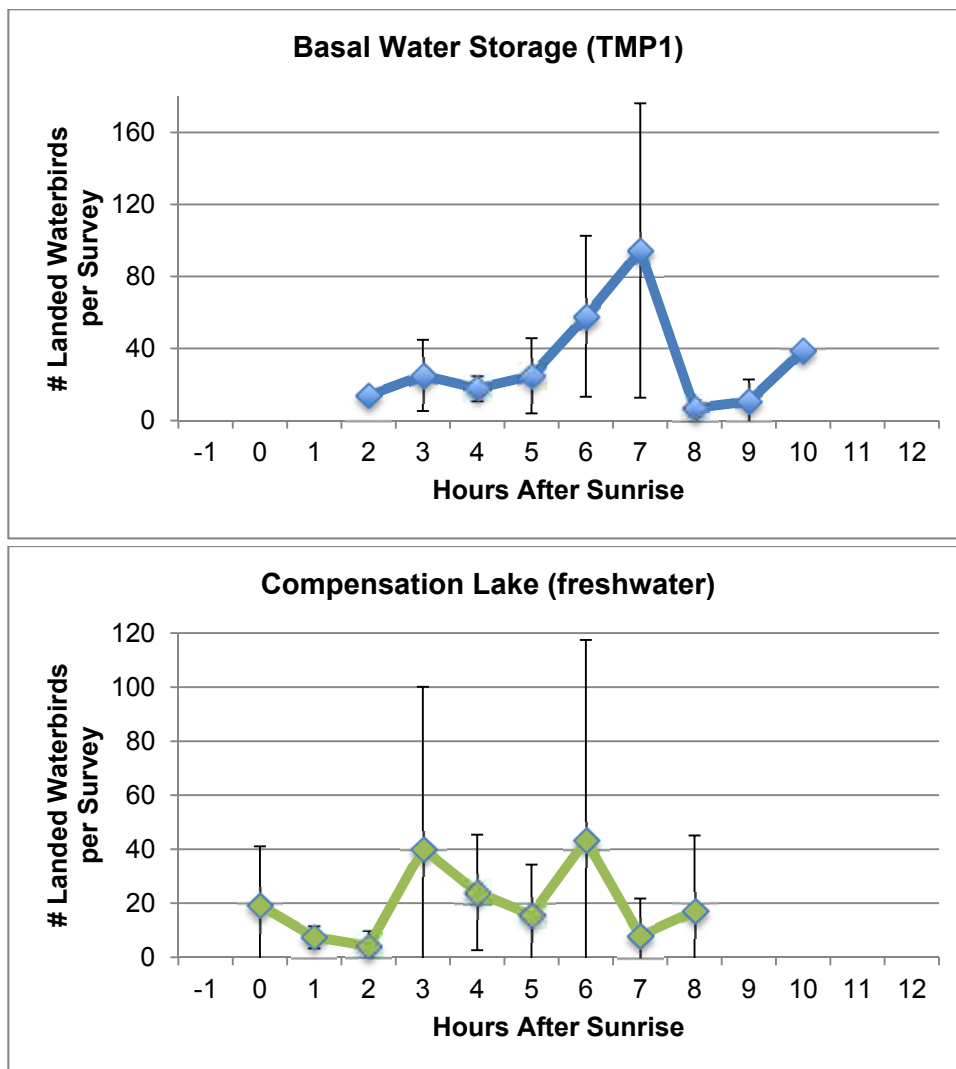


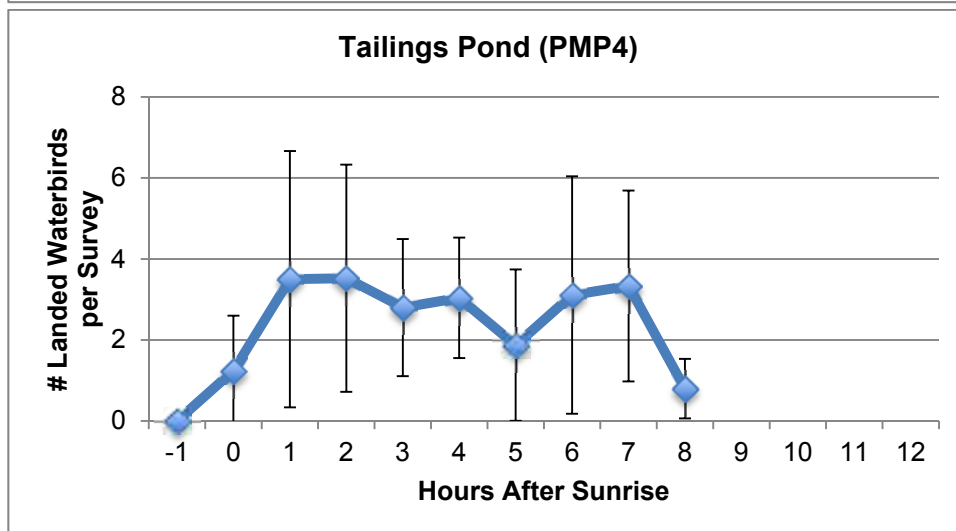
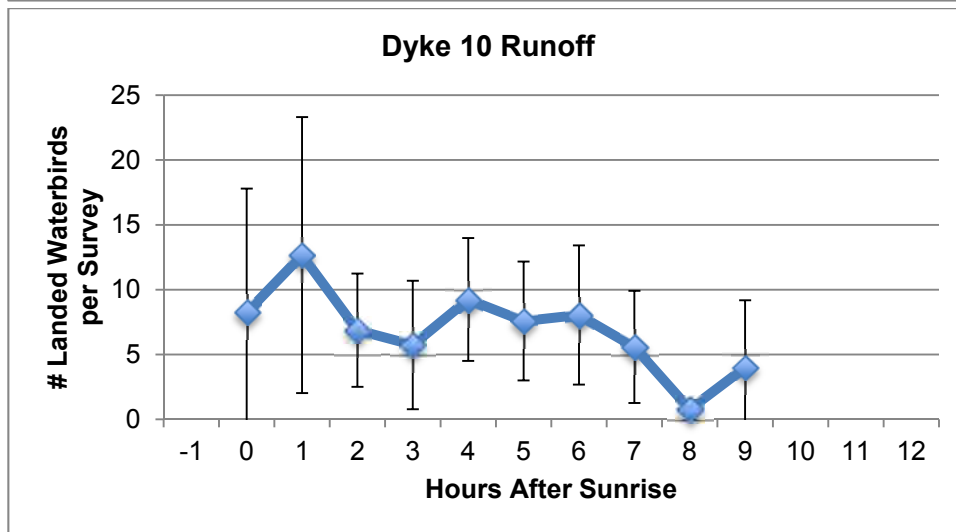
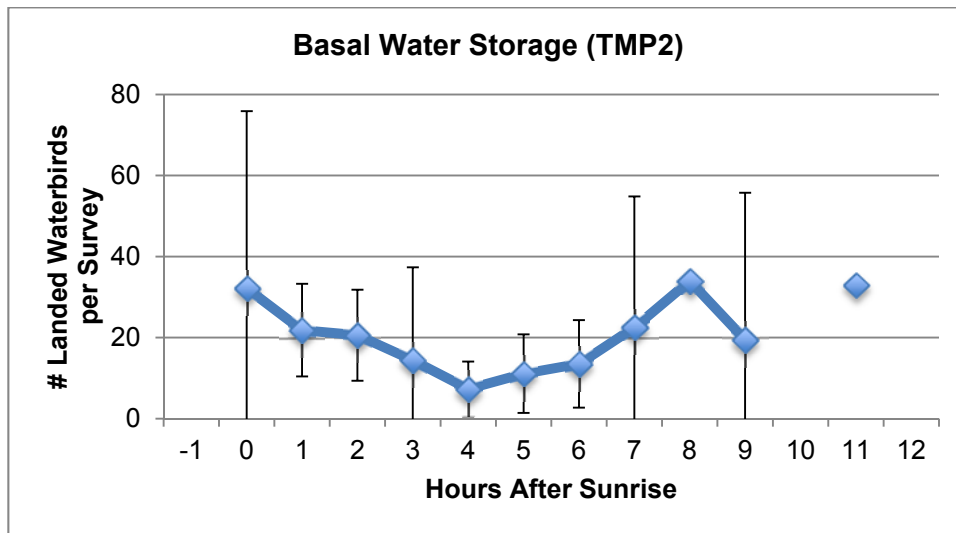


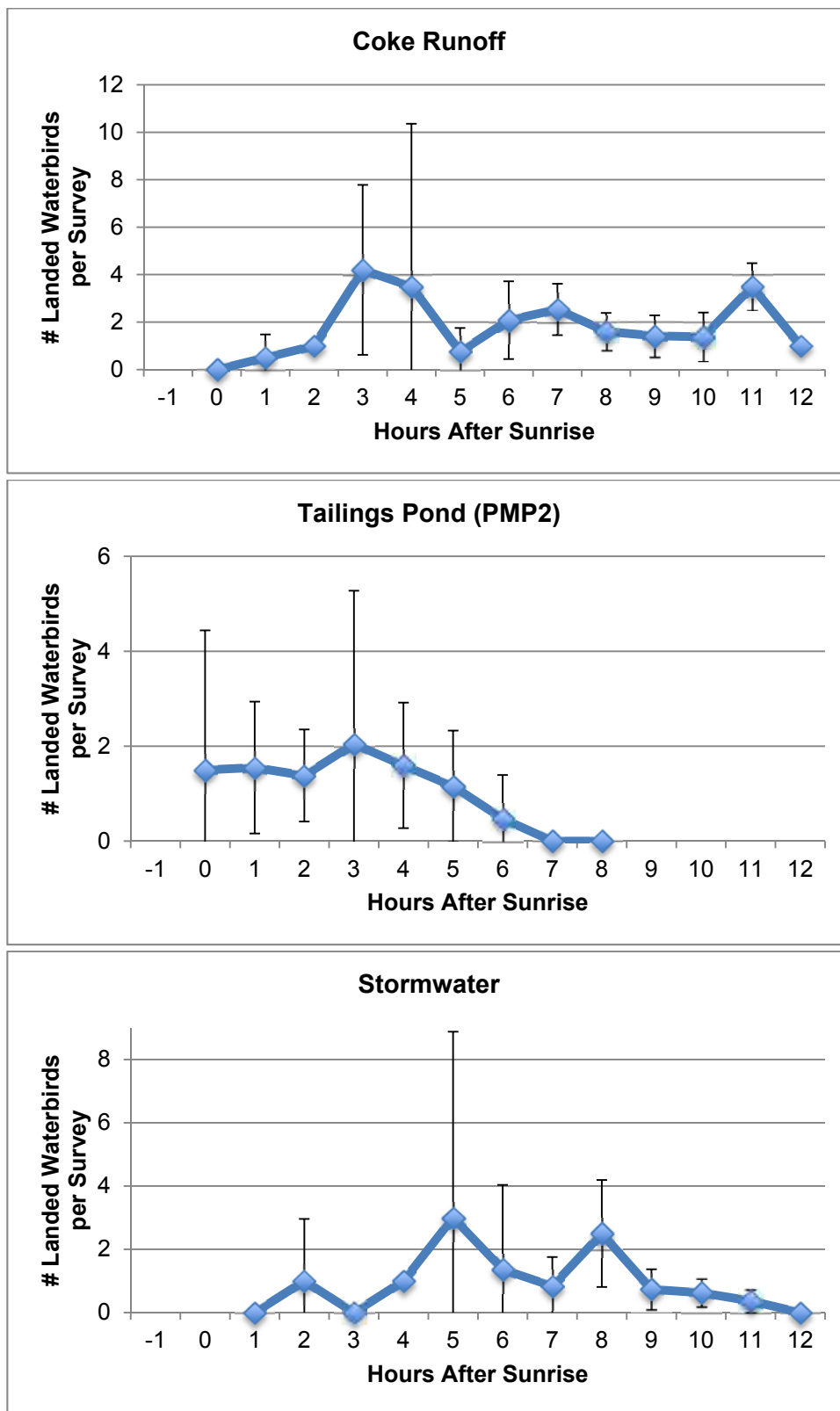


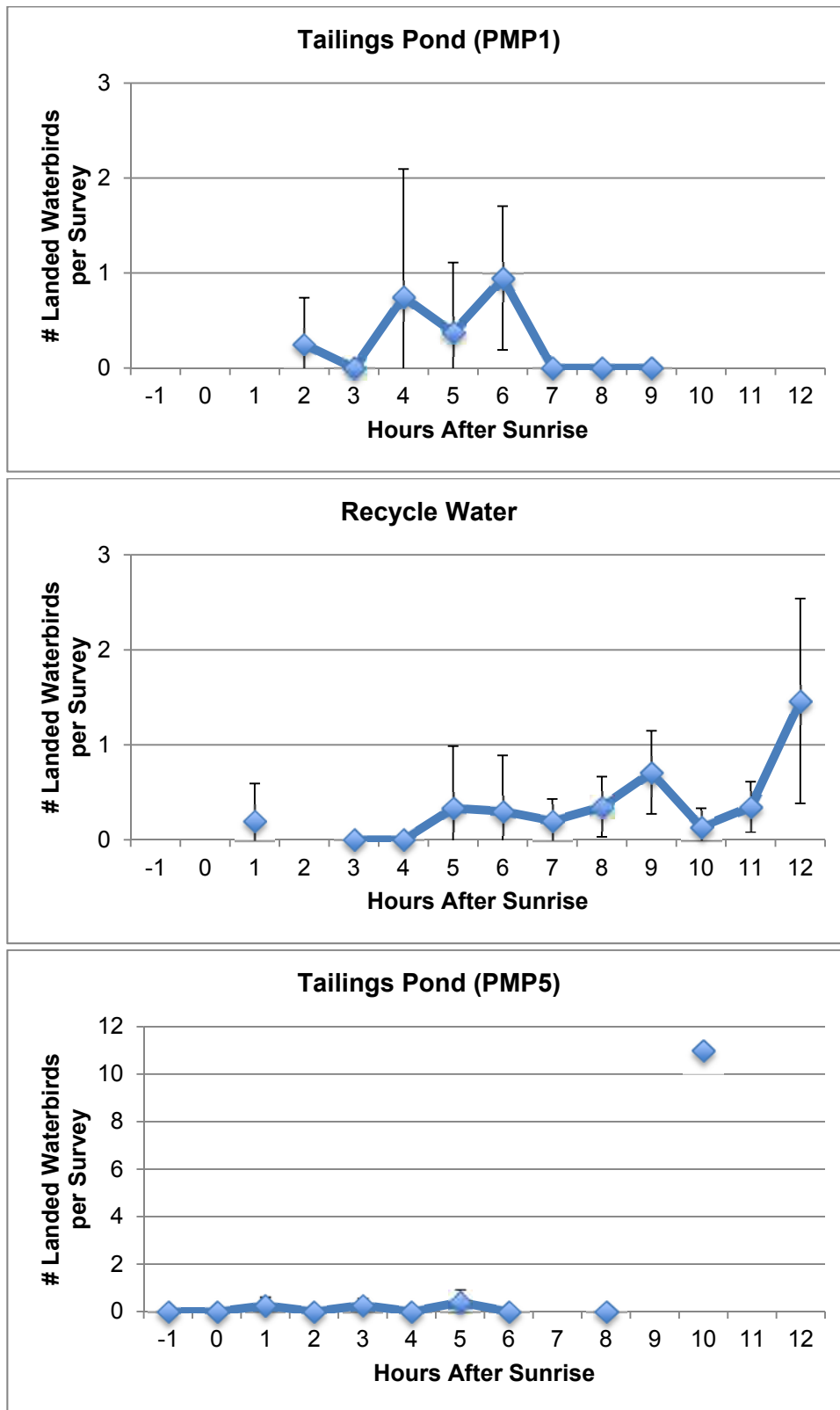
## Appendix 2.B: Relationship Between the Mean Number of Landed Waterbirds per Survey and Hour after Sunrise at Horizon in 2014

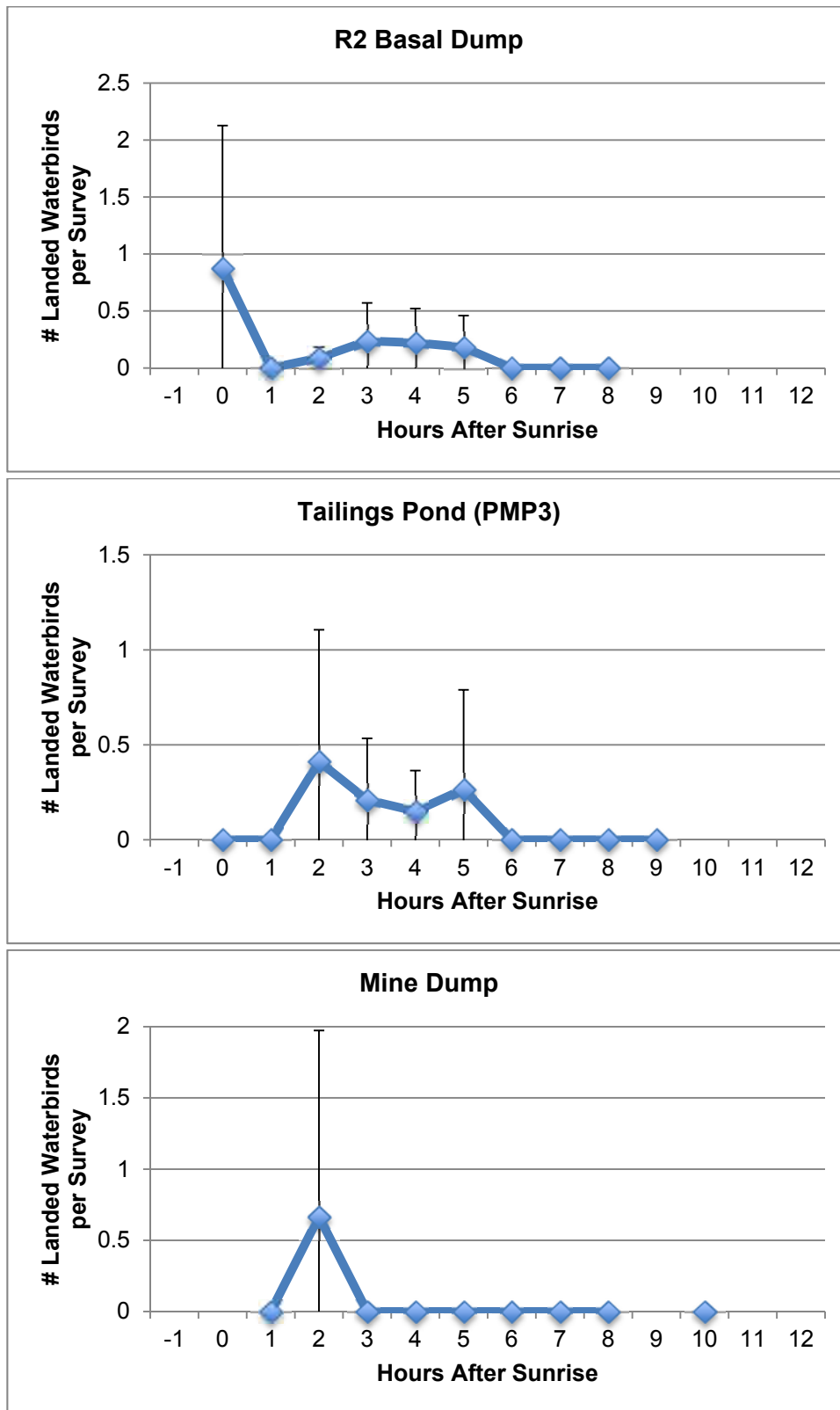
Note: No landed waterbirds were observed during surveys at 7 of the 18 process-affected ponds (Emergency Dump 1, Emergency Dump 2, Emergency Dump 3, Froth Dump, Mine Sump, R1 Distributor, and R1 Emergency Dump), and at one of the Tailings pond's alternative survey station (PMP6). Stations are presented in descending order of landed waterbird abundance. Bars = 95% Confidence Interval.

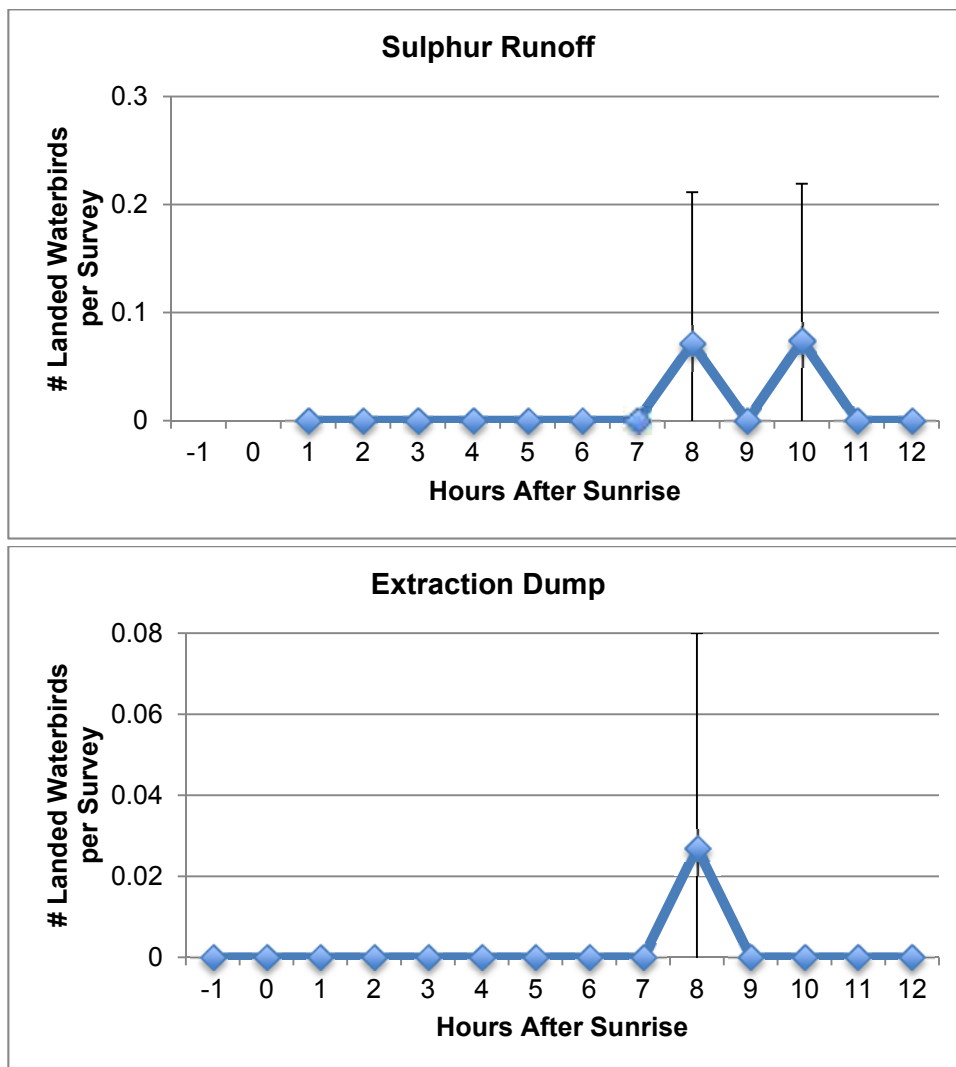












### Appendix 2.C: Number of Bird Observations by Species at Horizon Process-affected Ponds in 2014

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>WATERBIRDS</b>                  |                     |                         |                        |                                |            |                  |            |
| Mallard                            | 826                 |                         | 379                    | 2                              |            |                  |            |
| Greater Scaup                      | 676                 |                         | 1                      |                                |            |                  |            |
| Eared Grebe                        | 425                 |                         |                        |                                |            |                  | 7          |
| Ring-necked Duck                   | 386                 |                         | 6                      | 1                              |            |                  | 1          |
| Unknown Scaup                      | 358                 |                         | 6                      | 1                              |            |                  | 1          |
| Canada Goose                       | 304                 |                         | 388                    | 3                              | 2          |                  | 1          |
| Red-necked Phalarope               | 301                 |                         |                        | 1                              |            |                  |            |
| Lesser Yellowlegs                  | 291                 |                         | 26                     | 34                             | 1          |                  |            |
| Common Goldeneye                   | 281                 |                         | 6                      |                                |            |                  | 2          |
| Northern Shoveler                  | 244                 |                         | 54                     |                                | 4          |                  | 1          |
| Green-winged Teal                  | 236                 | 35                      | 71                     |                                |            |                  | 2          |
| Spotted Sandpiper                  | 217                 |                         | 8                      | 10                             |            |                  |            |
| Canvasback                         | 178                 |                         | 4                      |                                |            |                  |            |
| Baird's Sandpiper                  | 157                 |                         |                        | 23                             |            |                  |            |
| Unknown Duck                       | 131                 |                         | 288                    | 1                              |            |                  | 2          |
| Unknown Dabbling Duck              | 127                 |                         | 23                     |                                |            |                  |            |
| American Wigeon                    | 111                 |                         | 7                      |                                |            |                  |            |
| Killdeer                           | 96                  |                         | 24                     | 1                              |            |                  |            |
| Semipalmated Sandpiper             | 93                  |                         |                        | 6                              | 1          |                  |            |
| Northern Pintail                   | 91                  | 4                       | 25                     |                                |            |                  |            |
| Unknown Calidris Sandpiper         | 85                  |                         | 261                    | 2                              | 2          |                  |            |
| Unknown Shorebird                  | 85                  |                         | 183                    |                                |            |                  |            |
| Unknown Yellowlegs                 | 54                  |                         | 25                     |                                |            |                  |            |
| Wilson's Phalarope                 | 52                  |                         |                        |                                |            |                  |            |
| Lesser Scaup                       | 51                  |                         |                        |                                |            |                  | 1          |
| Ruddy Duck                         | 50                  |                         |                        |                                |            |                  | 1          |
| Bufflehead                         | 43                  |                         |                        |                                |            |                  |            |
| Franklin's Gull                    | 39                  |                         | 5                      | 23                             | 1          |                  | 5          |
| Unknown Diving Duck                | 39                  |                         |                        |                                |            |                  |            |
| Herring Gull                       | 37                  |                         | 10                     | 2                              |            |                  |            |
| Greater Yellowlegs                 | 32                  |                         |                        | 3                              |            |                  |            |
| Surf Scoter                        | 30                  |                         |                        |                                |            |                  |            |
| Redhead                            | 26                  |                         |                        |                                |            |                  |            |
| Unknown Sandpiper                  | 24                  |                         | 15                     |                                |            |                  |            |
| American Avocet                    | 17                  |                         |                        |                                |            |                  |            |
| Least Sandpiper                    | 17                  |                         |                        |                                |            |                  |            |
| Bonaparte's Gull                   | 16                  |                         |                        |                                |            |                  |            |
| Red-necked Grebe                   | 15                  |                         |                        |                                |            |                  |            |
| Blue-winged Teal                   | 14                  |                         |                        |                                |            |                  |            |
| Common Loon                        | 14                  |                         |                        |                                |            |                  |            |

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| Long-tailed Duck                   | 13                  |                         |                        |                                |            |                  | 1          |
| Unknown White-headed Gull          | 12                  |                         | 30                     | 3                              |            |                  |            |
| American Coot                      | 12                  |                         |                        |                                |            |                  | 4          |
| California Gull                    | 12                  |                         | 5                      |                                |            |                  |            |
| Unknown Diver                      | 10                  |                         | 1                      |                                |            |                  |            |
| American White Pelican             | 10                  |                         |                        |                                |            |                  |            |
| Sanderling                         | 9                   |                         |                        | 2                              |            |                  |            |
| Unknown Dowitcher                  | 8                   |                         | 70                     | 1                              |            |                  |            |
| Horned Grebe                       | 8                   |                         |                        |                                |            |                  | 1          |
| Unknown Black-headed Gull          | 6                   |                         | 6                      | 3                              |            |                  |            |
| Pectoral Sandpiper                 | 5                   |                         |                        |                                |            |                  |            |
| Unknown Phalarope                  | 5                   |                         |                        |                                |            |                  |            |
| Unknown Grebe                      | 4                   |                         |                        |                                |            |                  |            |
| Semipalmated Plover                | 3                   |                         |                        | 3                              |            |                  |            |
| Unknown Gull                       | 3                   |                         | 4                      | 2                              |            |                  |            |
| Snow Goose                         | 3                   |                         | 4                      |                                |            |                  |            |
| Gadwall                            | 3                   |                         | 3                      |                                |            |                  |            |
| Ruddy Turnstone                    | 3                   |                         |                        |                                |            |                  |            |
| Unknown Plover                     | 2                   |                         | 9                      |                                |            |                  |            |
| Black-bellied Plover               | 2                   |                         |                        |                                |            |                  |            |
| Red-breasted Merganser             | 2                   |                         |                        |                                |            |                  |            |
| Short-billed Dowitcher             | 2                   |                         |                        |                                |            |                  |            |
| White-rumped Sandpiper             | 2                   |                         |                        |                                |            |                  |            |
| Wilson's Snipe                     | 1                   |                         | 1                      |                                |            |                  |            |
| Pied-billed Grebe                  | 1                   |                         |                        |                                |            |                  |            |
| Stilt Sandpiper                    | 1                   |                         |                        |                                |            |                  |            |
| Sandhill Crane                     |                     | 14                      | 12                     |                                |            |                  |            |
| Tundra Swan                        |                     |                         | 6                      |                                |            |                  |            |
| Great Blue Heron                   |                     |                         | 1                      |                                |            |                  |            |
| Greater White-fronted Goose        |                     |                         | 1                      |                                |            |                  |            |
| Osprey                             |                     |                         | 1                      |                                |            |                  |            |
| Sora                               |                     | 1                       |                        |                                |            |                  |            |
| White-winged Scoter                |                     |                         |                        |                                |            |                  | 1          |
| <b>NON-TARGET GUILDS</b>           |                     |                         |                        |                                |            |                  |            |
| Common Raven                       | 127                 |                         | 982                    |                                |            |                  |            |
| Snow Bunting                       | 86                  |                         | 225                    |                                |            |                  |            |
| American Pipit                     | 44                  |                         | 345                    |                                |            |                  |            |
| Red-winged Blackbird               | 39                  |                         | 10                     |                                |            |                  |            |
| Barn Swallow                       | 35                  |                         | 1161                   |                                |            |                  |            |
| Yellow-headed Blackbird            | 32                  |                         | 5                      |                                |            |                  |            |
| Lapland Longspur                   | 30                  |                         | 67                     |                                |            |                  |            |
| Savannah Sparrow                   | 28                  |                         | 71                     |                                |            |                  |            |
| Song Sparrow                       | 17                  |                         | 7                      |                                |            |                  |            |
| Brewer's Blackbird                 | 13                  |                         | 60                     |                                |            |                  |            |

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| Unknown Blackbird                  | 12                  |                         | 193                    |                                |            |                  |            |
| Unknown Sparrow                    | 9                   |                         | 38                     |                                |            |                  |            |
| Unknown Passerine                  | 8                   |                         | 545                    |                                |            |                  |            |
| Clay-colored Sparrow               | 8                   |                         | 1                      |                                |            |                  |            |
| American Kestrel                   | 7                   |                         | 29                     |                                |            |                  |            |
| American Robin                     | 6                   |                         | 9                      |                                |            |                  |            |
| Tree Swallow                       | 5                   |                         | 184                    |                                |            |                  |            |
| Horned Lark                        | 5                   |                         | 5                      |                                |            |                  |            |
| Unknown Swallow                    | 4                   |                         | 141                    |                                |            |                  |            |
| Black-billed Magpie                | 4                   |                         | 13                     |                                |            |                  |            |
| Chipping Sparrow                   | 3                   |                         | 1                      |                                |            |                  |            |
| Sharp-tailed Grouse                | 2                   |                         | 17                     |                                |            |                  |            |
| Brown-headed Cowbird               | 2                   |                         | 6                      |                                |            |                  |            |
| Harris's Sparrow                   | 2                   |                         |                        |                                |            |                  |            |
| Northern Harrier                   | 1                   |                         | 27                     |                                |            |                  |            |
| Common Grackle                     | 1                   |                         | 3                      |                                |            |                  |            |
| Sharp-shinned Hawk                 | 1                   |                         | 1                      |                                |            |                  |            |
| Vesper Sparrow                     | 1                   |                         | 1                      |                                |            |                  |            |
| Alder Flycatcher                   | 1                   |                         |                        |                                |            |                  |            |
| Yellow Warbler                     | 1                   |                         |                        |                                |            |                  |            |
| Bank Swallow                       |                     |                         | 36                     |                                |            |                  |            |
| Cliff Swallow                      |                     |                         | 15                     |                                |            |                  |            |
| Merlin                             |                     |                         | 4                      |                                |            |                  |            |
| American Crow                      |                     |                         | 1                      |                                |            |                  |            |
| Hairy Woodpecker                   |                     |                         | 1                      |                                |            |                  |            |
| Northern Flicker                   |                     |                         | 1                      |                                |            |                  |            |
| Peregrine Falcon                   |                     |                         | 1                      |                                |            |                  |            |
| Unknown Raptor                     |                     |                         | 1                      |                                |            |                  |            |
| Unknown Woodpecker                 |                     |                         | 1                      |                                |            |                  |            |

**Notes:**

<sup>1</sup> Pink shading: Species of Conservation Concern.

<sup>2</sup> Individual birds may be observed on multiple days and thus be counted multiple times.

<sup>3</sup> Only for Species of Conservation Concern.

**Appendix 2.D: Bird Oiling and Mortality Events at Horizon in April–October 2014**

Note: Birds were reported as required depending on the situation: to hazing crews, in the observers’ daily email update to the Waterfowl Protection contact list, and to AESRD.

| Date   | Species/ Species Group | Pond (Survey Station)      | Location Description | # Birds <sup>1</sup> | % Oiled                | Outcome                              | Context of Detection                            | Method of Detection      | Potential Reason for Mortality/Oiling     |
|--------|------------------------|----------------------------|----------------------|----------------------|------------------------|--------------------------------------|-------------------------------------------------|--------------------------|-------------------------------------------|
| Apr-29 | Canada Goose           | Tailings Pond (PMP1)       |                      | 1                    | 20                     | Reported, bird flew but landed again | Incidental by observers                         | Using optics, from shore |                                           |
| Apr-30 | Canada Goose           | Tailings Pond (PMP1)       | Vegetation on shore  | 2                    | 25 (breast, belly)     | Reported                             | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Apr-30 | Canada Goose           | Tailings Pond (PMP1)       | Water                | 1                    | 20 (breast)            | Reported, bird flew                  | During bird survey                              | Using optics, from shore | Bird landed in bitumen mat near shore     |
| May-7  | Eared Grebe            | Dyke 10 Runoff             | NE quadrant          | 1                    | > 0                    | Bird unable to fly, not recovered    | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| May-8  | Long-tailed Duck       | Tailings Pond              | East side            | 1                    | 95                     | Euthanized                           | While hazing                                    |                          |                                           |
| May-12 | Eared Grebe            | Tailings Pond              |                      | 1                    | 90                     | Died during capture attempt          | While hazing                                    | Airboat                  |                                           |
| May-12 | Eared Grebe            | Tailings Pond              |                      | 1                    | 40                     | Euthanized                           | While hazing                                    |                          |                                           |
| May-12 | Eared Grebe            | Tailings Pond              |                      | 1                    | 55                     | Euthanized                           | While hazing                                    |                          |                                           |
| May-12 | Eared Grebe            | Tailings Pond              | Shoreline            | 1                    | 90                     | Euthanized                           | While hazing                                    |                          |                                           |
| May-12 | Common Goldeneye       | Tailings Pond              |                      | 1                    | 90-100                 | Not recovered, likely sank           | While hazing                                    |                          |                                           |
| May-13 | American Coot          | Tailings Pond              |                      | 1                    | 90                     | Euthanized                           | While inspecting cannons                        |                          |                                           |
| May-14 | Eared Grebe            | Tailings Pond              |                      | 1                    | 5                      | Euthanized                           | While hazing                                    |                          |                                           |
| May-14 | Eared Grebe            | Tailings Pond              |                      | 1                    | 95                     | Euthanized                           | While hazing                                    |                          |                                           |
| May-17 | Ring-necked Duck       | Tailings Pond              |                      | 1                    | 100                    | Euthanized                           | While hazing                                    |                          |                                           |
| May-19 | Common Goldeneye       | Tailings Pond              |                      | 1                    | 100                    | Euthanized                           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| May-26 | Unk. Duck              | Tailings Pond              |                      | 1                    | 100                    | Found dead                           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| May-31 | Green-winged Teal      | Tailings Pond              |                      | 1                    | 40                     | Euthanized                           | While hazing                                    |                          |                                           |
| Jul-9  | Canada Goose           | Basal Water Storage (TMP1) | SE corner            | 1                    | 30 (breast)            | Reported, bird flew                  | Incidental by observers                         | Using optics, from shore |                                           |
| Jul-11 | Semipalmated Sandpiper | Tailings Pond              |                      | 1                    | 30 (right flank/belly) | Reported                             | Incidental by observers                         | Using optics, from shore |                                           |

| Date   | Species/ Species Group  | Pond (Survey Station)      | Location Description | # Birds <sup>1</sup> | % Oiled                        | Outcome                    | Context of Detection                            | Method of Detection      | Potential Reason for Mortality/Oiling     |
|--------|-------------------------|----------------------------|----------------------|----------------------|--------------------------------|----------------------------|-------------------------------------------------|--------------------------|-------------------------------------------|
| Jul-17 | Unk. Calidris Sandpiper | Basal Water Storage        |                      | 2                    | 5-30 (belly, vent, legs, bill) | Reported, birds flew       | Incidental by observers                         | Using optics, from shore |                                           |
| Jul-21 | Northern Shoveler       | Tailings Pond (PMP4)       |                      | 4                    | 5-30 (belly, face, bill)       | Reported                   | Incidental by observers                         | Using optics, from shore |                                           |
| Jul-21 | Northern Shoveler       | Tailings Pond              | West shore           | 1                    | 5                              | Found dead                 | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Jul-21 | Green-winged Teal       | Tailings Pond              |                      | 1                    | 80-90                          | Not recovered, likely sank | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Jul-26 | Unk. Gull               | Tailings Pond (PMP3)       | Water                | 1                    | 30 (all of underside)          | Reported                   | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the bird  |
| Jul-26 | Horned Grebe            | Tailings Pond              |                      | 1                    | 100                            | Euthanized                 | Incidental by hazing/deterrent maintenance crew |                          | Floating bitumen present                  |
| Jul-27 | Unk. Gull               | Basal Water Storage (TPM2) | Water                | 1                    | 30 (all of underside)          | Reported, bird flew        | During bird survey                              | Using optics, from shore |                                           |
| Jul-27 | Franklin's Gull         | Tailings Pond              |                      | 1                    | 40                             | Euthanized                 | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Jul-29 | Franklin's Gull         | Basal Water Storage (TPM2) | Shore                | 1                    | 60 (body, head, vent)          | Reported                   | During bird survey                              | Using optics, from shore |                                           |
| Jul-30 | Franklin's Gull         | Basal Water Storage (TPM2) | Water                | 3                    | 5-20 (belly, vent)             | Reported                   | During bird survey                              | Using optics, from shore |                                           |
| Jul-31 | Franklin's Gull         | Tailings Pond (PMP2)       | Shore                | 1                    | 10 (breast, vent)              | Reported                   | During bird survey                              | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Jul-31 | Franklin's Gull         | Basal Water Storage (TPM2) | Shore                | 2                    | 10-50 (belly, vent)            | Reported                   | During bird survey                              | Using optics, from shore |                                           |
| Aug-1  | Franklin's Gull         | Tailings Pond (PMP3)       | Water                | 4                    | 85-95                          | Reported, captured         | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-1  | Unk. White-headed Gull  | Basal Water Storage (TPM2) |                      | 1                    | 15 (belly, bill)               | Reported                   | Incidental by observers                         | Using optics, from shore |                                           |
| Aug-1  | Franklin's Gull         | Tailings Pond              |                      | 1                    | 85                             | Euthanized                 | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Aug-1  | Franklin's Gull         | Tailings Pond              |                      | 1                    | 85                             | Euthanized                 | Incidental by hazing/deterrent maintenance crew |                          |                                           |

| Date  | Species/ Species Group | Pond (Survey Station)      | Location Description | # Birds <sup>1</sup> | % Oiled                         | Outcome              | Context of Detection                            | Method of Detection      | Potential Reason for Mortality/Oiling     |
|-------|------------------------|----------------------------|----------------------|----------------------|---------------------------------|----------------------|-------------------------------------------------|--------------------------|-------------------------------------------|
| Aug-1 | Franklin's Gull        | Tailings Pond              |                      | 1                    | 95                              | Found dead           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Aug-1 | Franklin's Gull        | Tailings Pond              |                      | 1                    | 85-90                           | Found dead           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Aug-2 | Semipalmated Sandpiper | Basal Water Storage (TPM2) | Shore                | 1                    | 10 (vent)                       | Reported             | During bird survey                              | Using optics, from shore |                                           |
| Aug-2 | Franklin's Gull        | Basal Water Storage (TPM2) | Shore                | 1                    | 30-40 (belly, breast, vent)     | Reported             | During bird survey                              | Using optics, from shore |                                           |
| Aug-3 | Spotted Sandpiper      | Recycle Water (AMP1)       | Shore                | 1                    | 5 (vent)                        | Reported             | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-3 | Unk. White-headed Gull | Basal Water Storage (TPM2) | Shore                | 1                    | 50 (breast, belly, vent)        | Reported             | During bird survey                              | Using optics, from shore |                                           |
| Aug-3 | Greater Yellowlegs     | Tailings Pond (PMP4)       | Vegetation on water  | 1                    | 5-10 (vent)                     | Reported, bird flew  | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-3 | Lesser Yellowlegs      | Tailings Pond (PMP4)       | Vegetation on water  | 1                    | 5-10 (vent)                     | Reported, bird flew  | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-4 | Semipalmated Sandpiper | Tailings Pond (PMP2)       | Shore                | 1                    | 5-10 (vent)                     | Reported             | During bird survey                              | Using optics, from shore | Floating bitumen present (6-15 % of pond) |
| Aug-4 | Semipalmated Plover    | Tailings Pond (PMP2)       | Shore                | 2                    | 5-15 (belly, vent, wingtips)    | Reported             | During bird survey                              | Using optics, from shore | Floating bitumen present (6-15 % of pond) |
| Aug-5 | Lesser Yellowlegs      | Tailings Pond (PMP4)       | Vegetation on water  | 2                    | 10-15 (vent)                    | Reported, birds flew | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the bird  |
| Aug-5 | Semipalmated Sandpiper | Tailings Pond (PMP2)       | Shore                | 1                    | 5-10 (vent)                     | Reported             | During bird survey                              | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-6 | California Gull        | Compensation Lake (ZMP1)   | Shore                | 1                    | 30                              | Reported             | During bird survey                              | Using optics, from shore |                                           |
| Aug-6 | Lesser Yellowlegs      | Tailings Pond (PMP4)       | Vegetation on water  | 5                    | 15-20 (belly, vent, legs)       | Reported, birds flew | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-6 | Red-necked Phalarope   | Basal Water Storage (TPM2) | Shore                | 1                    | 15 (breast)                     | Reported             | During bird survey                              | Using optics, from shore |                                           |
| Aug-6 | Franklin's Gull        | Basal Water Storage (TPM2) | Shore                | 2                    | 30 (belly)                      | Reported             | During bird survey                              | Using optics, from shore |                                           |
| Aug-6 | Herring Gull           | Basal Water Storage (TPM2) | Shore                | 1                    | 60 (breast, breast, neck, legs) | Reported             | During bird survey                              | Using optics, from shore |                                           |
| Aug-6 | Lesser Yellowlegs      | Basal Water Storage (TPM2) | Shore                | 2                    | 10 (belly)                      | Reported, birds flew | During bird survey                              | Using optics, from shore |                                           |

| Date   | Species/ Species Group | Pond (Survey Station)      | Location Description | # Birds <sup>1</sup> | % Oiled                           | Outcome                             | Context of Detection                            | Method of Detection      | Potential Reason for Mortality/Oiling     |
|--------|------------------------|----------------------------|----------------------|----------------------|-----------------------------------|-------------------------------------|-------------------------------------------------|--------------------------|-------------------------------------------|
| Aug-7  | Semipalmated Plover    | Tailings Pond (PMP2)       | Shore                | 1                    | 10<br>(belly, vent)               | Reported                            | During bird survey                              | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-7  | Semipalmated Sandpiper | Tailings Pond (PMP2)       | Shore                | 1                    | 10<br>(flanks)                    | Reported                            | During bird survey                              | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-7  | Lesser Yellowlegs      | Tailings Pond (PMP4)       | Vegetation on shore  | 2                    | 10-20<br>(belly, vent)            | Reported                            | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-8  | Franklin's Gull        | Basal Water Storage (TPM2) | Shore                | 1                    | > 0                               | Reported                            | During bird survey                              | Using optics, from shore |                                           |
| Aug-8  | Franklin's Gull        | Tailings Pond (PMP5)       |                      | [1]                  | 30<br>(breast, belly, vent)       | Bird flying, circling               | During bird survey                              | Using optics, from shore |                                           |
| Aug-8  | Franklin's Gull        | Basal Water Storage (TPM2) | Shore                | 1                    | 10<br>(flanks, vent)              | Reported                            | During bird survey                              | Using optics, from shore |                                           |
| Aug-8  | Franklin's Gull        | Tailings Pond (PMP2)       | Shore                | 1                    | 25<br>(belly, vent)               | Reported                            | During bird survey                              | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-8  | Franklin's Gull        | Basal Water Storage (TPM2) | Water                | 1                    | 30<br>(breast, belly, vent)       | Reported                            | During bird survey                              | Using optics, from shore |                                           |
| Aug-11 | Franklin's Gull        | Compensation Lake (ZMP1)   | Water                | 1 [1]                | 20-30<br>(belly, flanks, vent)    | Reported, one bird flying, circling | During bird survey                              | Using optics, from shore |                                           |
| Aug-11 | Franklin's Gull        | Basal Water Storage (TMP1) |                      | 1                    | 20<br>(vent, flanks)              | Reported, bird flew                 | Incidental by observers                         | Using optics, from shore |                                           |
| Aug-11 | Canada Goose           | Road near Tailings Pond    |                      | 1                    | 95                                | Euthanized                          | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Aug-12 | Unk. Black-headed Gull | Basal Water Storage (TPM2) |                      | [3]                  | 20-30<br>(belly, vent)            | Birds flying, circling              | During bird survey                              | Using optics, from shore |                                           |
| Aug-12 | Herring Gull           | Basal Water Storage (TPM2) | Shore                | 1                    | 40-50 (belly, flanks, vent, head) | Reported                            | During bird survey                              | Using optics, from shore |                                           |
| Aug-13 | Baird's Sandpiper      | Tailings Pond (PMP2)       | Shore                | 2                    | 5<br>(vent)                       | Reported                            | During bird survey                              | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-13 | Greater Yellowlegs     | Dyke 10 Runoff (NMP1)      | Shore                | 1                    | 10-15<br>(vent, legs)             | Reported                            | During bird survey                              | Using optics, from shore |                                           |
| Aug-13 | Greater Yellowlegs     | Tailings Pond (PMP4)       | Vegetation on water  | 1                    | 5<br>(vent, legs)                 | Reported                            | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-14 | Franklin's Gull        | Basal Water Storage (TPM2) | Shore                | 2                    | 5-15<br>(breast, belly)           | Reported                            | During bird survey                              | Using optics, from shore |                                           |
| Aug-14 | Baird's Sandpiper      | R2 Basal Dump (SMP1)       | Shore                | 1                    | 5<br>(vent)                       | Reported                            | During bird survey                              | Using optics, from shore |                                           |

| Date   | Species/ Species Group  | Pond (Survey Station)      | Location Description | # Birds <sup>1</sup> | % Oiled                            | Outcome                | Context of Detection | Method of Detection      | Potential Reason for Mortality/Oiling     |
|--------|-------------------------|----------------------------|----------------------|----------------------|------------------------------------|------------------------|----------------------|--------------------------|-------------------------------------------|
| Aug-14 | Lesser Yellowlegs       | Tailings Pond (PMP4)       | Vegetation on water  | 4                    | 5-15 (belly, vent)                 | Reported               | During bird survey   | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-14 | Unk. Dowitcher          | Tailings Pond (PMP4)       | Vegetation on water  | 1                    | 25 (breast, belly, vent)           | Reported               | During bird survey   | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-14 | Baird's Sandpiper       | Tailings Pond (PMP2)       | Shore                | 2                    | 5 (vent)                           | Reported               | During bird survey   | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-15 | Lesser Yellowlegs       | Storm Water (EMP1)         | Shore                | 1                    | 10 (vent, legs)                    | Reported               | During bird survey   | Using optics, from shore |                                           |
| Aug-15 | Baird's Sandpiper       | R2 Basal Dump (SMP1)       | Shore                | 5                    | 5-10 (belly, vent)                 | Reported, 3 birds flew | During bird survey   | Using optics, from shore |                                           |
| Aug-16 | Unk. Calidris Sandpiper | Tailings Pond (PMP2)       | Shore                | 1                    | 30 (breast, belly, vent, head)     | Reported               | During bird survey   | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-16 | Lesser Yellowlegs       | Tailings Pond (PMP2)       | Shore                | 2                    | 5 (vent)                           | Reported               | During bird survey   | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-16 | Spotted Sandpiper       | Recycle Water (AMP1)       | Shore                | 3                    | 10 (belly, vent)                   | Reported               | During bird survey   | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-17 | Lesser Yellowlegs       | Coke Runoff (FMP1)         | Shore                | 1                    | 10 (vent, legs)                    | Reported               | During bird survey   | Using optics, from shore |                                           |
| Aug-17 | Spotted Sandpiper       | Coke Runoff (FMP1)         | Shore                | 1                    | 5 (flanks)                         | Reported               | During bird survey   | Using optics, from shore |                                           |
| Aug-17 | Franklin's Gull         | R2 Basal Dump (SMP1)       | Shore                | 2                    | 5-40 (underside, neck, head)       | Reported, birds flew   | During bird survey   | Using optics, from shore |                                           |
| Aug-18 | Unk. White-headed Gull  | Basal Water Storage (TPM2) | Shore                | 1                    | 45 (underside, flanks, head, bill) | Reported               | During bird survey   | Using optics, from shore |                                           |
| Aug-19 | Baird's Sandpiper       | Tailings Pond (PMP2)       | Shore                | 2                    | 5-50 (underside, neck, head)       | Reported               | During bird survey   | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-19 | Baird's Sandpiper       | R2 Basal Dump (SMP1)       | Shore                | 2                    | 10 (breast, belly, vent)           | Reported, birds flew   | During bird survey   | Using optics, from shore |                                           |
| Aug-19 | Lesser Yellowlegs       | Storm Water (EMP1)         | Shore                | 1                    | 5 (vent, legs)                     | Reported               | During bird survey   | Using optics, from shore |                                           |
| Aug-19 | Unk. White-headed Gull  | Tailings Pond (PMP2)       | Shore                | 1                    | 30 (underside, wings)              | Reported               | During bird survey   | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Aug-20 | Baird's Sandpiper       | Storm Water (EMP1)         | Shore                | 4                    | 5-15 (belly, vent, flanks)         | Reported               | During bird survey   | Using optics, from shore |                                           |
| Aug-20 | Lesser Yellowlegs       | Tailings Pond (PMP4)       | Shore                | 5                    | 5-20 (breast, belly, flanks)       | Reported               | During bird survey   | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-20 | Lesser Yellowlegs       | Storm Water (EMP1)         | Shore                | 3                    | 10 (belly, flanks)                 | Reported               | During bird survey   | Using optics, from shore |                                           |

| Date   | Species/ Species Group  | Pond (Survey Station)      | Location Description | # Birds <sup>1</sup> | % Oiled                     | Outcome             | Context of Detection    | Method of Detection      | Potential Reason for Mortality/Oiling     |
|--------|-------------------------|----------------------------|----------------------|----------------------|-----------------------------|---------------------|-------------------------|--------------------------|-------------------------------------------|
| Aug-20 | Baird's Sandpiper       | Tailings Pond (PMP4)       | Shore                | 2                    | 5-10<br>(belly, vent)       | Reported            | During bird survey      | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-20 | Semipalmated Sandpiper  | R2 Emergency Dump (MMP1)   | Shore                | 1                    | 30<br>(breast, belly, head) | Reported, bird flew | During bird survey      | Using optics, from shore |                                           |
| Aug-21 | Lesser Yellowlegs       | Storm Water (EMP1)         | Shore                | 2                    | 10<br>(flanks, vent)        | Reported            | During bird survey      | Using optics, from shore |                                           |
| Aug-21 | Spotted Sandpiper       | Tailings Pond (PMP4)       | Shore                | 1                    | 20<br>(underside)           | Reported            | During bird survey      | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-21 | Spotted Sandpiper       | R2 Emergency Dump (MMP1)   | Shore                | 1                    | 5<br>(right flank, vent)    | Reported            | During bird survey      | Using optics, from shore |                                           |
| Aug-22 | Killdeer                | Recycle Water (AMP1)       | Shore                | 1                    | 10<br>(belly, right flank)  | Reported            | During bird survey      | Using optics, from shore |                                           |
| Aug-22 | Lesser Yellowlegs       | Tailings Pond (PMP4)       | Shore                | 1                    | 10<br>(vent)                | Reported            | During bird survey      | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-23 | Baird's Sandpiper       | Tailings Pond (PMP2)       | Shore                | 1                    | 10<br>(belly, flanks)       | Reported            | During bird survey      | Using optics, from shore | Floating bitumen within 25 m of the bird  |
| Aug-23 | Spotted Sandpiper       | Dyke 10 Runoff (NMP1)      | Shore                | 1                    | 30<br>(breast, belly)       | Reported            | During bird survey      | Using optics, from shore |                                           |
| Aug-23 | Lesser Yellowlegs       | Tailings Pond (PMP4)       | Shore                | 1                    | 5<br>(flanks)               | Reported, bird flew | During bird survey      | Using optics, from shore | Floating bitumen within 25 m of the bird  |
| Aug-23 | Spotted Sandpiper       | Tailings Pond (PMP4)       | Shore                | 1                    | 10 (breast, belly)          | Reported, bird flew | During bird survey      | Using optics, from shore | Floating bitumen within 25 m of the bird  |
| Aug-24 | Lesser Yellowlegs       | Light Duty Truck pond      |                      | 1                    | 10                          | Reported            | Incidental by observers | Using optics, from shore |                                           |
| Aug-26 | Spotted Sandpiper       | Tailings Pond (PMP4)       | Shore                | 1                    | 10<br>(vent)                | Reported            | During bird survey      | Using optics, from shore | Floating bitumen within 25 m of the bird  |
| Aug-26 | Lesser Yellowlegs       | Tailings Pond (PMP4)       | Shore                | 1                    | 15<br>(belly, vent)         | Reported            | During bird survey      | Using optics, from shore | Floating bitumen within 25 m of the birds |
| Aug-31 | Baird's Sandpiper       | Basal Water Storage (TPM2) | Shore                | 1                    | 10<br>(belly, vent)         | Bird flew           | During bird survey      | Using optics, from shore |                                           |
| Sep-2  | Unk. Calidris Sandpiper | Recycle Water (AMP1)       |                      | [1]                  | 5<br>(vent)                 | Reported            | During bird survey      | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Sep-4  | Semipalmated Sandpiper  | Basal Water Storage (TPM2) | Shore                | 1                    | 5<br>(vent)                 | Reported            | During bird survey      | Using optics, from shore |                                           |
| Sep-6  | Sanderling              | Basal Water Storage (TPM2) | Shore                | 1                    | 10<br>(left flank)          | Reported            | During bird survey      | Using optics, from shore |                                           |
| Sep-6  | Baird's Sandpiper       | Tailings Pond (PMP2)       | Shore                | 1                    | 5<br>(vent)                 | Reported, bird flew | During bird survey      | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |

| Date   | Species/ Species Group | Pond (Survey Station)      | Location Description | # Birds <sup>1</sup> | % Oiled                      | Outcome                              | Context of Detection                            | Method of Detection      | Potential Reason for Mortality/Oiling     |
|--------|------------------------|----------------------------|----------------------|----------------------|------------------------------|--------------------------------------|-------------------------------------------------|--------------------------|-------------------------------------------|
| Sep-11 | Unk. Diving Duck       | Mine Dump                  |                      | 1                    | 100                          | Euthanized                           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Sep-18 | Sanderling             | Dyke 10 Runoff (NMP1)      | Shore                | 1                    | 10 (flanks)                  | Reported                             | During bird survey                              | Using optics, from shore |                                           |
| Sep-21 | Ruddy Duck             | Tailings Pond              |                      | 1                    | 90                           | Euthanized                           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Sep-25 | Lesser Scaup           | Tailings Pond              |                      | 1                    | 90                           | Euthanized                           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Sep-30 | American Coot          | Tailings Pond              |                      | 1                    | 95                           | Euthanized                           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Oct-1  | Unk. Duck              | Basal Water Storage (TPM2) | Water                | 1                    | 80                           | Reported                             | During bird survey                              | Using optics, from shore |                                           |
| Oct-1  | American Coot          | Tailings Pond              | Near the boom        | 1                    | 75                           | Euthanized                           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Oct-3  | Ring-necked Duck       | Recycle Water (AMP1)       | Water                | 1                    | 20 (breast, head)            | Reported                             | During bird survey                              | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Oct-5  | American Coot          | Tailings Pond              | Near the boom        | 1                    | 60                           | Euthanized                           | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Oct-6  | White-winged Scoter    | Basal Water Storage        |                      | 1                    | 80                           | Not recovered, signs of predation    | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Oct-7  | Unk. Scaup             | Recycle Water (AMP1)       | Water                | 1                    | 80 (all of body except head) | Reported                             | During bird survey                              | Using optics, from shore | Floating bitumen present (1-5 % of pond)  |
| Oct-7  | Unk. Scaup             | Recycle Water              |                      | 1                    | 80                           | Not recovered, could not be captured | Incidental by hazing/deterrent maintenance crew |                          |                                           |
| Oct-14 | Mallard                | Tailings Pond (PMP5)       | Water                | 2                    | 5 (head)                     | Reported                             | During bird survey                              | Using optics, from shore | Floating bitumen within 25 m of the birds |

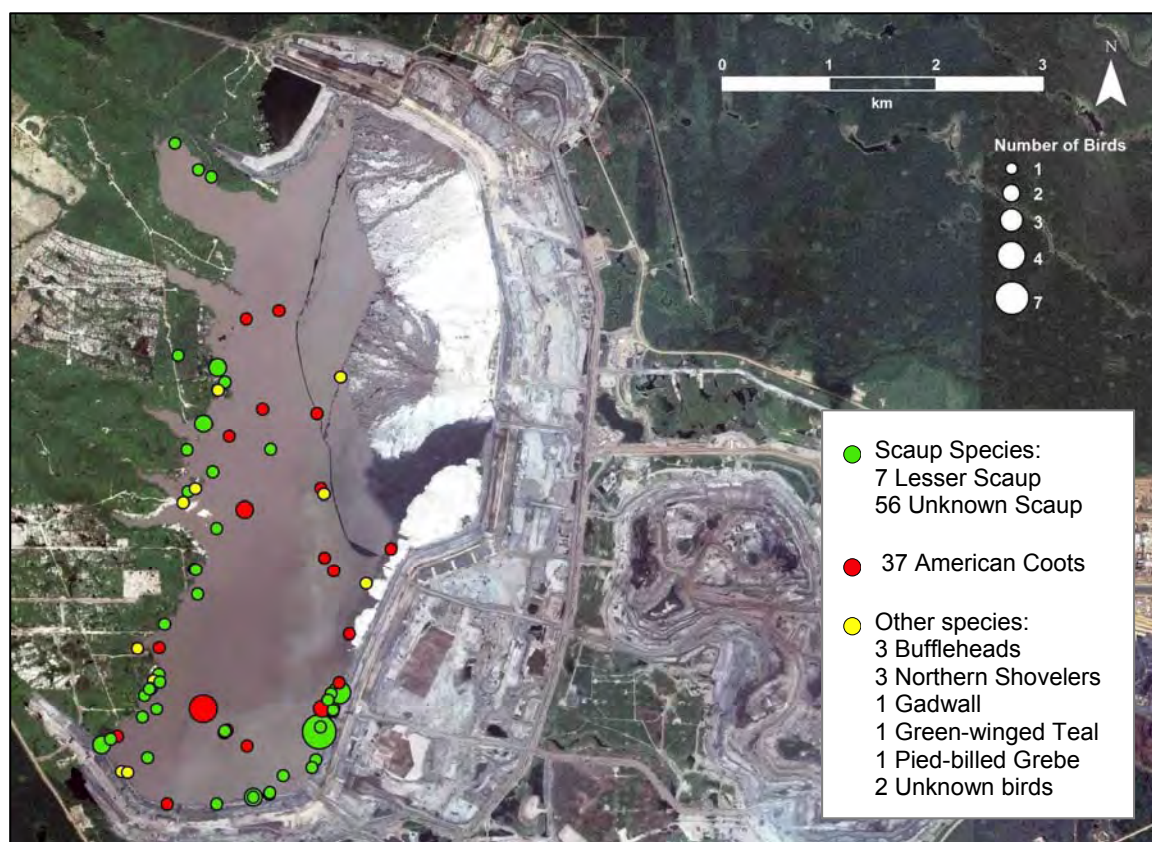
**Notes:**  
Purple shading: mortality.  
<sup>1</sup> [Brackets indicate bird flying].



### Appendix 2.E: Incidental Bird Mortalities at Horizon during a Weather-related Landing Event in November 2014

During the early morning hours of November 4, 2014, an unforeseen weather event of extreme fog conditions resulted in migratory waterfowl to land on the tailings pond at Horizon despite the full operation of the waterfowl deterrent system. The event was reported to Alberta Environment and Sustainable Development and the Alberta Energy Regulator on November 4th. Multiple factors contributed to the waterfowl landings that included the severe weather event, the timing of the waterfowl migration late in the season, and poor visibility. Waterfowl deterrents, including radar units, long range acoustic devices along with propane cannons and effigies, were functional and effective. There were 111 waterfowl fatalities. Canadian Natural's system has been operational since 2009 and this is the first event of this kind at Horizon Oil Sands.

Note: All observations occurred at the Tailings Pond, by boat.



### Appendix 2.E (cont'd)

| Date  | # Birds | Species/Species Group | % Oiled | Outcome                         |
|-------|---------|-----------------------|---------|---------------------------------|
| Nov-4 | 19      | American Coot         | > 25    | Euthanized                      |
| Nov-4 | 1       | Bufflehead            | > 25    | Euthanized                      |
| Nov-4 | 1       | Gadwall               | > 25    | Euthanized                      |
| Nov-4 | 7       | Lesser Scaup          | > 25    | Euthanized                      |
| Nov-4 | 1       | Northern Shoveler     | > 25    | Euthanized                      |
| Nov-4 | 1       | Unk. Scaup            | > 25    | Euthanized                      |
| Nov-5 | 1       | American Coot         | 30      | Euthanized                      |
| Nov-5 | 7       | American Coot         | 50      | Euthanized                      |
| Nov-5 | 1       | American Coot         | 60      | Euthanized                      |
| Nov-5 | 2       | American Coot         | 80      | Euthanized                      |
| Nov-5 | 4       | American Coot         | 100     | Euthanized                      |
| Nov-5 | 1       | American Coot         | > 0     | Scavenged by ravens             |
| Nov-5 | 2       | Bufflehead            | 75      | Euthanized                      |
| Nov-5 | 1       | Green-winged Teal     | 60      | Euthanized                      |
| Nov-5 | 1       | Northern Shoveler     | 50      | Euthanized                      |
| Nov-5 | 1       | Pied-billed Grebe     | 50      | Euthanized                      |
| Nov-5 | 13      | Unk. Scaup            | 50      | Euthanized                      |
| Nov-5 | 2       | Unk. Scaup            | 60      | Euthanized                      |
| Nov-5 | 2       | Unk. Scaup            | 70      | Euthanized                      |
| Nov-5 | 4       | Unk. Scaup            | 75      | Euthanized                      |
| Nov-5 | 8       | Unk. Scaup            | 80      | Euthanized                      |
| Nov-5 | 5       | Unk. Scaup            | 90      | Euthanized                      |
| Nov-5 | 2       | Unk. Scaup            | 100     | Euthanized                      |
| Nov-5 | 7       | Unk. Scaup            | 80-100  | Euthanized                      |
| Nov-6 | 1       | American Coot         | 60      | Euthanized                      |
| Nov-6 | 1       | American Coot         | 80      | Euthanized                      |
| Nov-6 | 1       | Northern Shoveler     | 50      | Euthanized                      |
| Nov-6 | 1       | Unk. bird             | unknown | On beach, scavenged by ravens   |
| Nov-6 | 1       | Unk. Scaup            | 10      | Euthanized                      |
| Nov-6 | 1       | Unk. Scaup            | 50      | Euthanized                      |
| Nov-6 | 1       | Unk. Scaup            | 75      | Euthanized                      |
| Nov-6 | 4       | Unk. Scaup            | 80      | Euthanized                      |
| Nov-6 | 1       | Unk. Scaup            | 85      | Euthanized                      |
| Nov-6 | 2       | Unk. Scaup            | 90      | Euthanized                      |
| Nov-6 | 1       | Unk. Scaup            | > 0     | Scavenged by ravens             |
| Nov-7 | 1       | Unk. bird             | > 0     | Scavenged by ravens and magpies |
| Nov-7 | 1       | Unk. Scaup            | 60      | Euthanized                      |

## Appendix 2.F: Summer Resident Birds

During the three-week interval between the spring and fall monitoring periods, Canadian Natural estimated the number of summer resident birds present within each survey area at Horizon Oil Sands, and evaluated the potential effect of multiple observations of these birds on the total through the 2014 season. A total of 48 dabblers (Canada Goose, Green-winged Teal, Mallard, Northern Shoveler) were considered to reside at Horizon ponds in the summer of 2014, of which 28 occurred at process-affected ponds (see table below). Assuming birds were resident from June 1 through to August 15 (at which date the young were presumed to be flight-capable), these birds could have been included in up to 50 surveys. While the actual impact of multiple counts of the 28 birds on each of 50 days (a theoretical maximum of 1,400 observations) cannot be calculated, repeated observations of these resident dabblers could represent up to 36% of the total number of observations of dabblers at Horizon's process-affected ponds in 2014, given that there were 694 observations of dabblers at process-affected ponds between June 1 and August 15, out of a total of 1,959 observation of dabblers at process-affected ponds during 2014. Similarly, every dabbler observed at Compensation Lake between June 1 and August 15 had the potential for being a resident bird and nesting in the area.

### Estimates of Summer Residents within Bird Survey Areas at Horizon

| Species<br>(in taxonomic order;<br>AOU 2014) | Guild      | Process-affected<br>Ponds | Compensation Lake<br>(Freshwater) |
|----------------------------------------------|------------|---------------------------|-----------------------------------|
| Canada Goose                                 | Dabbles    | 2                         | 14                                |
| Mallard                                      | Dabbles    | 18                        | 6                                 |
| Northern Shoveler                            | Dabbles    | 6                         |                                   |
| Green-winged Teal                            | Dabbles    | 2                         |                                   |
| Common Goldeneye                             | Dives      | 6                         |                                   |
| Red-breasted Merganser                       | Diver      | 0                         | 6                                 |
| Common Loon                                  | Dives      | 0                         | 2                                 |
| Killdeer                                     | Wades      | 1                         |                                   |
| Spotted Sandpiper                            | Wades      | 4                         |                                   |
| Lesser Yellowlegs                            | Wades      | 2                         |                                   |
| Common Raven                                 | Non-target | 2                         |                                   |
| Tree Swallow                                 | Non-target | 8                         |                                   |
| Bank Swallow                                 | Non-target | 4                         |                                   |
| Cliff Swallow                                | Non-target | 2                         |                                   |
| Barn Swallow                                 | Non-target | 15                        |                                   |
| American Robin                               | Non-target | 2                         |                                   |
| Clay-colored Sparrow                         | Non-target | 1                         |                                   |
| Savannah Sparrow                             | Non-target | 3                         |                                   |
| Song Sparrow                                 | Non-target | 2                         |                                   |
| Brewer's Blackbird                           | Non-target | 2                         |                                   |

**Note:**

Rose shading indicates species of concern. Blue indicates freshwater pond.

While summer residents are not likely to be visible during every survey, and this example overestimates their contribution to the seasonal totals, it serves to show that consideration of a numerical method to account for multiple counting of summer resident birds would be appropriate to consider in updating the 2015 OSBCMP protocol.

Because of the relatively longer exposure of summer resident birds to process-affected ponds, and the bitumen that many contain, the risk of oiling or mortality is higher for birds nesting on these ponds. It is likely that at least some oiled bird and mortality observations were of these summer residents. Eight percent of observation of oiled birds and 17% of mortalities in 2014 occurred between June 1 and August 15.

The presence of summer resident birds on process-affected ponds reflects the presence of suitable habitat for nesting and breeding at these ponds. In some cases, attempts to remove attractive habitat were made (e.g., herbicide applications to vegetation on the western side of the Horizon Tailings pond), in compliance with restrictions from the *Migratory Bird Convention Act* and Alberta's *Wildlife Act*. This use of OSBCMP data and supplementary observations in support of site management practices geared to the reduction of bird contact with process-affected ponds is supportive of achievement of the fifth program objective. Removal of habitat in and around process-affected ponds will likely reduce substantially the number of bird contact observations, observations of oiled birds, and bird mortalities (Hennan & Munson 1979<sup>1</sup>, Yonge 1979<sup>2</sup>), and is considered to be a best management practice. This would likely enhance the effectiveness of deterrent systems as well, as birds would no longer be attracted to suitable habitats to the extent that they would break through the deterrent arrays.

---

<sup>1</sup> Hennan E., Munson B. (1979) Species Distribution and Habitat Relationships of Waterfowl in Northeastern Alberta. Canadian Wildlife Service, for Alberta Oil Sand Environmental Research Program, Project LS 22.1.2, 115 p.

<sup>2</sup> Yonge K.S. (1979) Development of a bird protection strategy for tar sands tailings ponds. Proceedings of the 8th Bird Control Seminar, Bowling Green, Ohio.

OIL SANDS BIRD CONTACT MONITORING PROGRAM

# 2014 Annual Report – Imperial Oil Resources

Prepared by Imperial Oil Resources March 2015



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11 March 2015

Albert Liu  
Industrial Engineer, Mining Authorizations  
Alberta Energy Regulator  
111 Twin Atria Building  
4999 – 98 Avenue  
Edmonton, Alberta, T6B 2X3

**RE:   Kearl Oil Sands Project Bird Contact Monitoring Program  
Submission of 2014 Annual Bird Monitoring Report  
Environmental Protection and Enhancement Act (EPEA) Approval 46586-00-00 as  
amended, Clauses 6.1.77 (b) and 6.1.78**

Dear Mr.Liu,

Please find the Imperial Oil section enclosed as part of the regional *2014 Annual Bird Monitoring Report*, in accordance with the requirements of the *Oil Sands Bird Contact Monitoring Plan for 2014* (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 2014 and both the fresh water and process affected ponds were monitored regularly during 2014. 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,

A handwritten signature in black ink, appearing to read "Sandy Campbell".

Sandy J. Campbell P.Biol

cc:  
Kearl Document Control (Imperial)  
Rhiannon Davies (Imperial)  
Marie Nietfeld (AER)  
Kenneth Yap (AER)  
Joann Skilnick (AESRD)  
Andrea McGregor (AESRD)  
Richard Wiacek (Environment Canada)

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### 3. IMPERIAL OIL CANADA LIMITED (KEARL)

#### 3.1 Summary

##### 3.1.1 Bird Landings and Mortalities at Process-affected Ponds

Bird survey and mortality search efforts are summarized in Table 3.1. Over 2,000 bird surveys were conducted at Kearl in 2014.

**Table 3.1: Monitoring effort at process-affected ponds at Kearl in 2014**

| Bird Surveys               |                                           |         |         |          |
|----------------------------|-------------------------------------------|---------|---------|----------|
| # Ponds Surveyed           | 14                                        |         |         |          |
| # 10-min Surveys Conducted | 1,514                                     |         |         |          |
| # 30-min Surveys Conducted | 648                                       |         |         |          |
| Mortality Searches         |                                           |         |         |          |
| # Ponds Searched           | 14                                        |         |         |          |
| # Searches                 | 176 (2 focused and 174 transect searches) |         |         |          |
| Search Method              | Boat                                      | Walk    | Truck   | Total    |
| Total Time Searched        | 12.4 h                                    | 13.7 h  | 12.8 h  | 38.8 h   |
| Distance Searched          | 105.2 km                                  | 25.4 km | 49.6 km | 180.2 km |

Table 3.2 summarizes bird observations and mortalities at process-affected (PA) ponds in 2014. Thirty-nine (39) waterbirds were observed as mortalities at PA ponds, 35 of which were detected incidentally.

**Table 3.2: Bird observations at process-affected ponds at Kearl in 2014**

|                      | Waterbirds |           |                   |            |                  |            | Non-target Guilds |           |                   |            |                  |            |
|----------------------|------------|-----------|-------------------|------------|------------------|------------|-------------------|-----------|-------------------|------------|------------------|------------|
|                      | Landed     | Flew Over | Contacted Bitumen |            | Mortality        |            | Landed            | Flew over | Contacted Bitumen |            | Mortality        |            |
|                      |            |           | Bird Survey       | Incidental | Mortality Search | Incidental |                   |           | Bird Survey       | Incidental | Mortality Search | Incidental |
| # Birds <sup>1</sup> | 1,481      | 3,144     | 146               | 1          | 4                | 35         | 586               | 2,380     | 5                 | 0          | 0                | 4          |
| # Species            | 39         | 24        | 17                | 1          | 1                | 11         | 16                | 25        | 1                 | 0          | 0                | 4          |

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times

### 3.1.2 Bird Landings at Freshwater Ponds

Table 3.3 summarizes monitoring effort at three freshwater ponds at the Kearl site in 2014. Over 300 surveys were conducted throughout the duration of the program, while 14 mortality searches were completed at the Raw Water Pond. Table 3.4 summarizes bird observations at Kearl's freshwater ponds.

**Table 3.3: Monitoring effort at freshwater ponds at Kearl in 2014**

| Bird Surveys                            |                        |        |        |        |
|-----------------------------------------|------------------------|--------|--------|--------|
| # Ponds Surveyed                        | 3                      |        |        |        |
| # 10-min Surveys Conducted              | 157                    |        |        |        |
| # 30-min Surveys Conducted <sup>1</sup> | 169                    |        |        |        |
| Mortality Searches                      |                        |        |        |        |
| # Ponds Searched                        | 1                      |        |        |        |
| # Searches                              | 14 (transect searches) |        |        |        |
| Search Method                           | Boat                   | Walk   | Truck  | Total  |
| Total Time Searched                     | 0 h                    | 0.3 h  | 1 h    | 1.3 h  |
| Distance Searched                       | 0 km                   | 1.2 km | 5.1 km | 6.3 km |

<sup>1</sup> Includes 52 surveys at Muskeg Lake (48 surveys of 30 min and four surveys of 10 min, shorter surveys due to human error)

**Table 3.4: Bird observations at freshwater ponds at Kearl in 2014**

|                      | Waterbirds |           |                                |            |                  |            | Non-target Guilds |           |                                |            |                  |            |
|----------------------|------------|-----------|--------------------------------|------------|------------------|------------|-------------------|-----------|--------------------------------|------------|------------------|------------|
|                      | Landed     | Flew Over | Contacted Bitumen <sup>2</sup> |            | Mortality        |            | Landed            | Flew over | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|                      |            |           | Bird Survey                    | Incidental | Mortality Search | Incidental |                   |           | Bird Survey                    | Incidental | Mortality Search | Incidental |
| # Birds <sup>1</sup> | 1,223      | 464       | 2                              | 0          | 0                | 1          | 538               | 728       | 0                              | 0          | 0                | 0          |
| # Species            | 38         | 21        | 1                              | 0          | 0                | 1          | 13                | 16        | 0                              | 0          | 0                | 0          |

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times

<sup>2</sup> Denotes birds that had come into contact with bitumen elsewhere and become oiled, but were observed at freshwater ponds

### 3.1.3 Standardized Monitoring

Bird contact monitoring at the Imperial Oil Resources Ventures Ltd.'s (Imperial's) Kearl Oil Sands (Kearl) site was conducted according to the methods outlined in the 2014 Protocol for the Oil Sands Bird Contact Monitoring Program (OSBCMP; St Clair *et al.* 2014). The 2014 protocol was available for consultation by bird monitors at all times. On occasion, however, changing conditions encountered at site required modifications to the monitoring.

The West External Tailing Area (ETA) pond is in an area that regularly features cell and dyke construction, beaching (tailings discharge and sand deposition), and similar work by heavy equipment. As such, access to the monitoring stations at this pond (ETA Main, ETA NW, ETA NE, ETA SW, ETA 1) was often restricted. Observation points varied through the year, and while GPS coordinates were recorded at these locations, observation points would occasionally change on a daily basis; however, locations met the intent of the monitoring protocol. Apart from the changes in location, the methodology of monitoring sessions at the West ETA was the same as those at other ponds at Kearl.

Bird monitors were directed by Imperial to alter the frequency of visits to some ponds covered in the 2014 monitoring plan. The protocol dictated that all PA ponds were to be visited six times per week, but four of these ponds (Hydrotransport Ponds 1 and 2, OPP1 Crusher Sump, and OPP1 Emergency Dump Pond) were visited once weekly due to a lack of bird activity observed during the 2013 season. In addition, the protocol required that freshwater ponds were visited once per week, but Imperial directed monitors to visit the Raw Water Pond on a daily basis due to its large size and proximity to the plant (Adamek, C., pers. comm., 2014).

The inter-observer variability (IOV) surveys that were conducted by monitors at the Imperial Kearl site in 2014 did not result in statistical comparison opportunities, but were instead utilized as a means to assess and resolve differences between observations made by bird monitors.

Mortality searches followed the methods set forth in the 2014 OSBCMP protocol. At some areas on site, however, electronic devices are not safe due to their potential for sparking an explosion. When conducting work in these areas, tablets and GPS devices could not be used because posted barcodes could not be scanned, nor could distances to water be measured or mortality tracks recorded.

#### 3.1.4 Species of Conservation Concern

**Table 3.5: Number of observations of birds of conservation concern at process-affected ponds at Kearl in 2014**

| Species           | Landed <sup>1</sup> |            | Flew Over <sup>1</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|-------------------|---------------------|------------|------------------------|--------------------------------|------------|------------------|------------|
|                   | Bird Survey         | Incidental | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b> |                     |            |                        |                                |            |                  |            |
| Sandhill Crane    | 64                  | 3          | 11                     | 18                             |            |                  | 1          |
| Green-winged Teal | 14                  | 5          | 9                      |                                |            |                  |            |
| Northern Pintail  | 7                   |            | 1                      | 1                              |            |                  |            |
| Lesser Scaup      | 6                   |            | 1                      |                                |            |                  |            |

| Species                  | Landed <sup>1</sup> |            | Flew Over <sup>1</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|--------------------------|---------------------|------------|------------------------|--------------------------------|------------|------------------|------------|
|                          | Bird Survey         | Incidental | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| Horned Grebe             | 2                   |            |                        |                                |            |                  |            |
| Pied-billed Grebe        | 1                   |            |                        |                                |            |                  | 2          |
| Great Blue Heron         |                     |            | 1                      |                                |            |                  |            |
| <b>Non-target Guilds</b> |                     |            |                        |                                |            |                  |            |
| Bank Swallow             | 26                  |            | 80                     |                                |            |                  |            |
| Rusty Blackbird          | 2                   |            | 10                     |                                |            |                  |            |
| Eastern Phoebe           | 1                   |            |                        |                                |            |                  |            |
| Northern Harrier         |                     |            | 3                      |                                |            |                  |            |
| Bald Eagle               |                     |            | 2                      |                                |            |                  |            |
| Broad-winged Hawk        |                     |            | 1                      |                                |            |                  |            |
| Sharp-tailed Grouse      |                     | 4          | 1                      |                                |            |                  | 1          |

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times

### 3.1.5 Adaptive Management

At the West ETA pond, small muskeg mats were destroyed and removed at the beginning and end of the summer. None of these mats exhibited nesting habitat for migratory birds prior to their removal but posed a risk as potential nesting habitat in future breeding seasons. Furthermore, vegetation along the northern and eastern shores of the West ETA pond was removed over the course of the summer.

In response to approximately 300 migratory birds landing on the Raw Water Pond overnight on November 4<sup>th</sup>, Imperial directed that additional propane cannons be deployed along the tailings solvent recovery unit (TSRU) line and debris dyke at the West ETA pond. In addition, the radar and long-range acoustic devices (LRADs) were kept active at the West ETA until it was determined that the progress of the autumn migration had made a mass landing unlikely.

Imperial is evaluating potential future improvements to site management and bird deterrence in order to minimize bird contact with PA ponds. Vegetation management is regarded as a priority, and the possible use of herbicides to reduce the potential for nesting habitats near PA ponds, particularly the West ETA is currently under investigation. The East ETA pond, while not currently housing PA water, will also be addressed to highlight vegetation management practices.

The potential for improved placement of the LRADs at the West ETA pond is also being examined. If the LRADs are placed on the pond and oriented to radiate from the center of the pond, birds flying overhead may encounter deterring sounds before they reach the pond. The current orientation, which features the LRADs at the perimeter of the pond

facing towards its center, may not prevent deterrence until birds are flying over the tailings pond.

Imperial will continue to collaborate with other industry operators, academic institutions, and regulatory bodies to evaluate potential methods of reducing bird mortalities and contact with PA ponds at Kearl.

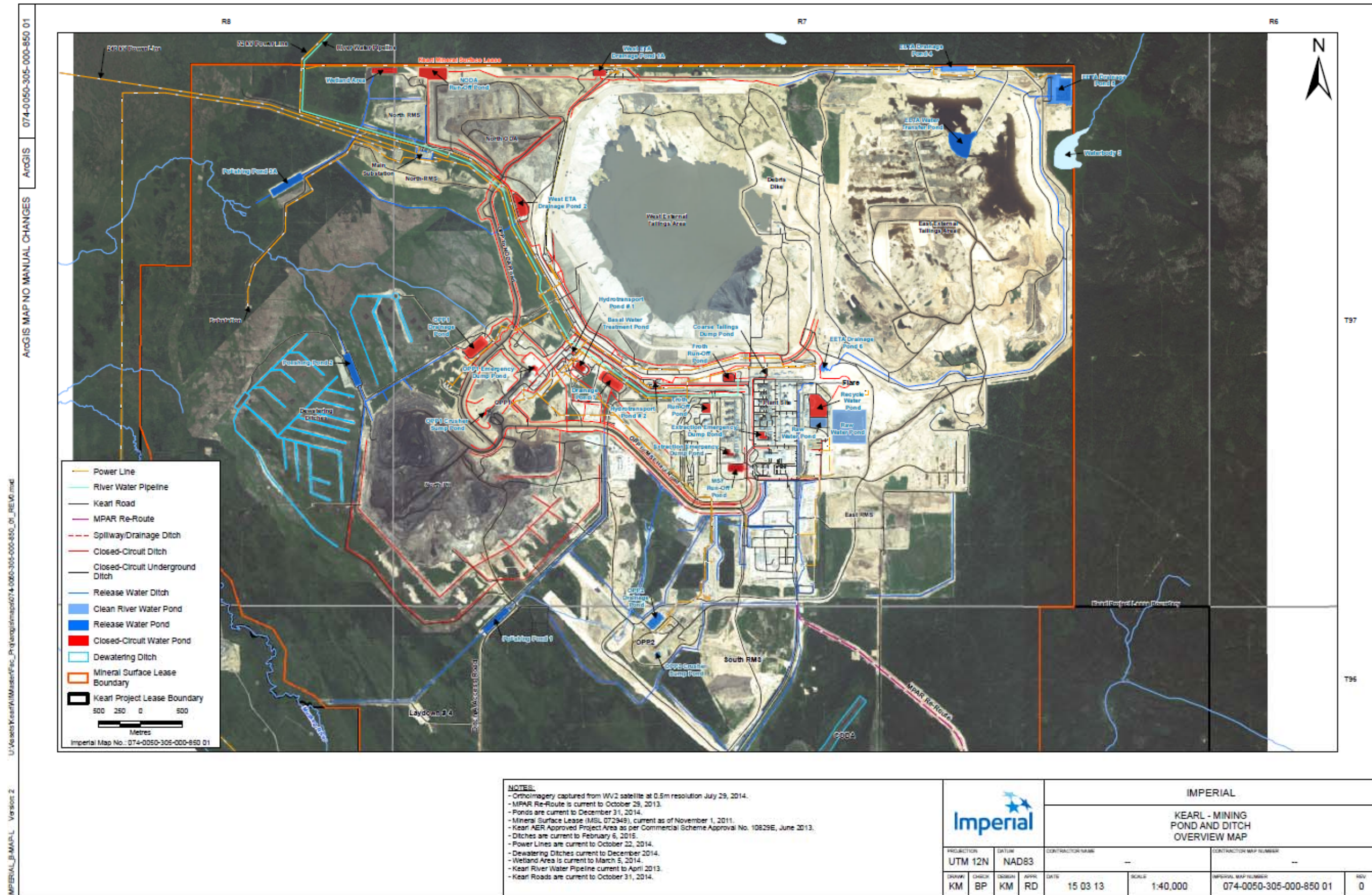
## **3.2 Introduction**

### **3.2.1 Site**

The northern extent of the oil sands lies 150 km south of the Peace – Athabasca Delta, the one of the world's largest deltas and a particularly important breeding site for waterfowl (Hennan & Munson 1979). The oil sands region is also at the confluence of all four continental flyways, and this leads to considerable migratory bird traffic near or directly above oil sands developments. This puts a large number of migrating birds in close proximity with water bodies on oil sands leases, including tailings and other ponds that contain the by-products of oil extraction, including bitumen or 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 PA ponds, as well as freshwater ponds on or near Kearl since 2011.

The Imperial Kearl site is located in the oil sands region, roughly 75 km north of Fort McMurray, Alberta. There are 14 ponds at Kearl that contain PA water. The combined total surface area of these ponds is almost 364 hectares, with the West ETA tailings pond alone accounting for 348 hectares. Two freshwater ponds were monitored throughout the 2014 season and had a combined total surface area of 31.8 hectares. Bird monitors began observation sessions at a third freshwater pond, the East ETA pond, partway through the 2014 season.

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).



### **3.2.2 Personnel**

Imperial personnel coordinated OSBCMP activities at the Kearl site, with bird monitoring and mortality search activities being conducted by qualified contractors and specialists. Two crews of three employees, each working a ten-day rotation, were responsible for bird monitoring and mortality searches. New-to-site employees complete a full rotation of on-site and in-classroom training with a mentor. In this period, the employee is familiarized with both the OSBCMP protocol and the locations of all ponds at the Kearl site, as well as all necessary site safety programs. Over the next two rotations, while obtaining mine driving experience, this employee works as a junior bird monitor and is coached by a more senior employee. After these first three rotations, assuming an appropriate degree of competence has been demonstrated; the employee may begin working alone as a bird monitor.

### **3.2.3 Management of Avian Attractants and Control of Hazards**

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 was 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 in August to minimize the potential for its use as forage habitat for cranes and geese or breeding habitat for sandpipers. Vegetation was removed using heavy equipment and work was completed over the course of approximately two weeks. Herbicides were not used in this process but are being considered as a potential tool for future vegetation removal efforts.

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.

Decoys and deterrents were not deployed at Muskeg Lake or the Raw Water Pond, both of which are freshwater ponds. Muskeg Lake is roughly 10 km from the plant site, and this distance is likely enough to prevent this pond from attracting waterfowl to the Kearl site itself. The Raw Water Pond, while adjacent to the Kearl plant, is roughly 2 km from the West ETA pond, which is the largest site of floating bitumen at Kearl. The Raw Water Pond does not represent a direct threat to waterfowl. On the morning of November 4<sup>th</sup>, roughly 300 waterfowl were observed resting on the Raw Water Pond, following a night of heavy fog. Aside from an additional six waterfowl on the West ETA, no other birds were observed onsite on the 4<sup>th</sup>. Imperial is engaged in a discussion with the OSBCMP on whether the absence of auditory bird deterrents or decoys at the Raw Water Pond may have made this site more attractive to descending waterfowl than the much larger West ETA tailings pond, which still featured an active deterrent system at the time.

Allowing birds to land at the Raw Water Pond may prevent mortalities, as they will avoid ponds that carry a risk of oiling.

Bird deterrents were installed in August, 2014 in the East ETA, which did not contain PA water but featured small pockets of freshwater and associated vegetation. These deterrents were installed for two reasons. First, the East ETA will contain PA water in the coming years, and pre-emptive deterrence of birds may reduce the number of nests initiated in the area, which in turn may reduce the number of birds returning to breed in the East ETA when bitumen is present. Second, the East ETA is less than a kilometer from the West ETA tailings pond, which has exhibited floating bitumen and poses a potential risk to migratory birds. Detering birds from the East ETA in 2014 may have helped reduce the number of birds observed at the nearby West ETA pond.

#### **3.2.4 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 2014 began on March 1<sup>st</sup>, and the system remained deployed until November 20<sup>th</sup> following signoff through the seasonal decommissioning approval process. Maps included in Appendix 3.A summarize the locations of bird deterrents deployed at Kearl. Deterrents remained in approximately the same location throughout the 2014 season (+/- 200m in order to accommodate dyke construction), although additional propane cannons were deployed at the West ETA in November in response to heightened bird activity in the region.

The West ETA, as the largest PA pond at the Kearl site in 2014, 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 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 air cannons and falcon kites. DeTect Inc. and monitoring personnel were responsible for the set-up and decommissioning of the radar system, and daily maintenance of the radar system and downloading of captured radar images.

The large size of the West ETA facilitated the use of watercraft as mobile deterrents. Two motorized 4.5 meter boats and an air boat allowed personnel to approach and deter birds that had landed on the water throughout the 2014 season. The rapid speed, loud noise, and considerable air disturbance generated by the air boat made it a considerably more effective deterrent than the other boats.

A second radar station and set of four LRADs was installed and operated at the East ETA in 2014, and will be utilized to deter birds from the area 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 and land-based visual deterrents (i.e., falcon kites and land effigies; Table 3.7). The OPP1 Crusher Sump Pond (0.03 ha surface area) and the OPP1 Emergency Dump Pond (0.06 ha surface area) were the only PA ponds that did not have any deployed deterrents.

One falcon kite was erected at the Raw Water Pond in order to discourage bird landings there; following common practice for the region, no auditory deterrents were installed despite the pond's relatively large size.

To further deter birds from landing at PA ponds, vegetation was removed from the shoreline wherever possible. With the exception of the West ETA, PA ponds were devoid of potential foraging or breeding habitat. At the West ETA, a few small muskeg mats rose to the surface of the pond over the course of the year but were removed before they could be utilized as breeding habitats by birds.

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 mid-October, overnight radar scans over the West ETA pond 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 concluded in mid-November, with deterrents being removed the following week. No deterrents were intentionally left on PA ponds over the winter.

**Table 3.6: Avian deterrents deployed at Kearl (as of Fall 2014)**

| <b>Deterrent Name</b>      | <b>Description</b>                                                         | <b>Stimuli</b>                    | <b>Sound Intensity at 1 m (dB)</b> | <b>Activation Control</b>                    | <b>Placement</b>     | <b>Number and Location</b>                                |
|----------------------------|----------------------------------------------------------------------------|-----------------------------------|------------------------------------|----------------------------------------------|----------------------|-----------------------------------------------------------|
| Merlin DeTect Radar System | Land-based radar detection system utilized to detect birds flying overhead | None, but linked to audio stimuli | N/A                                | N/A, controls activation of other deterrents | On land              | 2; one at West ETA, and one at East ETA (as of September) |
| Secondary Deterrent Unit   | Radar-linked, noise-emitting propane cannon; lasers                        | Audio                             | 100 - 130                          | Radar                                        | On land              | See Table 3.7                                             |
| Long Range Acoustic Device | Radar-linked sound-emitting speakers                                       | Audio                             | 149                                | Radar                                        | On land              | See Table 3.7                                             |
| Lasers                     | Light emitted from LRAD stations                                           | Visual                            | N/A                                | Radar                                        | On land              | See Table 3.7                                             |
| Cannon                     | Random-firing, noise-emitting propane cannon                               | Audio                             | 100 - 130                          | Random                                       | On land and on water | See Table 3.7                                             |
| Human Effigy               | Wire frame, high-visibility coat, hard hat                                 | Visual                            | N/A                                | N/A                                          | On land and on water | See Table 3.7                                             |
| Barrel Effigy              | Barrel raised above a platform                                             | Visual                            | N/A                                | N/A                                          | On water             | See Table 3.7                                             |
| Eagle Effigy               | Kite resembling a bird-of-prey                                             | Visual                            | N/A                                | N/A                                          | On land              | See Table 3.7                                             |

**Table 3.7: Number of avian radars and deterrents at process-affected ponds at Kearl (as of Fall 2014)**

| Pond Name <sup>1</sup>         | Pond Area (over water; ha) | Number of Radar(s) | Combined Audio & Visual Deterrents <sup>2</sup> |         |            |         | Audio-only Deterrents |         |            |         | Visual-only Deterrents |         |            |         | Total |                    |
|--------------------------------|----------------------------|--------------------|-------------------------------------------------|---------|------------|---------|-----------------------|---------|------------|---------|------------------------|---------|------------|---------|-------|--------------------|
|                                |                            |                    | Linked to Radar                                 |         | Not Linked |         | Linked to Radar       |         | Not Linked |         | Linked to Radar        |         | Not Linked |         | Units | Density (units/ha) |
|                                |                            |                    | Floating                                        | On Land | Floating   | On Land | Floating              | On Land | Floating   | On Land | Floating               | On Land | Floating   | On Land |       |                    |
| Basal Water Treatment Pond     | 0.61                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 1       | 0                      | 0       | 0          | 2       | 3     | 4.9                |
| Emergency Extraction Dump Pond | 0.32                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 0       | 0                      | 0       | 0          | 1       | 1     | 3.1                |
| Froth Run-off Pond             | 0.40                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 0       | 0                      | 0       | 0          | 3       | 3     | 7.5                |
| Hydrotransport Pond #1         | 0.03                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 0       | 0                      | 0       | 0          | 1       | 1     | 33.3               |
| Hydrotransport Pond #2         | 0.09                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 0       | 0                      | 0       | 0          | 1       | 1     | 11.1               |
| MSF Run-off Pond               | 1.5                        | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 1       | 0                      | 0       | 0          | 0       | 1     | 0.7                |
| NODA Runoff Pond               | 3.0                        | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 4       | 0                      | 0       | 0          | 2       | 6     | 2                  |
| OPP1 Crusher Sump              | 0.03                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 0       | 0                      | 0       | 0          | 0       | 0     | 0                  |
| OPP1 Drainage Pond             | 3.2                        | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 4       | 0                      | 0       | 0          | 1       | 5     | 1.6                |
| OPP1 Emergency Dump Pond       | 0.06                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 0       | 0                      | 0       | 0          | 0       | 0     | 0                  |
| Recycle Water Pond             | 4.5                        | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 2       | 0                      | 0       | 0          | 3       | 5     | 1.1                |
| West External Tailings Area    | 348                        | 1                  | 4                                               | 0       | 0          | 0       | 0                     | 3       | 20         | 32      | 0                      | 4       | 30         | 1       | 96    | 0.28               |
| West ETA Drainage Pond 1A      | 0.39                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 3       | 0                      | 0       | 0          | 0       | 3     | 7.7                |
| West ETA Drainage Pond 2       | 1.63                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 4       | 0                      | 0       | 0          | 0       | 4     | 2.5                |
| East External Tailings Area    | 75.13                      | 1                  | 5                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 10      | 0                      | 4       | 0          | 0       | 20    | 0.26               |
| Muskeg Lake                    | 30                         | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 0       | 0                      | 0       | 0          | 0       | 0     | 0                  |
| Raw Water Pond                 | 1.83                       | 0                  | 0                                               | 0       | 0          | 0       | 0                     | 0       | 0          | 0       | 0                      | 0       | 0          | 1       | 1     | 0.3                |

<sup>1</sup> Blue shading: freshwater ponds

<sup>2</sup> Combined deterrents count as one unit; individual components are described in Table 3.6

### **3.2.5 Hazing Procedures**

Hazing activities were conducted on a case-by-case basis. Bird monitoring crews continued monitoring sessions while hazing activities were taking place. When birds were observed on PA ponds during a monitoring session and hazing was possible, bird monitors contacted nearby operators or bird monitoring and mortality search personnel. This occurred most frequently at the West ETA pond, where monitoring sessions were 30 minutes long. If hazing had not taken place by the time the observation period had ended, or if operators could not arrive to haze the birds before the observation period finished, the bird monitors would proceed with hazing the birds after their monitoring period had ended. Hazing was also conducted on land and water when birds were reported by Contract Supervisors, IOL Tailings Operators and/or contractors.

Hazing at the West ETA pond was generally undertaken by the boat crew under direction of their shore watch, the bird monitor team, or their supervisor. Hazing was most typically undertaken using the airboat. When necessary, the boat crew would slowly position themselves between the targeted bird and floating bitumen, so as to direct the bird away from potential danger. Diving birds in particular were approached with caution when floating bitumen was nearby. The speed and noise of the airboat made it very effective at hazing birds.

Hazing at smaller PA ponds was conducted by monitors wielding air horns or, occasionally, handheld lasers. Approaching the birds was often enough to cause them to leave the area. Hazing typically took place within an hour of the birds being reported, but response times could vary depending on site access and the immediate availability of personnel.

## **3.3 Methods**

The methods utilized for bird monitoring and mortality searches at the Imperial Kearn site in 2014 followed the 2014 OSBCMP protocol (St Clair *et al.* 2014). Any deviations from the protocol are described in this section.

### **3.3.1 Pond Characteristics**

Imperial established the surface area, shoreline composition, and presence of emergent vegetation or islands at the ponds included in the 2014 OSBCMP using satellite imagery and ground truthing. Tables 3.8 and 3.9 summarize the characteristics of Kearn's ponds; definitions of these characteristics are available in the Glossary.

### **3.3.2 Bird Surveys**

The bird monitoring program commenced on April 16<sup>th</sup>, although monitors had been visiting and surveying the onsite ponds since April 1<sup>st</sup>. All 14 PA ponds were visited six times each week, per the 2014 protocol, except the following four: Hydrotransport Ponds 1 and 2, OPP1 Crusher Sump, and OPP1 Emergency Dump Pond. Imperial directed

that these ponds be visited once per week, as very little bird activity had been observed in 2013 (Adamek, C., pers. comm., 2014). Muskeg Lake and the East ETA, both freshwater ponds, were each visited twice per week. The East ETA was under construction for the first part of the 2014 season, and monitoring there did not commence until September. The bird monitors were directed by Imperial to visit a third freshwater pond, the Raw Water Pond, six times per week (Adamek, C., pers. comm., 2014). Appendix 3.A outlines the locations of ponds and survey sites on the Imperial Kearl site.

Three observers worked together during surveys early in the season, but as new workers became familiar with site safety regulations and the monitoring program itself, crews split into two groups in order to survey ponds earlier in the morning. Bird monitoring crews adhered to the daily start times outlined in the 2014 protocol and continued monitoring through the scheduled mid-summer break (July 7<sup>th</sup> to July 24<sup>th</sup>).

Aside from the changes in scheduling outlined above, the only significant deviation from the 2014 protocol was a series of changes in survey locations in the West ETA. Cell construction and beaching in the West ETA throughout 2014 at times rendered established survey sites inaccessible. Bird monitors recorded the GPS coordinates of new survey locations as they were visited, and informed the Program Manager of these changes.

### **3.3.3 Inter-observer Variability (IOV)**

Observers at the Kearl site are equipped with the required supplies and training in order to reduce variability between observers. Inter-observer variability (IOV) surveys were used as a training exercise at the Kearl site in 2014. The bird monitoring IOV teams consisted of three people instead of two because two would conduct the survey while the third monitored for wildlife hazards (i.e. bear presence at Muskeg Lake). The two bird monitors making observations would compare notes following the monitoring session and discuss the differences in their results. The outcomes of these discussions would be used to refine all subsequent monitoring sessions. Further clarity and training on the IOV program and its execution will occur in the spring of 2015 with the addition of assistance and expertise provided by biologists that work on the Kearl site.

### **3.3.4 Mortality Searches**

Mortality searches at the Kearl site adhered to the recommendations set forth in the 2014 protocol. Two monitors conducted mortality searches together. In addition, Imperial decided to conduct mortality searches at the Raw Water Pond, despite it being a freshwater pond. Searches could be conducted on foot at most locations, but an amphibious all-terrain vehicle (AATV - Argo) was required at the West ETA.

### **3.3.5 Incidental Observations and Reporting**

Incidental mortalities are reported directly to the on-site Environment and Regulatory Advisor.

### **3.4 Results**

#### **3.4.1 Pond Characteristics**

The areas covered at each survey station are shown in Table 3.8 and Appendix 3.A. The only PA pond which was not completely covered by the surrounding survey stations was the West ETA; the center of the pond is too distant to be adequately surveyed from the shore.

Five PA ponds consistently contained floating bitumen in 2014, summarized in Table 3.9. The OPP1 Emergency Dump Pond had the most extensive cover (75-100%), but the small total surface area of the pond; however, the actual area covered by bitumen was roughly 0.05 ha. Hydrotransport Pond #1, Hydrotransport Pond #2, and the Emergency Extraction Dump Pond each had less than 25% bitumen cover and a bitumen surface area of less than 0.1 ha. The West ETA held, by a margin, the largest quantity of floating bitumen at Kearl in 2014, with a mean coverage of almost 70 ha.

No ponds featured islands with appropriate nesting habitat or emergent vegetation in 2014 (Table 3.9). In addition, no sections of shoreline were vegetated at either PA or freshwater ponds. However, vegetation was present nearby at the West ETA (PA) as well as the East ETA and Muskeg Lake (both freshwater). At Muskeg Lake, tree cover was within 100 m of the shoreline in some places. Vegetation near the West ETA was removed throughout August.

**Table 3.8: Characteristics of survey stations monitored at Kearl in 2014**

| Pond Name <sup>1</sup>         | Survey Station ID    | Survey Area<br>(over water;<br>ha) | Island (ha) | Emergent<br>Veg. (ha) | Shoreline (m) |          |
|--------------------------------|----------------------|------------------------------------|-------------|-----------------------|---------------|----------|
|                                |                      |                                    |             |                       | Vegetated     | Non-veg. |
| Basal Water Treatment Pond     | Basal                | 0.61                               | 0           | 0                     | 0             | 350      |
| Emergency Extraction Dump Pond | E_Emerg_Runoff       | 0.32                               | 0           | 0                     | 0             | 350      |
| Froth Run-off Pond             | Froth_Runoff         | 0.40                               | 0           | 0                     | 0             | 380      |
| Hydrotransport Pond #1         | Hydro_Dump_1         | 0.03                               | 0           | 0                     | 0             | 120      |
| Hydrotransport Pond #2         | Hydro_Dump_2         | 0.09                               | 0           | 0                     | 0             | 140      |
| MSF Run-off Pond               | MSF                  | 1.5                                | 0           | 0                     | 0             | 520      |
| NODA Runoff Pond               | Temp_NODA_Runoff     | 3.0                                | 0           | 0                     | 0             | 870      |
| OPP1 Crusher Sump              | OPP1_Crusher_Sump    | 0.03                               | 0           | 0                     | 0             | 110      |
| OPP1 Drainage Pond             | ODP_Drainage         | 3.2                                | 0           | 0                     | 0             | 800      |
| OPP1 Emergency Dump Pond       | OPP1_Emerg_Dump      | 0.06                               | 0           | 0                     | 0             | 210      |
| Recycle Water Pond             | RCW                  | 4.5                                | 0           | 0                     | 0             | 830      |
| West External Tailings Area    | ETA 1*               | 20                                 | 0           | 0                     | 0             | 600      |
|                                | ETA Main             | 20                                 | 0           | 0                     | 0             | 650      |
|                                | ETA NE               | 38                                 | 0           | 0                     | 0             | 750      |
|                                | ETA NW               | 15                                 | 0           | 0                     | 0             | 500      |
|                                | ETA SW               | 30                                 | 0           | 0                     | 0             | 700      |
|                                | All Regular Stations | 103                                | 0           | 0                     | 0             | 2600     |
| West ETA Drainage Pond 1A      | W_ETA_Drainage_Pond1 | 0.39                               | 0           | 0                     | 0             | 400      |
| West ETA Drainage Pond 2       | W_ETA_Drainage_Pond2 | 1.63                               | 0           | 0                     | 0             | 690      |
| East External Tailings Area    | East_ETA NE          |                                    |             |                       |               |          |
|                                | East_ETA NW          |                                    |             |                       |               |          |
|                                | East_ETA SE          |                                    |             |                       |               |          |
|                                | East_ETA SW          |                                    |             |                       |               |          |
|                                | All Regular Stations | 75.13                              |             |                       |               |          |
| Muskeg Lake                    | KComp2               | 30                                 | 0           | 0                     |               | 3000     |
| Raw Water Pond                 | Raw_Water            | 1.83                               | 0           | 0                     | 0             | 570      |

<sup>1</sup> Blue shading: freshwater ponds

\* Alternative Survey Station (not included in total)

**Table 3.9: Characteristics of ponds monitored at Kearl in 2014**

| Pond Name <sup>1</sup><br>(Year of Origin) | Pond<br>Content      | Bitumen Cover                       |                                              | Pond Area<br>(over water;<br>ha) | Island<br>(ha) | Emergent<br>Veg. (ha) | Shoreline (m) |          |
|--------------------------------------------|----------------------|-------------------------------------|----------------------------------------------|----------------------------------|----------------|-----------------------|---------------|----------|
|                                            |                      | % <sup>2</sup> : Mode (Min-<br>Max) | Area <sup>3</sup> (ha):<br>Mean<br>(Min-Max) |                                  |                |                       | Vegetated     | Non-veg. |
| Basal Water Treatment Pond<br>(2012)       | Process-<br>affected | 0<br>(0 to 16-20)                   | 0                                            | 0.61                             | 0              | 0                     | 0             | 350      |
| Emergency Extraction Dump Pond<br>(2012)   | Process-<br>affected | 6-15<br>(0 to 76-100)               | 0.032                                        | 0.32                             | 0              | 0                     | 0             | 350      |
| Froth Run-off Pond<br>(2012)               | Process-<br>affected | 0<br>(0 to 6-15)                    | 0                                            | 0.40                             | 0              | 0                     | 0             | 380      |
| Hydrotransport Pond #1<br>(2012)           | Process-<br>affected | 1-5<br>(0 to 16-25)                 | 0.0009                                       | 0.03                             | 0              | 0                     | 0             | 120      |
| Hydrotransport Pond #2<br>(2012)           | Process-<br>affected | 6-15<br>(0 to 76-100)               | 0.009                                        | 0.09                             | 0              | 0                     | 0             | 140      |
| MSF Run-off Pond<br>(2012)                 | Process-<br>affected | 0                                   | 0                                            | 1.5                              | 0              | 0                     | 0             | 520      |
| NODA Runoff Pond<br>(2012)                 | Process-<br>affected | 0<br>(0 to 6-15)                    | 0                                            | 3.0                              | 0              | 0                     | 0             | 870      |
| OPP1 Crusher Sump<br>(2012)                | Process-<br>affected | 0<br>(0 to 16-25)                   | 0                                            | 0.03                             | 0              | 0                     | 0             | 110      |
| OPP1 Drainage Pond<br>(2012)               | Process-<br>affected | 0<br>(0 to 16-25)                   | 0                                            | 3.2                              | 0              | 0                     | 0             | 800      |
| OPP1 Emergency Dump Pond<br>(2012)         | Process-<br>affected | 76-100<br>(1-5 to 76-100)           | 0.05                                         | 0.06                             | 0              | 0                     | 0             | 210      |
| Recycle Water Pond<br>(2012)               | Process-<br>affected | 0<br>(0 to 6-15)                    | 0                                            | 4.5                              | 0              | 0                     | 0             | 830      |
| West External Tailings Area<br>(2013)      | Process-<br>affected | 16-25<br>(0 to 26-50)               | 69.6                                         | 103                              | 0              | 0                     | 0             | 2600     |
| West ETA Drainage Pond 1A<br>(2013)        | Process-<br>affected | 0<br>(0 to 1-5)                     | 0                                            | 0.39                             | 0              | 0                     | 0             | 400      |
| West ETA Drainage Pond 2<br>(2012)         | Process-<br>affected | 0<br>(0 to 16-25)                   | 0                                            | 1.63                             | 0              | 0                     | 0             | 690      |
| East External Tailings Area                | Freshwater           | 0                                   | 0                                            | 75.13                            |                |                       |               |          |
| Muskeg Lake                                | Freshwater           | 0                                   | 0                                            | 30                               | 0              | 0                     | 0             | 3000     |
| Raw Water Pond                             | Freshwater           | 0                                   | 0                                            | 1.83                             | 0              | 0                     | 0             | 570      |

<sup>1</sup> Blue shading: freshwater ponds. <sup>2</sup> Estimated during bird surveys. <sup>3</sup> Estimated from satellite imagery

### 3.4.2 Bird Observations

The numbers and duration of surveys conducted at each survey station are summarized in Table 3.10, while surveys are summarized by pond in Table 3.11. Bird surveys began in April for all ponds except the East ETA, at which surveys began in September when the area became accessible. Due to site access issues, an alternate survey site at the West ETA (ETA 1) was utilized 38 times in 2014. In terms of completing scheduled surveys, the NODA Run-off Pond was the least-visited pond due to construction and access issues, with 77% of scheduled surveys completed. The mean number of landed waterbirds observed by hour after sunrise is provided in Appendix 3.B.

**Table 3.10: Bird survey effort by station at Kearl in 2014**

| Pond Name <sup>1</sup>         | Survey Duration (min) | Survey Station ID    | Survey Area (over water; ha) | # Surveys Conducted in 2014 |
|--------------------------------|-----------------------|----------------------|------------------------------|-----------------------------|
| Basal Water Treatment Pond     | 10                    | Basal                | 0.61                         | 170                         |
| Emergency Extraction Dump Pond | 10                    | E_Emerg_Runoff       | 0.32                         | 142                         |
| Froth Run-off Pond             | 10                    | Froth_Runoff         | 0.40                         | 163                         |
| Hydrotransport Pond #1         | 10                    | Hydro_Dump_1         | 0.03                         | 24                          |
| Hydrotransport Pond #2         | 10                    | Hydro_Dump_2         | 0.09                         | 25                          |
| MSF Run-off Pond               | 10                    | MSF                  | 1.5                          | 157                         |
| NODA Runoff Pond               | 10                    | Temp_NODA_Runoff     | 3.0                          | 135                         |
| OPP1 Crusher Sump              | 10                    | OPP1_Crusher_Sump    | 0.03                         | 23                          |
| OPP1 Drainage Pond             | 10                    | ODP_Drainage         | 3.2                          | 160                         |
| OPP1 Emergency Dump Pond       | 10                    | OPP1_Emerg_Dump      | 0.06                         | 24                          |
| Recycle Water Pond             | 10                    | RCW                  | 4.5                          | 169                         |
| West External Tailings Area    | 30                    | ETA 1                | 20                           | 38                          |
|                                |                       | ETA Main             | 20                           | 154                         |
|                                |                       | ETA NE               | 38                           | 165                         |
|                                |                       | ETA NW               | 15                           | 130                         |
|                                |                       | ETA SW               | 30                           | 161                         |
| West ETA Drainage Pond 1A      | 10                    | W_ETA_Drainage_Pond1 | 0.39                         | 163                         |
| West ETA Drainage Pond 2       | 10                    | W_ETA_Drainage_Pond2 | 1.63                         | 159                         |
| East External Tailings Area    | 30                    | East_ETA NE          |                              | 31                          |
|                                |                       | East_ETA NW          |                              | 31                          |
|                                |                       | East_ETA SE          |                              | 26                          |
|                                |                       | East_ETA SW          |                              | 29                          |
| Muskeg Lake                    | 30*                   | KComp2               | 30                           | 52                          |
| Raw Water Pond                 | 10                    | Raw_Water            | 1.83                         | 157                         |

<sup>1</sup> Blue shading: freshwater ponds

\* At Muskeg Lake, there were 48 surveys of 30 min and four surveys of 10 min, due to human error

**Table 3.11: Bird survey effort by pond at Kearl in 2014**

| Pond Name <sup>1</sup>         | # Survey Stations | Survey Area (over water; ha) | Survey Area as % of Pond Area (over water; ha) | Duration of Surveys (min) | Scheduled Monitoring Frequency (days/week) | # Surveys Conducted in 2014 | % Days with all scheduled surveys conducted |
|--------------------------------|-------------------|------------------------------|------------------------------------------------|---------------------------|--------------------------------------------|-----------------------------|---------------------------------------------|
| Basal Water Treatment Pond     | 1                 | 0.61                         | 100                                            | 10                        | 6                                          | 170                         | 100                                         |
| Emergency Extraction Dump Pond | 1                 | 0.32                         | 100                                            | 10                        | 6                                          | 142                         | 82                                          |
| Froth Run-off Pond             | 1                 | 0.40                         | 100                                            | 10                        | 6                                          | 163                         | 96                                          |
| Hydrotransport Pond #1         | 1                 | 0.03                         | 100                                            | 10                        | 1                                          | 24                          | 85                                          |
| Hydrotransport Pond #2         | 1                 | 0.09                         | 100                                            | 10                        | 1                                          | 25                          | 88                                          |
| MSF Run-off Pond               | 1                 | 1.5                          | 100                                            | 10                        | 6                                          | 157                         | 92                                          |
| NODA Runoff Pond               | 1                 | 3.0                          | 100                                            | 10                        | 6                                          | 135                         | 77                                          |
| OPP1 Crusher Sump              | 1                 | 0.03                         | 100                                            | 10                        | 1                                          | 23                          | 81                                          |
| OPP1 Drainage Pond             | 1                 | 3.2                          | 100                                            | 10                        | 6                                          | 160                         | 94                                          |
| OPP1 Emergency Dump Pond       | 1                 | 0.06                         | 100                                            | 10                        | 1                                          | 24                          | 85                                          |
| Recycle Water Pond             | 1                 | 4.5                          | 100                                            | 10                        | 6                                          | 169                         | 99                                          |
| West External Tailings Area    | 4                 | 103                          | 29.6                                           | 30                        | 6                                          | 648                         | 95                                          |
| West ETA Drainage Pond 1A      | 1                 | 0.39                         | 100                                            | 10                        | 6                                          | 163                         | 95                                          |
| West ETA Drainage Pond 2       | 1                 | 1.63                         | 100                                            | 10                        | 6                                          | 159                         | 93                                          |
| East External Tailings Area**  | 4                 | 75.13                        | 100                                            | 30                        | 6                                          | 117                         | 101                                         |
| Muskeg Lake                    | 1                 | 30                           | 100                                            | 30*                       | 2                                          | 52                          | 90                                          |
| Raw Water Pond                 | 1                 | 1.83                         | 100                                            | 10                        | 6                                          | 157                         | 92                                          |

<sup>1</sup> Blue shading: freshwater ponds

\* At Muskeg Lake, there were 48 surveys of 30 min and four surveys of 10 min, due to human error

\*\* New pond; monitoring started in September 2014

The number of observations by pond and guild is summarized in Table 3.12. No landed birds were observed at three PA ponds (Hydrotransport Pond #1, OPP1 Crusher Sump, OPP1 Emergency Dump Pond). Five PA ponds featured more than 100 observed landed birds in 2014 (Basal Water Treatment Pond, MSF Run-off Pond, NODA Runoff Pond, West ETA, West ETA Drainage Pond 2). Of these five ponds, monitors detected more landed birds at the West ETA (1,016) than the remaining four ponds combined. Almost half of all landed birds at PA ponds were detected at the West ETA. In addition, more birds were observed flying over the West ETA (3,610) than at all other PA and freshwater ponds combined (3,106). The West ETA was monitored from four survey station per day and for 30 minutes at each station, making it the most closely monitored pond at Kearl. As such, a higher number of birds being observed at this pond is to be expected.

Approximately 55 landed birds were observed per hectare (1,761 birds in total) at the three freshwater ponds surveyed in 2014 (Raw Water Pond, Muskeg Lake, East ETA). In comparison, approximately 17 landed birds were observed per hectare at 14 PA ponds. The most active freshwater pond was Muskeg Lake (1,058 landed birds, 468 flying birds).

Of ponds visited through the entire 2014 season, the West ETA was the most active PA pond, and the most active pond overall. It was also, by a wide margin, the largest pond visited by Kearl bird monitors in 2014 (see Table 3.7). The second-most active pond at Kearl was Muskeg Lake, which is also the second-largest pond overall.

Of the target guilds, the largest numbers of landed dabblers (340), divers (396), and gulls (177) all appeared at Muskeg Lake, a freshwater pond. The most landed waders were detected at the Basal Water Treatment Pond and West ETA Drainage Pond 2, both PA ponds (145 each). Total number of landed non-target birds observed at the East ETA was 465, which is the highest number of landed non-target birds at any pond despite the East ETA not being visited until September. More members of each guild were observed flying over the West ETA than at any other pond.

On average, more landed birds of each guild were observed per survey at freshwater ponds than at PA ponds (see Table 3.13). At PA ponds, a landed bird was detected once every 1.67 surveys, while 8.72 birds were detected per survey at freshwater ponds. On average, fewer than five landed waterbirds were detected per survey at each pond except at Muskeg Lake, which averaged 19.91 landed waterbirds per survey (see Figure 3.2).

More oiled birds were observed at West ETA Drainage Pond 2 per survey (0.182) than at any other pond (see Table 3.14). However, this value was exceeded at two survey sites in the West ETA (0.224 at ETA NE; 0.254 at ETA NW); the overall average of the West ETA was 0.164. Across all PA ponds, the average number of oiled birds detected per survey was 0.034. The average number of oiled birds detected at freshwater ponds per survey in 2014 was 0.006. While birds could not come into contact with bitumen at freshwater ponds, they could become oiled elsewhere before traveling to and being

observed at a freshwater pond. The mean number of oiled birds per survey at each survey station is illustrated in Figure 3.3.

Appendix 3.C summarizes the number of bird observations at Kearl PA ponds in 2014. Among landed birds, killdeer were detected most often by bird monitors (156 observations). Killdeer, sandhill cranes, and Baird's sandpipers, all wading species, were most commonly identified as being oiled. Despite this, only one individual of these three species resulted in a mortality. Canada geese and snow geese flew overhead in the largest numbers (1358 and 1208, respectively). Canada geese accounted for 16 detected mortalities. Four were found during searches and another 12 were found incidentally, the most of any species at Kearl.

**Table 3.12: Number of bird observations by pond and guild at Kearl in 2014<sup>1</sup>**

| Pond Name <sup>2</sup>                | Dabblers   |              | Divers     |           | Waders     |            | Gulls      |            | Non-target |              | Total <sup>3</sup> |              |
|---------------------------------------|------------|--------------|------------|-----------|------------|------------|------------|------------|------------|--------------|--------------------|--------------|
|                                       | Landed     | Flew Over    | Landed     | Flew Over | Landed     | Flew Over  | Landed     | Flew Over  | Landed     | Flew Over    | Landed             | Flew Over    |
| Basal Water Treatment Pond            | 6          | 0            | 30         | 2         | 145        | 1          | 4          | 3          | 35         | 121          | 220                | 128          |
| Emergency Extraction Dump Pond        | 0          | 0            | 0          | 0         | 0          | 0          | 0          | 0          | 11         | 35           | 11                 | 35           |
| Froth Run-off Pond                    | 0          | 0            | 2          | 0         | 2          | 0          | 0          | 2          | 1          | 27           | 5                  | 29           |
| Hydrotransport Pond #1                | 0          | 0            | 0          | 0         | 0          | 0          | 0          | 0          | 0          | 9            | 0                  | 9            |
| Hydrotransport Pond #2                | 0          | 0            | 0          | 0         | 1          | 0          | 0          | 0          | 0          | 0            | 1                  | 0            |
| MSF Run-off Pond                      | 18         | 40           | 62         | 0         | 59         | 1          | 29         | 2          | 30         | 275          | 198                | 318          |
| NODA Runoff Pond                      | 20         | 30           | 42         | 0         | 42         | 12         | 2          | 0          | 191        | 17           | 297                | 64           |
| OPP1 Crusher Sump                     | 0          | 0            | 0          | 0         | 0          | 1          | 0          | 1          | 0          | 6            | 0                  | 8            |
| OPP1 Drainage Pond                    | 0          | 89           | 0          | 1         | 22         | 5          | 1          | 30         | 13         | 55           | 36                 | 180          |
| OPP1 Emergency Dump Pond              | 0          | 0            | 0          | 0         | 0          | 0          | 0          | 0          | 0          | 10           | 0                  | 10           |
| Recycle Water Pond                    | 2          | 200          | 1          | 0         | 1          | 5          | 6          | 16         | 22         | 190          | 32                 | 411          |
| West External Tailings Area           | 59         | 1,717        | 365        | 58        | 141        | 170        | 153        | 171        | 206        | 1,456        | 1,016              | 3,610        |
| West ETA Drainage Pond 1A             | 5          | 365          | 0          | 0         | 13         | 1          | 0          | 0          | 9          | 44           | 27                 | 410          |
| West ETA Drainage Pond 2              | 3          | 167          | 7          | 0         | 145        | 6          | 1          | 4          | 68         | 135          | 224                | 312          |
| <b>Total (Process-affected Ponds)</b> | <b>113</b> | <b>2,608</b> | <b>509</b> | <b>61</b> | <b>571</b> | <b>202</b> | <b>196</b> | <b>229</b> | <b>586</b> | <b>2,380</b> | <b>2,067</b>       | <b>5,524</b> |
| East External Tailings Area           | 65         | 110          | 0          | 17        | 9          | 3          | 0          | 1          | 465        | 318          | 611                | 432          |
| Muskeg Lake                           | 340        | 168          | 396        | 16        | 121        | 38         | 177        | 61         | 23         | 132          | 1,058              | 468          |
| Raw Water Pond                        | 1          | 0            | 8          | 0         | 20         | 8          | 13         | 6          | 50         | 278          | 92                 | 292          |
| <b>Total (Freshwater Ponds)</b>       | <b>406</b> | <b>278</b>   | <b>421</b> | <b>33</b> | <b>150</b> | <b>49</b>  | <b>190</b> | <b>68</b>  | <b>538</b> | <b>728</b>   | <b>1,761</b>       | <b>1,192</b> |

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times

<sup>2</sup> Blue shading: freshwater ponds

<sup>3</sup> Includes unknown duck species (which may be dabblers or divers)

**Table 3.13: Mean number of landed birds per survey at Kearl in 2014**

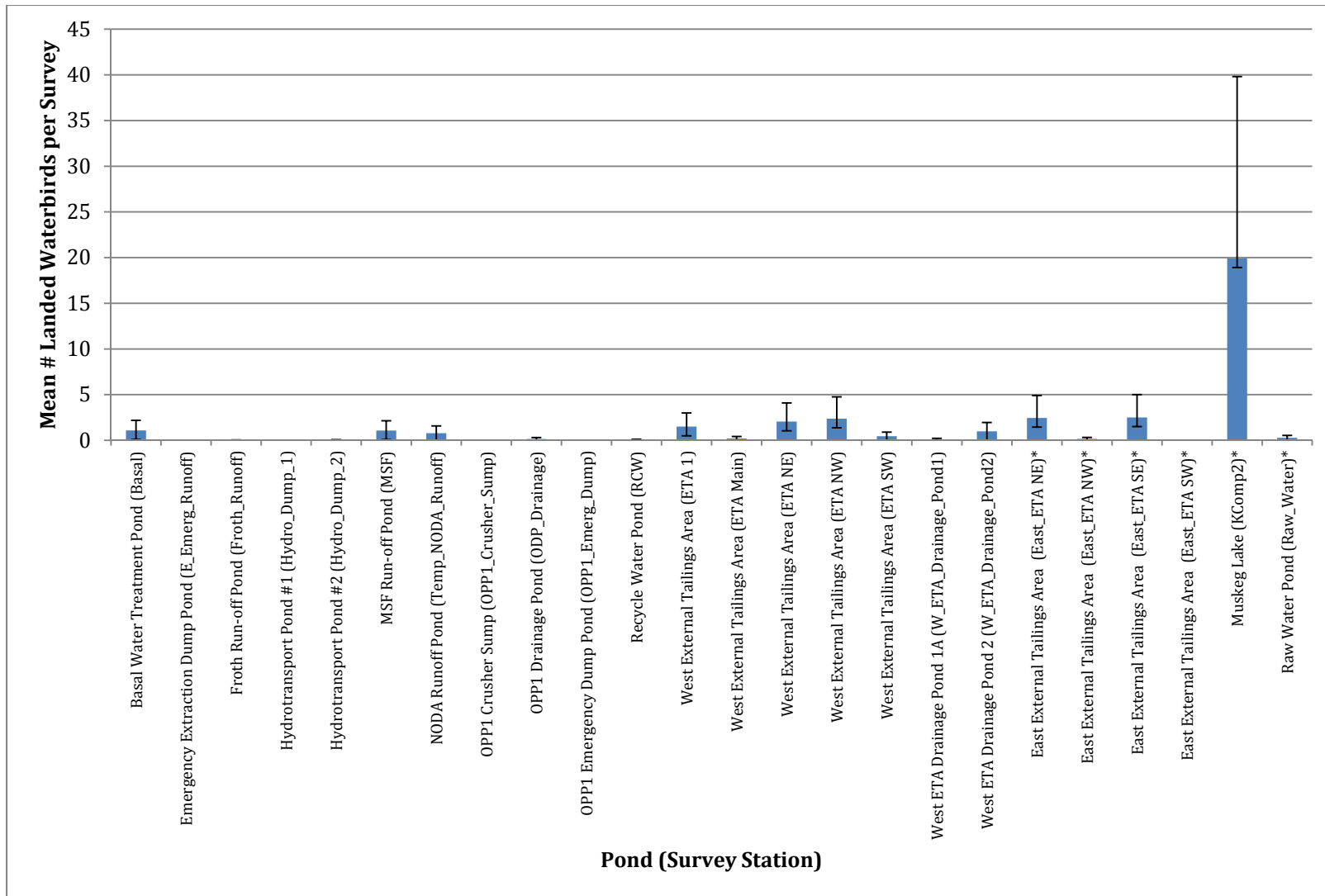
| Pond Name <sup>1</sup>            | Survey Station ID        | Dabblers    | Divers      | Waders      | Gulls       | Non-target Guilds | All Guilds <sup>2</sup> |
|-----------------------------------|--------------------------|-------------|-------------|-------------|-------------|-------------------|-------------------------|
| Basal Water Treatment Pond        | Basal                    | 0.04        | 0.18        | 0.85        | 0.02        | 0.21              | 1.29                    |
| Emergency Extraction Dump Pond    | E_Emerg_Runoff           | 0           | 0           | 0           | 0           | 0.08              | 0.08                    |
| Froth Run-off Pond                | Froth_Runoff             | 0           | 0.01        | 0.01        | 0           | 0.01              | 0.03                    |
| Hydrotransport Pond #1            | Hydro_Dump_1             | 0           | 0           | 0           | 0           | 0                 | 0                       |
| Hydrotransport Pond #2            | Hydro_Dump_2             | 0           | 0           | 0.04        | 0           | 0                 | 0.04                    |
| MSF Run-off Pond                  | MSF                      | 0.11        | 0.39        | 0.38        | 0.18        | 0.19              | 1.26                    |
| NODA Runoff Pond                  | Temp_NODA_Runoff         | 0.15        | 0.31        | 0.31        | 0.01        | 1.41              | 2.20                    |
| OPP1 Crusher Sump                 | OPP1_Crusher_Sump        | 0           | 0           | 0           | 0           | 0                 | 0                       |
| OPP1 Drainage Pond                | ODP_Drainage             | 0           | 0           | 0.14        | 0.01        | 0.08              | 0.23                    |
| OPP1 Emergency Dump Pond          | OPP1_Emerg_Dump          | 0           | 0           | 0           | 0           | 0                 | 0                       |
| Recycle Water Pond                | RCW                      | 0.01        | 0.01        | 0.01        | 0.04        | 0.13              | 0.19                    |
| West External Tailings Area       | ETA 1                    | 0.45        | 0.24        | 0.21        | 0.55        | 0.13              | 1.63                    |
|                                   | ETA Main                 | 0.02        | 0.12        | 0.03        | 0.05        | 0.54              | 0.75                    |
|                                   | ETA NE                   | 0.13        | 0.88        | 0.42        | 0.61        | 0.22              | 2.27                    |
|                                   | ETA NW                   | 0.11        | 1.24        | 0.22        | 0.14        | 0.54              | 2.92                    |
|                                   | ETA SW                   | 0.02        | 0.19        | 0.19        | 0.04        | 0.07              | 0.52                    |
|                                   | Mean across surveys      | 0.09        | 0.56        | 0.22        | 0.24        | 0.32              | 1.57                    |
| West ETA Drainage Pond 1A         | W_ETA_Drainage_Pond1     | 0.03        | 0           | 0.08        | 0           | 0.06              | 0.17                    |
| West ETA Drainage Pond 2          | W_ETA_Drainage_Pond2     | 0.02        | 0.04        | 0.91        | 0.01        | 0.43              | 1.41                    |
| <b>All Process-affected Ponds</b> | <b>Mean across ponds</b> | <b>0.03</b> | <b>0.11</b> | <b>0.21</b> | <b>0.04</b> | <b>0.21</b>       | <b>0.60</b>             |
| East External Tailings Area       | East_ETA NE              | 1.74        | 0.42        | 0.29        | 0           | 1.03              | 3.48                    |
|                                   | East_ETA NW              | 0.03        | 0.13        | 0           | 0           | 0.23              | 0.39                    |
|                                   | East_ETA SE              | 0.38        | 0           | 0           | 0           | 14.50             | 17.00                   |
|                                   | East_ETA SW              | 0           | 0           | 0           | 0           | 1.69              | 1.69                    |
|                                   | Mean across surveys      | 0.56        | 0.15        | 0.08        | 0           | 3.97              | 5.22                    |
| Muskeg Lake                       | KComp2                   | 6.54        | 7.62        | 2.33        | 3.40        | 0.44              | 20.35                   |
| Raw Water Pond                    | Raw_Water                | 0.01        | 0.05        | 0.13        | 0.08        | 0.32              | 0.59                    |
| <b>All Freshwater Ponds</b>       | <b>Mean across ponds</b> | <b>2.37</b> | <b>2.60</b> | <b>0.84</b> | <b>1.16</b> | <b>1.58</b>       | <b>8.72</b>             |

<sup>1</sup> Blue shading: freshwater ponds. <sup>2</sup> Includes unknown duck species (which may be dabblers or divers).

**Table 3.14: Mean number of oiled birds per survey at Kearl in 2014**

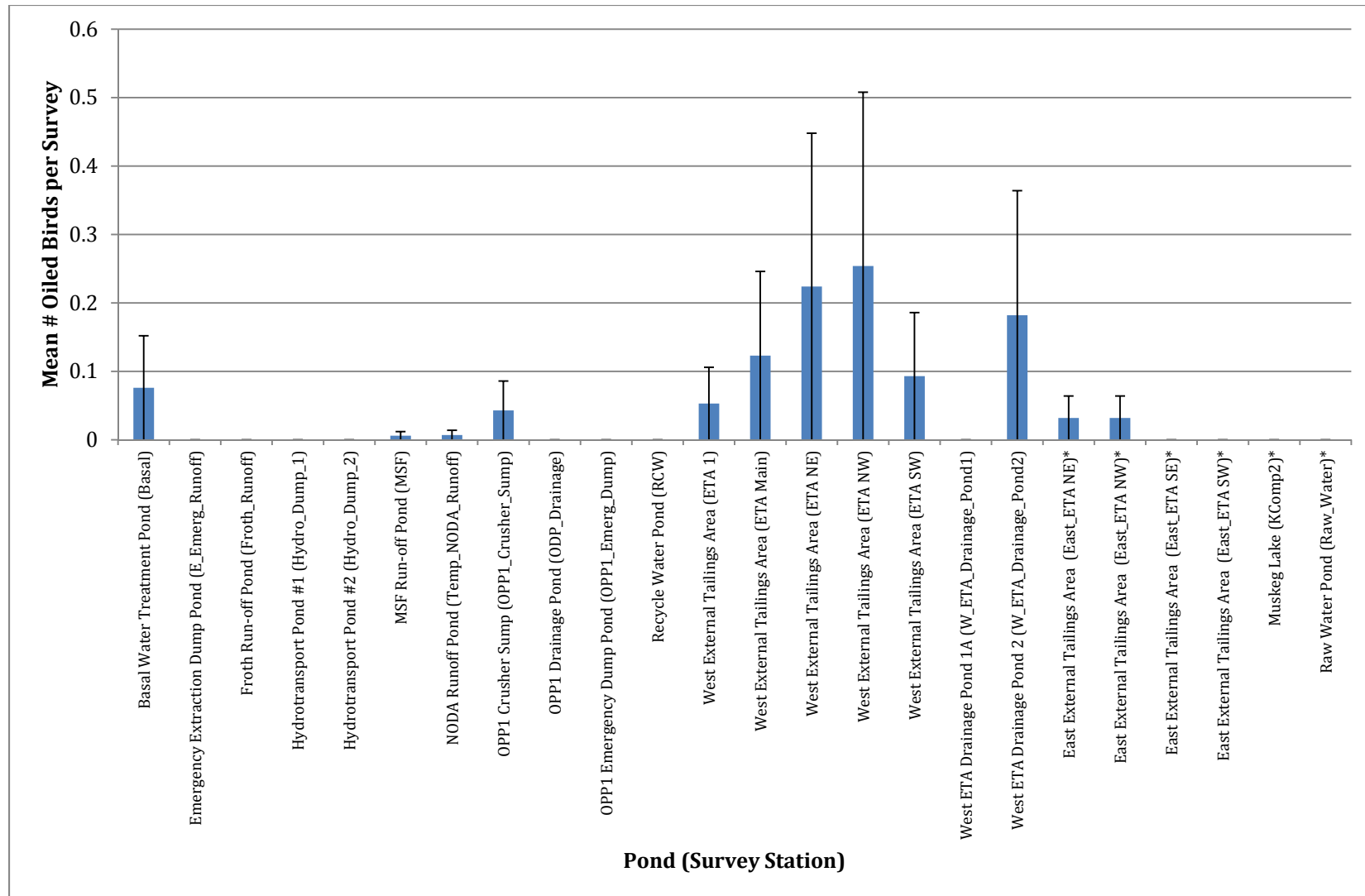
| Pond Name <sup>1</sup>            | Survey Station ID        | Dabblers     | Divers       | Waders       | Gulls        | Non-target Guilds | All Guilds <sup>2</sup> |
|-----------------------------------|--------------------------|--------------|--------------|--------------|--------------|-------------------|-------------------------|
| Basal Water Treatment Pond        | Basal                    | 0            | 0            | 0.076        | 0            | 0                 | 0.076                   |
| Emergency Extraction Dump Pond    | E_Emerg_Runoff           | 0            | 0            | 0            | 0            | 0                 | 0                       |
| Froth Run-off Pond                | Froth_Runoff             | 0            | 0            | 0            | 0            | 0                 | 0                       |
| Hydrotransport Pond #1            | Hydro_Dump_1             | 0            | 0            | 0            | 0            | 0                 | 0                       |
| Hydrotransport Pond #2            | Hydro_Dump_2             | 0            | 0            | 0            | 0            | 0                 | 0                       |
| MSF Run-off Pond                  | MSF                      | 0            | 0            | 0.006        | 0            | 0                 | 0.006                   |
| NODA Runoff Pond                  | Temp_NODA_Runoff         | 0.007        | 0            | 0            | 0            | 0                 | 0.007                   |
| OPP1 Crusher Sump                 | OPP1_Crusher_Sump        | 0            | 0            | 0.043        | 0            | 0                 | 0.043                   |
| OPP1 Drainage Pond                | ODP_Drainage             | 0            | 0            | 0            | 0            | 0                 | 0                       |
| OPP1 Emergency Dump Pond          | OPP1_Emerg_Dump          | 0            | 0            | 0            | 0            | 0                 | 0                       |
| Recycle Water Pond                | RCW                      | 0            | 0            | 0            | 0            | 0                 | 0                       |
| West External Tailings Area       | ETA 1                    | 0.053        | 0            | 0            | 0            | 0                 | 0.053                   |
|                                   | ETA Main                 | 0.019        | 0.039        | 0.019        | 0.032        | 0.013             | 0.123                   |
|                                   | ETA NE                   | 0.061        | 0.012        | 0.145        | 0.006        | 0                 | 0.224                   |
|                                   | ETA NW                   | 0.023        | 0            | 0.031        | 0            | 0                 | 0.254                   |
|                                   | ETA SW                   | 0.012        | 0.012        | 0.025        | 0.025        | 0.019             | 0.093                   |
|                                   | Mean across surveys      | 0.031        | 0.015        | 0.054        | 0.015        | 0.008             | 0.164                   |
| West ETA Drainage Pond 1A         | W_ETA_Drainage_Pond1     | 0            | 0            | 0            | 0            | 0                 | 0                       |
| West ETA Drainage Pond 2          | W_ETA_Drainage_Pond2     | 0            | 0            | 0.182        | 0            | 0                 | 0.182                   |
| <b>All Process-affected Ponds</b> | <b>Mean across ponds</b> | <b>0.003</b> | <b>0.001</b> | <b>0.026</b> | <b>0.001</b> | <b>0.001</b>      | <b>0.034</b>            |
| East External Tailings Area       | East_ETA NE              | 0.032        | 0            | 0            | 0            | 0                 | 0.032                   |
|                                   | East_ETA NW              | 0.032        | 0            | 0            | 0            | 0                 | 0.032                   |
|                                   | East_ETA SE              | 0            | 0            | 0            | 0            | 0                 | 0                       |
|                                   | East_ETA SW              | 0            | 0            | 0            | 0            | 0                 | 0                       |
|                                   | Mean across surveys      | 0.017        | 0            | 0            | 0            | 0                 | 0.017                   |
| Muskeg Lake                       | KComp2                   | 0            | 0            | 0            | 0            | 0                 | 0                       |
| Raw Water Pond                    | Raw_Water                | 0            | 0            | 0            | 0            | 0                 | 0                       |
| <b>All Freshwater Ponds</b>       | <b>Mean across ponds</b> | <b>0.006</b> | <b>0</b>     | <b>0</b>     | <b>0</b>     | <b>0</b>          | <b>0.006</b>            |

<sup>1</sup> Blue shading: freshwater ponds. <sup>2</sup> Includes unknown duck species (which may be dabblers or divers)



\* Freshwater Ponds.

**Figure 3.2: Mean number of landed waterbirds per survey at Kearl in 2014.**



\* Freshwater Ponds.

**Figure 3.3: Mean number of oiled birds per survey at Kearsarge in 2014.**

Three broods, all killdeer, were observed at PA ponds during bird surveys at Kearl in 2014 (Table 3.15). Two of the killdeer broods were found at West ETA Drainage Pond 2, while the third was at the Temporary NODA Pond.

**Table 3.15: Brood observations by species at process-affected ponds at Kearl in 2014**

| Species  | # Brood Observations <sup>1</sup> |
|----------|-----------------------------------|
| Killdeer | 3                                 |

<sup>1</sup> Each brood may contain one to multiple chicks; broods may be observed repeatedly and thus be counted multiple times

### 3.4.3 Inter-observer Variability

No comparison surveys were completed at the Imperial Kearl site in 2014.

### 3.4.4 Mortalities

The mortality search effort at Kearl is summarized in Table 3.16. In total, 38.8 hours were spent and 180.2 km covered searching for mortalities at PA ponds, while a further 1.3 hours and 6.3 km were spent at the Raw Water Pond, a freshwater pond near the plant. Figure 3.4 illustrates the relationship between pond area, mortality search effort, and mortality search results. The number of days on which mortality searches were conducted remained roughly the same for all ponds, regardless of surface area. For ponds with less than 10 ha surface area, the total number of hours spent searching and the total distance searched were roughly equivalent. At the West ETA, which featured 103 ha of survey area over water, more hours were dedicated to mortality searches (16.5, compared to 2.6 at the Froth Run-off Pond), and a greater distance was covered during these searches (116.2 km, compared to 9.8 at West ETA Drainage Pond 2).

**Table 3.16: Mortality search effort at Kearl in 2014<sup>1</sup>**

| Pond Name <sup>2</sup>                | # Days Searched | Boat        |              | Walk        |             | Truck       |             | Total       |              |
|---------------------------------------|-----------------|-------------|--------------|-------------|-------------|-------------|-------------|-------------|--------------|
|                                       |                 | h           | km           | h           | km          | h           | km          | h           | km           |
| Basal Water Treatment Pond            | 14              | 0           | 0            | 0.6         | 1.9         | 0.9         | 4.1         | 1.5         | 6.0          |
| Emergency Extraction Dump Pond        | 11              | 0           | 0            | 0.7         | 1.2         | 0.6         | 1.6         | 1.3         | 2.7          |
| Froth Run-off Pond                    | 12              | 0           | 0            | 2.6         | 4.7         | 0.1         | 0.4         | 2.6         | 5.2          |
| Hydrotransport Pond #1                | 13              | 0           | 0            | 1.2         | 1.5         | 0           | 0           | 1.2         | 1.5          |
| Hydrotransport Pond #2                | 11              | 0           | 0            | 1.4         | 1.3         | 0           | 0           | 1.4         | 1.3          |
| MSF Run-off Pond                      | 13              | 0           | 0            | 1.7         | 2.7         | 0           | 0           | 1.7         | 2.7          |
| NODA Runoff Pond                      | 10              | 0           | 0            | 0.5         | 1.8         | 1.2         | 6.8         | 1.7         | 8.6          |
| OPP1 Crusher Sump                     | 13              | 0           | 0            | 1.3         | 0.7         | 0           | 0           | 1.3         | 0.7          |
| OPP1 Drainage Pond                    | 12              | 0           | 0            | 0.9         | 2.3         | 1.1         | 5.5         | 2.0         | 7.8          |
| OPP1 Emergency Dump Pond              | 13              | 0           | 0            | 0.3         | 0.5         | 1.1         | 1.9         | 1.4         | 2.4          |
| Recycle Water Pond                    | 14              | 0           | 0            | 0.7         | 2.1         | 1.1         | 7.5         | 1.8         | 9.6          |
| West External Tailings Area           | 13              | 12.4        | 105.2        | 0           | 0           | 4.1         | 11.0        | 16.5        | 116.2        |
| West ETA Drainage Pond 1A             | 14              | 0           | 0            | 0.8         | 1.7         | 1.3         | 4.0         | 2.1         | 5.7          |
| West ETA Drainage Pond 2              | 13              | 0           | 0            | 1.2         | 3.0         | 1.2         | 6.9         | 2.5         | 9.8          |
| <b>Total (Process-affected Ponds)</b> |                 | <b>12.4</b> | <b>105.2</b> | <b>13.7</b> | <b>25.4</b> | <b>12.8</b> | <b>49.6</b> | <b>38.8</b> | <b>180.2</b> |
| Raw Water Pond                        | 14              | 0           | 0            | 0.3         | 1.2         | 1.0         | 5.1         | 1.3         | 6.3          |
| Muskeg Lake                           | 0               | 0           | 0            | 0           | 0           | 0           | 0           | 0           | 0            |
| East ETA                              | 0               | 0           | 0            | 0           | 0           | 0           | 0           | 0           | 0            |
| <b>Total (Freshwater Ponds)</b>       | 14              | 0           | 0            | 0.3         | 1.2         | 1.0         | 5.1         | 1.3         | 6.3          |

<sup>1</sup> Includes route-based and focused transects; for each search, either distance OR area counted towards effort

<sup>2</sup> Blue shading: freshwater ponds

Mortality searches yielded four mortalities, all in the West ETA (Table 3.17). These four birds were all Canada geese and were detected on August 17<sup>th</sup> via a focused truck-based search along the shoreline of the northeast corner of the tailings pond. All four were alive when they were first observed but were at least 75% covered in bitumen. One was recovered and euthanized, while the remaining three could not be recovered and are assumed to have died in the tailings area soon afterwards. Thirty-nine (39) incidental mortalities were discovered at Kearl PA ponds in 2014, including 37 at the West ETA. Table 3.18 summarizes the mortality numbers for each species discovered at Kearl in 2014. One heavily-oiled Canada goose was detected incidentally at the East ETA Tailings Pond, which contained freshwater in 2014. This bird was not recovered and is assumed to have died shortly after its discovery. Appendix 3.D summarizes bird oiling and mortality events at the Kearl site in 2014.

The proportion of birds detected at PA ponds by guild is depicted in Figure 3.5. Dabblers represent one quarter of all birds recorded that made contact with bitumen during monitoring surveys. However, dabblers were the only guild detected during mortality searches and comprised over 40% of incidental mortality observations.

Table 3.19 summarizes bird surveys, mortalities and incidental results by pond at Kearl in 2014. 28 of the 44 birds identified as mortalities were alive when first observed, and all but six were oiled to some extent. The detection of mortalities did not have clear peaks throughout the 2014 season, although small increases were evident between May 14<sup>th</sup> and May 21<sup>st</sup>, as well as a later increase on August 17<sup>th</sup> (see Figure 3.6). Both peaks took place during periods of migration.

**Table 3.17: Number of mortalities by pond at Kearl in 2014**

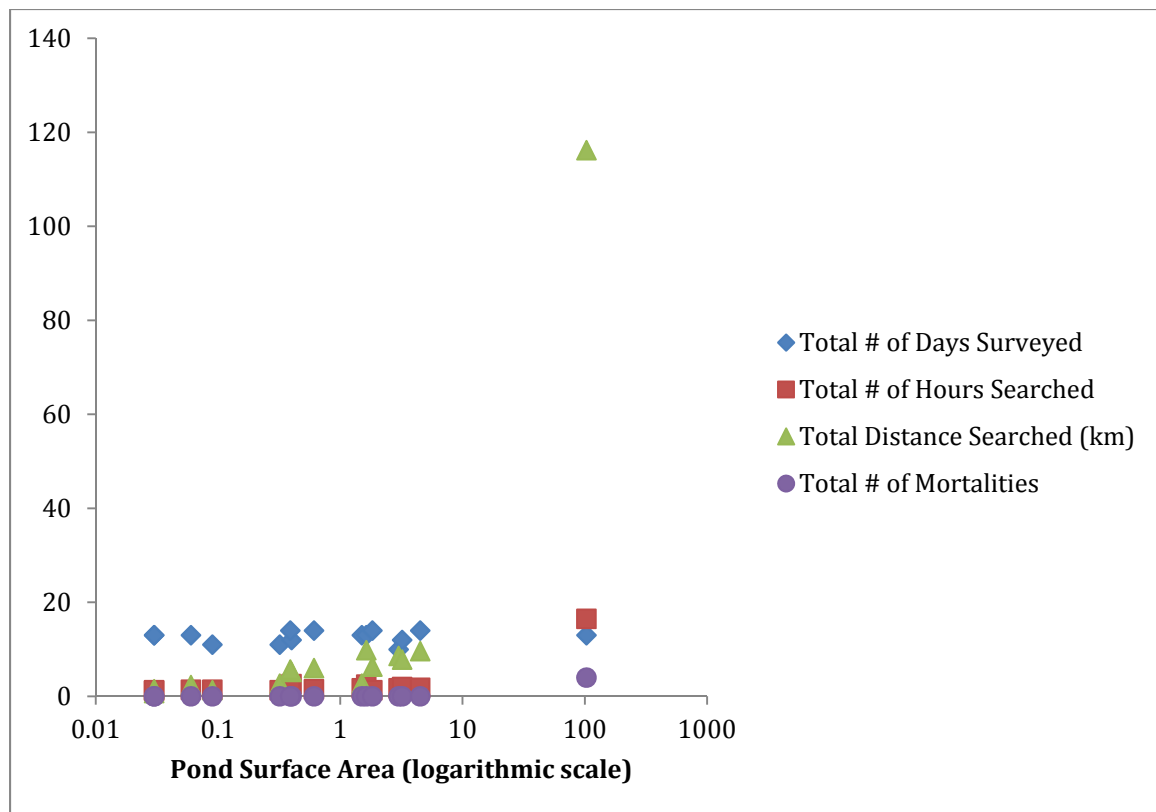
| Pond Name <sup>1</sup>                | Mortality Search | Incidental | Total     |
|---------------------------------------|------------------|------------|-----------|
| Basal Water Treatment Pond            | 0                | 1          | 1         |
| Emergency Extraction Dump Pond        | 0                | 0          | 0         |
| Froth Run-off Pond                    | 0                | 0          | 0         |
| Hydrotransport Pond #1                | 0                | 0          | 0         |
| Hydrotransport Pond #2                | 0                | 0          | 0         |
| MSF Run-off Pond                      | 0                | 0          | 0         |
| NODA Runoff Pond                      | 0                | 0          | 0         |
| OPP1 Crusher Sump                     | 0                | 0          | 0         |
| OPP1 Drainage Pond                    | 0                | 1          | 1         |
| OPP1 Emergency Dump Pond              | 0                | 0          | 0         |
| Recycle Water Pond                    | 0                | 0          | 0         |
| West External Tailings Area           | 4                | 37         | 41        |
| West ETA Drainage Pond 1A             | 0                | 0          | 0         |
| West ETA Drainage Pond 2              | 0                | 0          | 0         |
| <b>Total (Process-affected Ponds)</b> | <b>4</b>         | <b>39</b>  | <b>43</b> |
| East External Tailings Area           | 0                | 1          | 1         |
| Raw Water Pond                        | 0                | 0          | 0         |
| Muskeg Lake                           | 0                | 0          | 0         |
| <b>Total (Freshwater Ponds)</b>       | <b>0</b>         | <b>1</b>   | <b>1</b>  |

<sup>1</sup> Blue shading: freshwater ponds

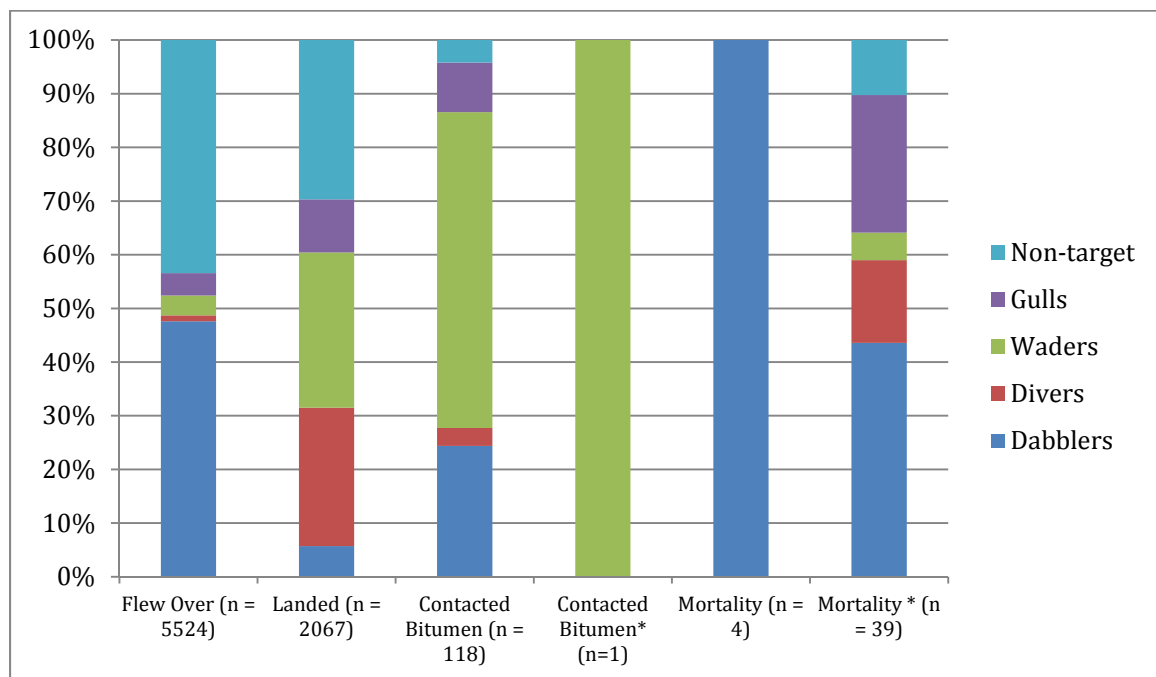
**Table 3.18: Number of observations of oiling and mortalities,  
by species, at Kearl in 2014**

| Species/Species Group    | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|--------------------------|--------------------------------|------------|------------------|------------|
|                          | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>        |                                |            |                  |            |
| Killdeer                 | 29                             |            |                  |            |
| Sandhill Crane           | 18                             |            |                  | 1          |
| Baird's Sandpiper        | 10                             |            |                  |            |
| Canada Goose             | 10                             |            | 4                | 11         |
| California Gull          | 9                              |            |                  | 1          |
| Canvasback               | 6                              |            |                  |            |
| Northern Shoveler        | 6                              |            |                  |            |
| Mallard                  | 4                              |            |                  |            |
| Spotted Sandpiper        | 4                              |            |                  |            |
| Lesser Yellowlegs        | 3                              | 1          |                  |            |
| Greater Yellowlegs       | 3                              |            |                  |            |
| Red-necked Grebe         | 3                              |            |                  |            |
| Semipalmated Sandpiper   | 3                              |            |                  |            |
| American Wigeon          | 2                              |            |                  |            |
| Bonaparte's Gull         | 1                              |            |                  | 4          |
| Common Loon              | 1                              |            |                  |            |
| Northern Pintail         | 1                              |            |                  |            |
| Unknown Gull             |                                |            |                  | 4          |
| Unknown Dabbling Duck    |                                |            |                  | 3          |
| Unknown Duck             |                                |            |                  | 3          |
| Common Tern              |                                |            |                  | 2          |
| Pied-billed Grebe        |                                |            |                  | 2          |
| Common Merganser         |                                |            |                  | 1          |
| Eared Grebe              |                                |            |                  | 1          |
| Herring Gull             |                                |            |                  | 1          |
| Unknown Sandpiper        |                                |            |                  | 1          |
| <b>Non-target Guilds</b> |                                |            |                  |            |
| Common Raven             | 5                              |            |                  |            |
| Barn Swallow             |                                |            |                  | 1          |
| Horned Lark              |                                |            |                  | 1          |
| Sharp-tailed Grouse      |                                |            |                  | 1          |
| Tree Swallow             |                                |            |                  | 1          |
| <b>Total</b>             | <b>118</b>                     | <b>1</b>   | <b>4</b>         | <b>39</b>  |

<sup>1</sup> Individual birds may be observed on multiple days or also observed as mortalities, and thus be counted multiple times

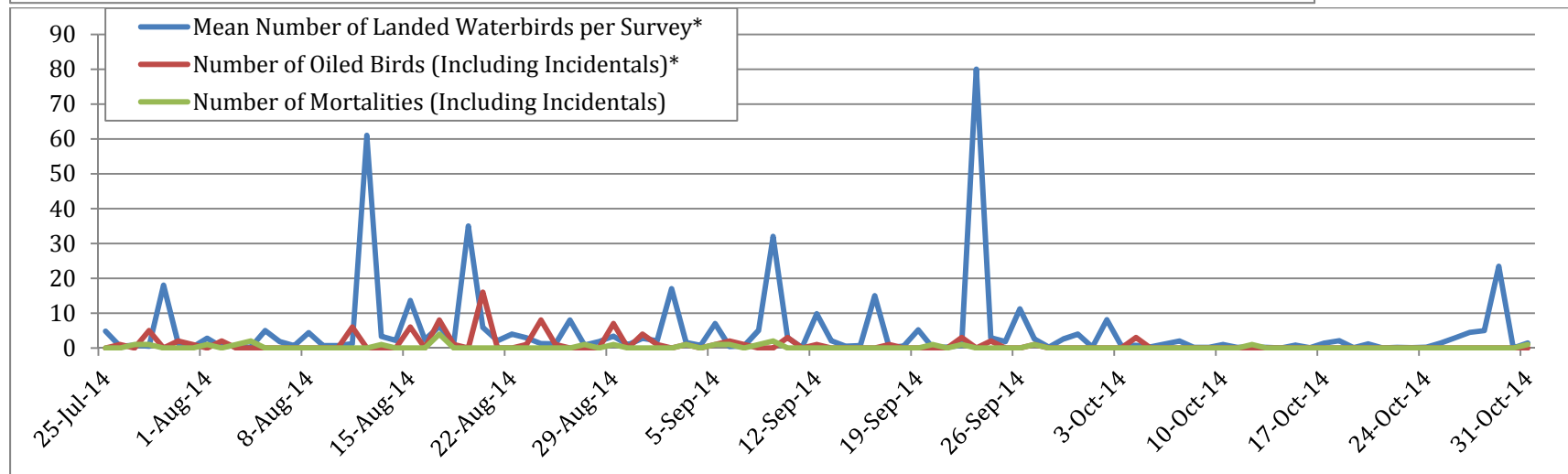
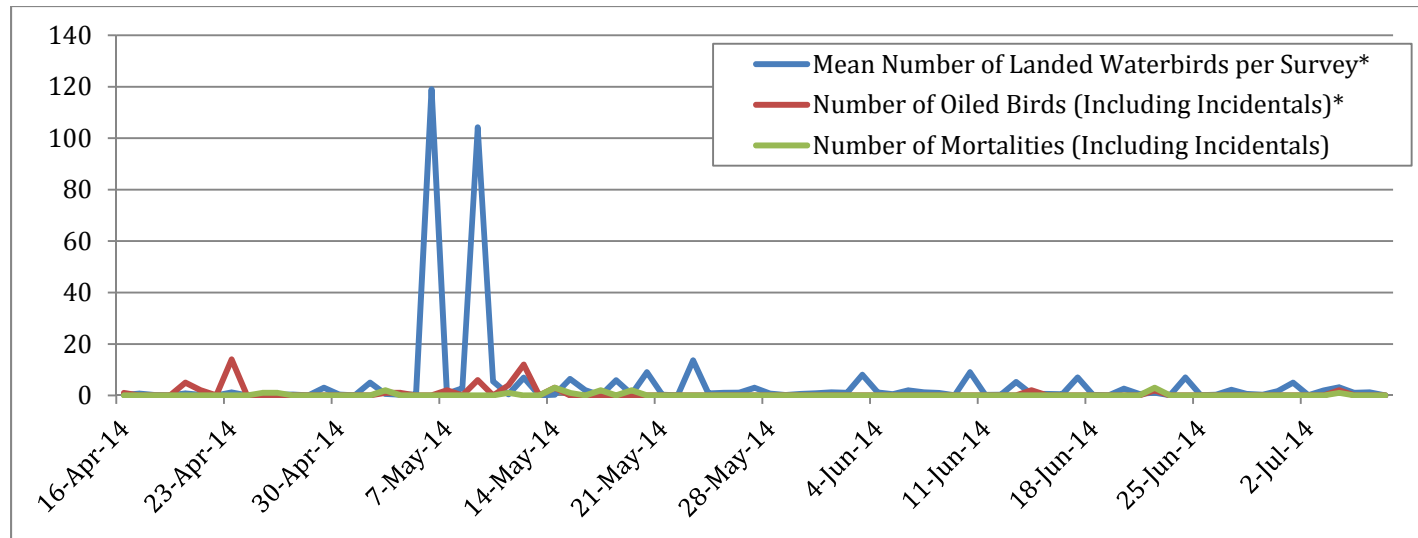


**Figure 3.4: Relationship between pond area (over water), mortality search effort, and mortality search results**



\* Incidental observations

**Figure 3.5: Proportion of each guild for birds that flew over or landed at process-affected ponds, contacted bitumen, or died at Kearl in 2014.**



\*Individual birds may be observed repeatedly during consecutive days

**Figure 3.6: Timing of bird landings, oiling, and mortalities in spring (top) and fall (bottom) 2014 at Kearl.**

**Table 3.19: Summary of bird survey, mortality and incidental results by pond at Kearl in 2014**

| Pond Name <sup>1</sup>            | Pond Area<br>(over water;<br>ha) | Potential Attractants                                               | % Days with<br>Floating Bitumen<br>Present | Mean # Landed Waterbirds per Survey |             |             |             | # Species Landed   |                                   | # Observations of Oiled Birds |            | # Mortalities    |            |
|-----------------------------------|----------------------------------|---------------------------------------------------------------------|--------------------------------------------|-------------------------------------|-------------|-------------|-------------|--------------------|-----------------------------------|-------------------------------|------------|------------------|------------|
|                                   |                                  |                                                                     |                                            | Dabblers                            | Divers      | Waders      | Gulls       | Total <sup>2</sup> | Conservation Concern <sup>3</sup> | Per Survey                    | Incidental | Mortality Search | Incidental |
| West External Tailings Area       | 348                              | Large surface area, vegetation near northern and eastern shorelines | 99                                         | 0.09                                | 0.56        | 0.22        | 0.24        | 31                 | 6                                 | 0.164                         | 0          | 4                | 37         |
| Recycle Water Pond                | 4.5                              | Relatively large surface area                                       | 1                                          | 0.01                                | 0.01        | 0.01        | 0.04        | 7                  | 0                                 | 0                             | 0          | 0                | 0          |
| OPP1 Drainage Pond                | 3.2                              | Relatively large surface area                                       | 10                                         | 0                                   | 0           | 0.14        | 0.01        | 9                  | 1                                 | 0                             | 0          | 0                | 1          |
| NODA Runoff Pond                  | 3.0                              | Relatively large surface area                                       | 2                                          | 0.15                                | 0.31        | 0.31        | 0.01        | 16                 | 2                                 | 0.007                         | 0          | 0                | 0          |
| West ETA Drainage Pond 2          | 1.63                             | Relatively large surface area                                       | 40                                         | 0.02                                | 0.04        | 0.91        | 0.01        | 18                 | 1                                 | 0.182                         | 0          | 0                | 0          |
| MSF Run-off Pond                  | 1.5                              | Relatively large surface area                                       | 0                                          | 0.11                                | 0.39        | 0.38        | 0.18        | 26                 | 3                                 | 0.006                         | 0          | 0                | 0          |
| Basal Water Treatment Pond        | 0.61                             | None                                                                | 1                                          | 0.04                                | 0.18        | 0.85        | 0.02        | 20                 | 3                                 | 0.076                         | 0          | 0                | 1          |
| Froth Run-off Pond                | 0.40                             | None                                                                | 6                                          | 0                                   | 0.01        | 0.01        | 0           | 4                  | 0                                 | 0                             | 0          | 0                | 0          |
| West ETA Drainage Pond 1A         | 0.39                             | None                                                                | 3                                          | 0.03                                | 0           | 0.08        | 0           | 12                 | 2                                 | 0                             | 0          | 0                | 0          |
| Emergency Extraction Dump Pond    | 0.32                             | None                                                                | 99                                         | 0                                   | 0           | 0           | 0           | 1                  | 0                                 | 0                             | 0          | 0                | 0          |
| Hydrotransport Pond #2            | 0.09                             | None                                                                | 96                                         | 0                                   | 0           | 0.04        | 0           | 1                  | 1                                 | 0                             | 1          | 0                | 0          |
| OPP1 Emergency Dump Pond          | 0.06                             | None                                                                | 100                                        | 0                                   | 0           | 0           | 0           | 0                  | 0                                 | 0                             | 0          | 0                | 0          |
| OPP1 Crusher Sump                 | 0.03                             | None                                                                | 39                                         | 0                                   | 0           | 0           | 0           | 0                  | 0                                 | 0.043                         | 0          | 0                | 0          |
| Hydrotransport Pond #1            | 0.03                             | None                                                                | 92                                         | 0                                   | 0           | 0           | 0           | 0                  | 0                                 | 0                             | 0          | 0                | 0          |
| <b>All Process-affected Ponds</b> | <b>363.76</b>                    |                                                                     |                                            | <b>0.03</b>                         | <b>0.11</b> | <b>0.21</b> | <b>0.04</b> | <b>55</b>          | <b>12</b>                         | <b>0.034</b>                  | <b>1</b>   | <b>4</b>         | <b>39</b>  |

| Pond Name <sup>1</sup>      | Pond Area<br>(over water;<br>ha) | Potential Attractants                                                                                | % Days with<br>Floating Bitumen<br>Present | Mean # Landed<br>Waterbirds per Survey |             |             |             | # Species<br>Landed |                                      | # Obser-<br>vations of<br>Oiled Birds |            | #<br>Mortalities    |            |
|-----------------------------|----------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------------|-------------|-------------|-------------|---------------------|--------------------------------------|---------------------------------------|------------|---------------------|------------|
|                             |                                  |                                                                                                      |                                            | Dabblers                               | Divers      | Waders      | Gulls       | Total <sup>2</sup>  | Conservation<br>Concern <sup>3</sup> | Per Survey                            | Incidental | Mortality<br>Search | Incidental |
| East External Tailings Area | 75.13                            | Multiple small ponds,<br>emergent and land-<br>based vegetation                                      | 0                                          | 0.56                                   | 0.15        | 0.08        | 0           | 13                  | 0                                    | 0.017                                 | 0          | 0                   | 1          |
| Muskeg Lake                 | 30                               | Large surface area,<br>isolated location,<br>vegetation near<br>shoreline, adjacent to<br>Kearl Lake | 0                                          | 6.54                                   | 7.62        | 2.33        | 3.40        | 41                  | 9                                    | 0                                     | 0          | 0                   | 0          |
| Raw Water Pond              | 1.83                             | Relatively large<br>surface area                                                                     | 0                                          | 0.01                                   | 0.05        | 0.13        | 0.08        | 13                  | 1                                    | 0                                     | 0          | 0                   | 0          |
| <b>All Freshwater Ponds</b> | <b>106.96</b>                    |                                                                                                      |                                            | <b>2.37</b>                            | <b>2.60</b> | <b>0.84</b> | <b>1.16</b> | <b>51</b>           | <b>10</b>                            | <b>0.006</b>                          | <b>0</b>   | <b>0</b>            | <b>1</b>   |

<sup>1</sup> Blue shading: freshwater ponds. <sup>2</sup> During bird surveys. <sup>3</sup> Includes incidental observations.

### 3.4.5 Species of Conservation Concern

Seven waterbird species of conservation concern were observed at PA ponds in 2014 (Table 3.5). Sandhill cranes, green-winged teals, northern pintails, lesser scaup, horned grebes, pied-billed grebes, and great blue herons are all ranked as 'Sensitive' in the Alberta Wild Species General Status Listing (Government of Alberta, 2010). Eighteen (18) sandhill cranes were observed contacting bitumen in 2014, and one incidental mortality was also recorded. One northern pintail was observed contacting bitumen, and two pied-billed grebe mortalities were found through incidental observation.

Seven non-target species of conservation concern were also observed during bird surveys at Kearn in 2014 (Table 3.5). Bank swallows, rusty blackbirds, eastern phoebes, northern harriers, bald eagles, broad-winged hawks, and sharp-tailed grouse are all ranked as 'Sensitive' in the Alberta Wild Species General Status Listing (Government of Alberta, 2010). Appendix 3.C lists the number of bird observations by species at Kearn's PA ponds.

## 3.5 Discussion

Bird monitors observed 59 landed dabbling ducks at the West ETA, the most of any PA ponds on the Kearn site in 2014 (Table 3.12). A further 20 were observed at the NODA Runoff Pond, and 18 were seen at the MSF Run-off Pond. Fewer than 10 dabbling ducks were seen at each of the remaining PA ponds in 2014. The West ETA, NODA Runoff Pond, and MSF Run-off Pond are the largest, fourth-largest, and sixth-largest PA ponds at Kearn in terms of surface area, and this may be a factor in the large number of dabbling ducks found at these locations. In terms of dabbling ducks observed flying overhead at PA ponds, more than 100 birds were recorded at the West ETA (1717), West ETA Drainage Pond 1A (365), the Recycle Water Pond (200), and West ETA Drainage Pond 2 (167). The West ETA was monitored from four stations in 2014 (a fifth was utilized when access was an issue at one of the other four stations) and is the largest pond at Kearn, which explains the high number of dabbling ducks observed. The Recycle Water Pond, which had the third-highest number of dabbling ducks flying overhead, had only two confirmed landings. The Recycle Water Pond is the second-largest PA pond and has the fifth-lowest density of bird deterrents (1.1 units/ha; see Table 3.7) at Kearn, so a higher number of landed dabblers might have been expected. However, this pond does not feature vegetation nearby and is in close proximity to the Kearn plant; both factors may have aided in deterring birds from the area.

Three hundred sixty-five (365) diving ducks were recorded landing at the West ETA; no other PA pond featured more than 100 observations. Additionally, 58 of the 61 diving birds observed flying overhead at PA ponds were seen at the West ETA. The large surface area of the West ETA is a likely explanation for the relatively large number of diving birds observed there.

The most landed wading birds were observed at West ETA Drainage Pond 2 and the Basal Water Treatment Pond (145 each). One hundred forty-one (141) landed waders were seen at the West ETA, while no other PA pond featured more than 100 observations. Other than the West ETA (170), no PA ponds had more than 100 waders fly overhead during monitoring sessions. In terms of observations of landed birds, waders were by far the most prevalent of all target guilds at the Basal Water Treatment Pond and West ETA Drainage Pond 2. Vegetation was sparse at both ponds, particularly at the Basal Water Treatment Pond, but both also featured sandy, gravelly terrain that may have attracted sandpipers. Bird deterrent coverage at the Basal Water Treatment Pond was high (4.9 units/ha; both visual and auditory units), but this did not appear to deter wading birds from frequenting the pond.

One hundred seventy (170) landed gulls were observed at the West ETA, while the second-most observations (29) were made at the MSF Run-off Pond. In 2013, California gulls and Bonaparte's gulls successfully nested on muskeg mats floating on the West ETA, and the relatively high number of gull observations this year might be explained by gulls returning to what had been a successful breeding site. No muskeg mats were present throughout the course of the breeding season in 2014, and no gull nests were found at the West ETA over the same period. This apparent failure to breed on PA ponds may result in fewer gulls visiting the site next year.

The West ETA (206 birds) and NODA Runoff Pond (191 birds) were the only PA ponds that featured more than 100 landed non-target birds in 2014. Of the 2,380 observations of non-target birds flying over PA ponds, 1,456 were made at the West ETA while 17 were made at the NODA Runoff Pond. The majority of non-target observations at Kearl were of resident ravens, which are at a low risk of coming into contact with bitumen.

The West ETA featured the highest total of landed bird observations (1016), followed by the NODA Runoff Pond (297), West ETA Drainage Pond 2 (224), the Basal Water Treatment Pond (220), and the MSF Run-off Pond (198). Fewer than 100 observations were made at each of the remaining nine PA ponds at Kearl. The five ponds listed above comprise five of the seven largest PA ponds at site. The Recycle Water Pond and OPP1 Drainage Pond, despite being the second- and third-largest ponds at Kearl, featured relatively few observations of landed birds. Neither pond had relatively dense deterrent coverage; the OPP1 Drainage Pond ranked ninth among the 14 PA ponds at site, while the Recycle Water Pond ranked tenth. The features of these two ponds warrant further investigation in 2015, as there may be factors that are serving to deter birds that could be put to use elsewhere at Kearl to reduce landed bird observations. Both ponds are adjacent to industrial facilities, and the noise or human presence at these facilities (along with a lack of natural habitat) may be serving as a deterrent to wildlife.

Muskeg Lake, a freshwater pond, featured the most landed dabblers, divers, and gulls of all ponds included in Kearl's 2014 bird monitoring program. Overall, more landed birds were observed at Muskeg Lake than at any other pond. The East ETA, another freshwater pond in 2014, was the site of the most observations of landed non-target

birds, despite monitoring at this pond not commencing until September. Of the 384 total bird observations made at the Raw Water Pond, 278 were non-target flyovers. Following a period of heavy fog, approximately 300 diving and dabbling ducks were observed on the Raw Water Pond on November 3<sup>rd</sup> and 4<sup>th</sup>, although it is likely that the same individuals were counted on both days.

Muskeg Lake and the East ETA ranked first and second, respectively, in the mean number of landed birds observed per survey at each pond at Kearl in 2014 (Table 3.13). The mean number of landed birds observed per survey at freshwater ponds was over 14 times higher than that of PA ponds. These findings indicate that more birds are visiting, staying, and potentially breeding at freshwater ponds at the Kearl site than at PA ponds in the same area. While this result is encouraging, it also suggests that the East ETA may become a priority for bird deterrence efforts in 2015, as PA water will enter this pond following the peak bird nesting season.

Of the 43 mortalities detected at Kearl in 2014, both through searches and incidental observations, 40 were at the West ETA Tailings Pond. 37 of the West ETA mortalities had some degree of oil coverage. The other three were not oiled and died of unknown causes. Contact with bitumen in the West ETA was the dominant cause of bird mortalities at the Kearl site in 2014.

The large size of the West ETA Tailings Pond, as well as the extensive cover of bitumen on its surface, clearly made it the largest on-site threat to migratory and breeding birds in 2014. To mitigate this threat, the most extensive bird BDDS at Kearl has been installed in the West ETA, including radar-linked LRADs and lasers, random-fire propane cannons, and visual deterrents. The spread of bitumen is managed by booms, and boat crews were qualified to haze landed birds using boats. The 38 West ETA mortalities are put into context by the 3610 birds observed flying over the pond by monitors, the 1016 birds identified as landed at the pond, as well as the amount of time spent monitoring for flyovers and landed birds.

Of the three mortalities discovered at Kearl that were not at the West ETA Pond, two were not oiled. These individuals were found at the Basal Water Treatment Pond and the OPP1 Drainage Pond. The third mortality, a Canada goose, was found in the East ETA and had 75-100% oil coverage. Ponds in the East ETA did not house PA water in 2014, so this individual must have contacted bitumen at another pond and subsequently travelled to the East ETA. The amount of bitumen coverage eventually rendered this goose incapable of flight. The West ETA is less than a kilometer and is likely the site at which the goose was oiled.

Thirty-nine (39) mortalities were detected incidentally, compared to four found through scheduled searches. Incidental mortalities were reported either by workers in the area or bird monitors during scheduled bird monitoring sessions. Confirmed mortalities would be retrieved whenever possible, in some cases safety concerns would prevent workers from approaching the area where a dead bird had been identified. When birds were heavily oiled but alive, efforts to capture the birds were made by bird monitors, on-site

biologists, or the Imperial Environment and Regulatory Advisors. No capture of live birds was undertaken without the knowledge and advice of E&R Advisors, who engaged ESRD prior to authorizing any activity.

Seven waterbird species identified as species of concern were observed at the Kearl site in 2014 (Table 3.5). Of these species, two (18 sandhill cranes and one northern pintail) were observed making contact with bitumen. One sandhill crane was discovered as an incidental mortality, as were two pied-billed grebes. These three individuals were each 75-100% covered in bitumen when discovered and represent the only bitumen-related mortalities among species of concern at the Kearl site this past year. One barn swallow and one sharp-tailed grouse were also found dead on site, but neither individual had come into contact with bitumen. Causes of death were not determined.

The most significant potential contributor to bias in data collection during bird monitoring at Kearl was likely the intermittent availability of monitoring stations at the West ETA Pond. Construction, beaching, and related activities in the area regularly restricted access to monitoring sites. Safe access had been identified as a concern before the 2014 monitoring program had begun, and an alternative site (ETA 1) was established to mitigate the issue. In some cases, bird monitors surveyed from more suitable vantage points; GPS coordinates of these sites were delivered to OMEI in order to better track changes to the monitoring program. Changes to monitoring station locations may reduce the reliability of the data being collected, but given the nature of the construction, it is not realistic to expect that the same stations would be available every day over the course of the monitoring program. Regular communication with operators in the West ETA may help reduce the duration over which a survey station is made unavailable or facilitate the creation of alternate access routes.

Three broods were detected during the 2014 monitoring program at Kearl, all of which were killdeer. Killdeer nests are regularly observed at Kearl by wildlife biologists during nest sweeps, and the species is considered resident during the breeding season. Killdeer, despite being shorebirds, are often found some distance from water and can nest in gravelly or sandy areas (Jackson & Jackson, 2000). Gravel and sand are both common at the Kearl site, and the observed broods may not have hatched near PA ponds. Other target species known to have nested at Kearl in recent years include greater and lesser yellowlegs, green-winged teals, mallards, and sandhill cranes. Common terns, California gulls, and Bonaparte's gulls all nested successfully at Kearl in 2013, but nesting attempts were dramatically reduced this year; these species had relied on floating muskeg mats on the West ETA Pond, which were removed as the breeding season finished in 2013. Barn and bank swallows also regularly nest at Kearl, as do ravens, but none of these species is targeted by the OSBCMP nor are they at high risk of coming into contact with PA water.

The largest effect on bird numbers at Kearl's ponds in 2014 relative to the previous year was the removal of vegetation along the northern and eastern shores of the West ETA Pond. Canada geese, green-winged and blue-winged teals, sandhill cranes, killdeer, greater and lesser yellowlegs and other sandpiper species had been observed foraging

in these areas over the summer, particularly north of the pond. Nest sweep surveys undertaken during the vegetation removal process also led to the observation of numerous sandhill fledglings. With the vegetation removed and mitigative strategies to prevent its return in 2015, the anticipation is that fewer birds will stage in these areas.

Vegetation was also prevalent in the East ETA in 2014, although much of it had been removed or buried by the time monitoring began in September. Again, it is possible that fewer birds will visit the area in 2015, as foraging and nesting conditions will be more limited than in 2014. The same removal and preventative strategies employed at the West ETA in 2014 and 2015 will be employed at the East ETA in order to further reduce the area's attractiveness to birds.

The largest change in monitoring results from 2013 to 2014 came at the West ETA. In 2013, floating muskeg mats on the tailings pond provided foraging and nesting habitat for many bird species, and 3768 landed birds were observed at the pond over the course of 2013. The muskeg mats were removed by the end of August, and mats that floated to the surface afterwards were removed before vegetation could grow and provide new habitat for birds. In 2014, no muskeg mats were available for breeding birds, and a total of 1016 landed birds were observed. The number of birds flying over the West ETA did not change from year to year (3743 in 2013, 3610 in 2014). The removal of vegetation near the shorelines of the West ETA pond may further reduce the number of landed bird observations.

In addition, Imperial's engagement in the OSBCMP committee may lead to studies and trials aimed at improving monitoring programs.

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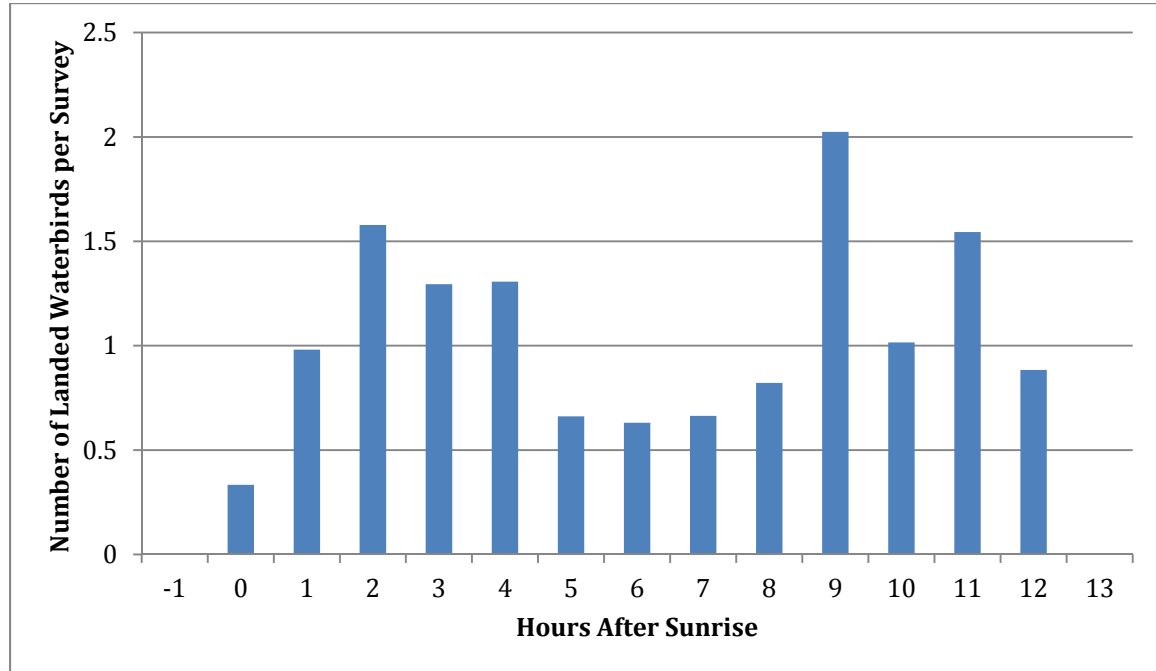
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### **3.7 Personal Communications**

Adamek, C. Bird Monitor, SGS Canada Inc. Communicated via email to Simon Hall, Golder Associates, 17 December 2014.



**Appendix 3.B: Relationship between the mean number of landed waterbirds per survey and hour after sunrise at Kearl in 2014**



**Appendix 3.C: Number of bird observations by species at Kearl process-affected ponds in 2014**

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>                  |                     |                         |                        |                                |            |                  |            |
| Killdeer                           | 156                 |                         | 15                     | 29                             |            |                  |            |
| Common Goldeneye                   | 148                 |                         | 3                      |                                |            |                  |            |
| California Gull                    | 139                 |                         | 76                     | 9                              |            |                  | 1          |
| Canvasback                         | 134                 |                         |                        | 6                              |            |                  |            |
| Eared Grebe                        | 99                  |                         | 11                     |                                |            |                  | 1          |
| Spotted Sandpiper                  | 96                  |                         | 8                      | 4                              |            |                  |            |
| Unknown Duck                       | 92                  |                         | 44                     | 26                             |            |                  | 3          |
| Unknown Grebe                      | 65                  |                         |                        |                                |            |                  |            |
| Sandhill Crane                     | 64                  | 3                       | 11                     | 18                             |            |                  | 1          |
| Baird's Sandpiper                  | 53                  |                         | 3                      | 10                             |            |                  |            |
| Unknown Sandpiper                  | 50                  |                         | 63                     | 9                              |            |                  | 1          |
| Least Sandpiper                    | 42                  |                         |                        |                                |            |                  |            |
| Bonaparte's Gull                   | 41                  |                         | 23                     | 1                              |            |                  | 4          |
| Semipalmated Sandpiper             | 36                  |                         |                        | 3                              |            |                  |            |
| Canada Goose                       | 30                  |                         | 1,358                  | 8                              |            | 4                | 12         |
| Greater Yellowlegs                 | 27                  |                         | 3                      | 3                              |            |                  |            |
| American Wigeon                    | 27                  |                         |                        | 2                              |            |                  |            |
| Mallard                            | 15                  |                         | 8                      | 4                              |            |                  |            |
| Northern Shoveler                  | 14                  |                         |                        | 6                              |            |                  |            |
| Green-winged Teal                  | 14                  | 5                       | 9                      |                                |            |                  |            |
| Common Tern                        | 13                  |                         | 26                     |                                |            |                  | 2          |
| Lesser Yellowlegs                  | 13                  |                         | 2                      | 3                              | 1          |                  |            |
| Unknown Gull                       | 11                  |                         | 42                     |                                |            |                  | 4          |
| Bufflehead                         | 11                  |                         |                        |                                |            |                  |            |
| Unknown Diving Duck                | 11                  |                         |                        |                                |            |                  |            |
| Sanderling                         | 10                  |                         |                        |                                |            |                  |            |
| White-rumped Sandpiper             | 10                  |                         |                        |                                |            |                  |            |
| Northern Pintail                   | 7                   |                         | 1                      | 1                              |            |                  |            |
| Greater Scaup                      | 7                   |                         |                        |                                |            |                  |            |
| Lesser Scaup                       | 6                   |                         | 1                      |                                |            |                  |            |
| Solitary Sandpiper                 | 5                   |                         |                        |                                |            |                  |            |
| Red-necked Grebe                   | 4                   |                         |                        | 3                              |            |                  |            |
| American Coot                      | 4                   |                         |                        |                                |            |                  |            |
| Blue-winged Teal                   | 4                   |                         |                        |                                |            |                  |            |
| Herring Gull                       | 3                   |                         | 21                     |                                |            |                  | 1          |
| Unknown Plover                     | 3                   |                         |                        |                                |            |                  |            |
| Common Loon                        | 2                   |                         | 7                      | 1                              |            |                  |            |
| Snow Goose                         | 2                   |                         | 1,208                  |                                |            |                  |            |
| Horned Grebe                       | 2                   |                         |                        |                                |            |                  |            |

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| Pectoral Sandpiper                 | 2                   |                         |                        |                                |            |                  |            |
| Ruddy Duck                         | 2                   |                         |                        |                                |            |                  |            |
| Semipalmated Plover                | 2                   |                         |                        |                                |            |                  |            |
| Pied-billed Grebe                  | 1                   |                         |                        |                                |            |                  | 2          |
| Unknown Shorebird                  | 1                   |                         | 60                     |                                |            |                  |            |
| Ring-billed Gull                   | 1                   |                         | 42                     |                                |            |                  |            |
| Franklin's Gull                    | 1                   |                         | 2                      |                                |            |                  |            |
| Unknown Dowitcher                  | 1                   |                         |                        |                                |            |                  |            |
| Unknown Dabbling Duck              |                     |                         | 3                      |                                |            |                  | 3          |
| Common Merganser                   |                     |                         |                        |                                |            |                  | 1          |
| Unknown Yellowlegs                 |                     |                         | 36                     |                                |            |                  |            |
| Unknown White-headed Gull          |                     |                         | 23                     |                                |            |                  |            |
| Tundra Swan                        |                     |                         | 18                     |                                |            |                  |            |
| Unknown Scaup                      |                     |                         | 11                     |                                |            |                  |            |
| Gadwall                            |                     |                         | 2                      |                                |            |                  |            |
| Unknown Diver                      |                     |                         | 2                      |                                |            |                  |            |
| Great Blue Heron                   |                     |                         | 1                      |                                |            |                  |            |
| Unknown Swan                       |                     |                         | 1                      |                                |            |                  |            |
| <b>Non-target Guilds</b>           |                     |                         |                        |                                |            |                  |            |
| Brewer's Blackbird                 | 271                 |                         | 162                    |                                |            |                  |            |
| Common Raven                       | 65                  |                         | 253                    | 5                              |            |                  |            |
| Snow Bunting                       | 63                  |                         | 322                    |                                |            |                  |            |
| American Pipit                     | 38                  |                         | 80                     |                                |            |                  |            |
| Unknown Sparrow                    | 31                  |                         | 206                    |                                |            |                  |            |
| Bank Swallow                       | 26                  |                         | 80                     |                                |            |                  |            |
| Unknown Blackbird                  | 23                  |                         | 5                      |                                |            |                  |            |
| Horned Lark                        | 22                  |                         | 20                     |                                |            |                  | 1          |
| Barn Swallow                       | 21                  |                         | 730                    |                                |            |                  | 1          |
| Black-billed Magpie                | 10                  |                         | 4                      |                                |            |                  |            |
| Tree Swallow                       | 3                   |                         | 46                     |                                |            |                  | 1          |
| American Kestrel                   | 3                   |                         | 16                     |                                |            |                  |            |
| American Robin                     | 3                   |                         | 3                      |                                |            |                  |            |
| Rusty Blackbird                    | 2                   |                         | 10                     |                                |            |                  |            |
| Smith's Longspur                   | 2                   |                         | 4                      |                                |            |                  |            |
| Eastern Phoebe                     | 1                   |                         |                        |                                |            |                  |            |
| Northern Hawk Owl                  | 1                   |                         |                        |                                |            |                  |            |
| Savannah Sparrow                   | 1                   |                         |                        |                                |            |                  |            |
| Sharp-tailed Grouse                |                     | 4                       | 1                      |                                |            |                  | 1          |
| Unknown Pecking Bird               |                     |                         | 230                    |                                |            |                  |            |
| Unknown Passerine                  |                     |                         | 109                    |                                |            |                  |            |
| Lapland Longspur                   |                     |                         | 35                     |                                |            |                  |            |
| Unknown Swallow                    |                     |                         | 35                     |                                |            |                  |            |

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| Cliff Swallow                      |                     |                         | 9                      |                                |            |                  |            |
| Lincoln's Sparrow                  |                     |                         | 3                      |                                |            |                  |            |
| Northern Harrier                   |                     |                         | 3                      |                                |            |                  |            |
| White-crowned Sparrow              |                     |                         | 3                      |                                |            |                  |            |
| Bald Eagle                         |                     |                         | 2                      |                                |            |                  |            |
| Unknown Gleaner                    |                     |                         | 2                      |                                |            |                  |            |
| White-throated Sparrow             |                     |                         | 2                      |                                |            |                  |            |
| Black-capped Chickadee             |                     |                         | 1                      |                                |            |                  |            |
| Broad-winged Hawk                  |                     |                         | 1                      |                                |            |                  |            |
| Cedar Waxwing                      |                     |                         | 1                      |                                |            |                  |            |
| Rough-legged Hawk                  |                     |                         | 1                      |                                |            |                  |            |
| Unknown Raptor                     |                     |                         | 1                      |                                |            |                  |            |

<sup>1</sup> Pink shading: Species of Conservation Concern

<sup>2</sup> Individual birds may be observed on multiple days and thus be counted multiple times

<sup>3</sup> Only for Species of Conservation Concern

### Appendix 3.D: Bird oiling and mortality events at Kearl in April–October 2014

| Date   | Species      | Pond Name (Survey Station ID) | Location Description | % Oiled | Outcome       | Context of Detection | Method of Detection | Potential Reason for Mortality/Oiling |
|--------|--------------|-------------------------------|----------------------|---------|---------------|----------------------|---------------------|---------------------------------------|
| 16-Apr | MALL         | ETA SW                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 20-Apr | CAGU         | ETA Main                      | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 20-Apr | CAGU         | ETA NE                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 21-Apr | NSHO         | ETA NE                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 21-Apr | CAGU         | ETA SW                        | Flew Over            | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 23-Apr | Unknown Duck | ETA NW                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 23-Apr | CANG         | ETA NW                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 25-Apr | CANG         | ETA NW                        | Unknown              | 75-100% | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 26-Apr | CANG         | ETA Main                      | Unknown              | 75-100% | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 3-May  | CORA         | ETA Main                      | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 3-May  | Unknown Gull | ETA Main                      | Unknown              | 50-75%  | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 3-May  | Unknown Gull | ETA Main                      | Unknown              | 25-50%  | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 4-May  | CORA         | ETA Main                      | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 7-May  | CORA         | ETA SW                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 7-May  | CORA         | ETA SW                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 9-May  | CANV         | ETA Main                      | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 11-May | RNGR         | ETA NE                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 11-May | COLO         | ETA SW                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 11-May | RNGR         | ETA SW                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 11-May | PBGR         | ETA NE                        | Unknown              | 75-100% | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 12-May | Unknown Duck | ETA NW                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 12-May | NSHO         | ETA NE                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 14-May | Unknown Duck | ETA NW                        | Water                | 75-100% | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 15-May | BOGU         | ETA SW                        | Unknown              | 75-100% | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 17-May | EAGR         | ETA NE                        | Unknown              | 25-50%  | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 17-May | PBGR         | ETA NW                        | Unknown              | 75-100% | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 19-May | TRES         | ODP_Drainage                  | Shore                | 0%      | Found dead    | Incidental           | Unknown             | Unknown                               |
| 19-May | HOLA         | ETA NW                        | Shore                | 0-25%   | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 27-May | KILL         | OPP1_Crusher_Sump             | Flew overhead        | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 14-Jun | NSHO         | ETA 1                         | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 20-Jun | NOPI         | ETA NE                        | Flew overhead        | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 22-Jun | CANG         | ETA NE                        | Shore                | 50-75%  | Not recovered | Bird survey          | Binoculars          | Floating bitumen                      |
| 22-Jun | CAGU         | ETA NW                        | Unknown              | 50-75%  | Not recovered | Incidental           | Binoculars          | Floating bitumen                      |

| Date   | Species           | Pond Name (Survey Station ID) | Location Description | % Oiled | Outcome       | Context of Detection | Method of Detection | Potential Reason for Mortality/Oiling |
|--------|-------------------|-------------------------------|----------------------|---------|---------------|----------------------|---------------------|---------------------------------------|
| 4-Jul  | CANG              | ETA SW                        | Water                | 75-100% | Not recovered | Bird survey          | Binoculars          | Floating bitumen                      |
| 4-Jul  | CANG              | ETA Main                      | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 7-Jul  | BOGU              | ETA Main                      | Unknown              | 0%      | Found dead    | Incidental           | Unknown             | Unknown                               |
| 21-Jul | COTE              | ETA NW                        | Shore                | 0%      | Found dead    | Incidental           | On foot             | Unknown                               |
| 21-Jul | COTE              | ETA NW                        | Shore                | 0%      | Found dead    | Incidental           | On foot             | Unknown                               |
| 23-Jul | SPSA              | ETA NE                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 26-Jul | SPSA              | MSF                           | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 27-Jul | BOGU              | ETA Main                      | Unknown              | 75-100% | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 28-Jul | SACR              | ETA NW                        | Shore                | 75-100% | Not recovered | Bird survey          | Binoculars          | Floating bitumen                      |
| 28-Jul | KILL              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 30-Jul | KILL              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 31-Jul | KILL              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 1-Aug  | BOGU              | ETA Main                      | Unknown              | 75-100% | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 2-Aug  | BOGU              | ETA Main                      | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 2-Aug  | CANG              | ETA Main                      | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 3-Aug  | Unknown Gull      | ETA NW                        | Unknown              | 50-75%  | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 4-Aug  | Unknown Duck      | ETA NW                        | Unknown              | 75-100% | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 4-Aug  | CANG              | ETA NW                        | Unknown              | 50-75%  | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 11-Aug | KILL              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 13-Aug | CANG              | ETA NE                        | Unknown              | 75-100% | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 15-Aug | KILL              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 15-Aug | SPSA              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 17-Aug | MALL              | ETA NE                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 17-Aug | KILL              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 17-Aug | CANG              | ETA Main                      | Shore                | 75-100% | Not recovered | Focused              | On foot             | Floating bitumen                      |
| 17-Aug | CANG              | ETA Main                      | Shore                | 75-100% | Euthanized    | Focused              | On foot             | Floating bitumen                      |
| 18-Aug | GRYE              | ETA NW                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 20-Aug | SACR              | ETA NE                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 23-Aug | BASA              | Basal                         | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 24-Aug | BASA              | Basal                         | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 25-Aug | BASA              | Basal                         | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 27-Aug | HERG              | ETA SW                        | Unknown              | 75-100% | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 29-Aug | Unknown Sandpiper | ETA NE                        | Shore                | 75-100% | Found dead    | Bird survey          | Binoculars          | Floating bitumen                      |

| Date   | Species           | Pond Name (Survey Station ID) | Location Description | % Oiled | Outcome       | Context of Detection | Method of Detection | Potential Reason for Mortality/Oiling |
|--------|-------------------|-------------------------------|----------------------|---------|---------------|----------------------|---------------------|---------------------------------------|
| 29-Aug | Unknown Sandpiper | ETA NE                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 29-Aug | LEYE              | Basal                         | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 31-Aug | LEYE              | Basal                         | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 31-Aug | Unknown Sandpiper | ETA Main                      | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 1-Sep  | LEYE              | Basal                         | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 3-Sep  | SPSA              | ETA NE                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 3-Sep  | CANG              | ETA NE                        | Unknown              | 25-50%  | Euthanized    | Incidental           | Unknown             | Floating bitumen                      |
| 5-Sep  | COME              | ETA SW                        | Unknown              | 75-100% | Not recovered | Incidental           | Unknown             | Floating bitumen                      |
| 5-Sep  | CORA              | ETA SW                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 6-Sep  | CANG              | ETA NW                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 6-Sep  | CANG              | ETA Main                      | Cokebeach            | 75-100% | Euthanized    | Bird survey          | Binoculars          | Floating bitumen                      |
| 7-Sep  | KILL              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 8-Sep  | CANG              | ETA NW                        | Unknown              | 75-100% | Not recovered | Incidental           | Unknown             | Floating bitumen                      |
| 10-Sep | KILL              | W_ETA_Drainage_Pond2          | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 10-Sep | CANG              | ETA NW                        | Unknown              | 75-100% | Not recovered | Incidental           | Unknown             | Floating bitumen                      |
| 10-Sep | Unknown Duck      | ETA NW                        | Unknown              | 75-100% | Not recovered | Incidental           | Unknown             | Floating bitumen                      |
| 12-Sep | AMWI              | ETA NE                        | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 17-Sep | SACR              | ETA SW                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 20-Sep | CANG              | East ETA NE                   | Unknown              | 75-100% | Not recovered | Incidental           | Unknown             | West ETA bitumen                      |
| 22-Sep | SESA              | ETA SW                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 22-Sep | STGR              | Basal                         | Shore                | 0%      | Found dead    | Incidental           | Unknown             | Unknown                               |
| 24-Sep | GRYE              | ETA NW                        | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 27-Sep | BARS              | ETA NE                        | Shore                | 0%      | Found dead    | Incidental           | Unknown             | Unknown                               |
| 4-Oct  | AMWI              | Temp_NODA_Runoff              | Water                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 4-Oct  | CANG              | East ETA NW                   | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 4-Oct  | CANG              | East ETA NE                   | Shore                | Unknown | Unknown       | Bird survey          | Binoculars          | Floating bitumen                      |
| 12-Oct | Unknown Gull      | ETA NE                        | Unknown              | 75-100% | Found dead    | Incidental           | Unknown             | Floating bitumen                      |
| 31-Oct | Unknown Duck      | ETA NW                        | Unknown              | 75-100% | Found dead    | Incidental           | Unknown             | Floating bitumen                      |

**Appendix 3.E: Incidental bird oiling and mortality events at Kearl post-monitoring program (after Oct 31, 2014)**

| Date  | Species | Pond Name<br>(Survey Station<br>ID) | Location<br>Description | % Oiled | Outcome | Context of<br>Detection | Method of<br>Detection | Potential<br>Reason for<br>Mortality/Oiling |
|-------|---------|-------------------------------------|-------------------------|---------|---------|-------------------------|------------------------|---------------------------------------------|
| 5-Nov | AMCO    | ETA NW                              | On bitumen              | Unknown | Unknown | Incidental              | Scope                  | Floating<br>bitumen                         |



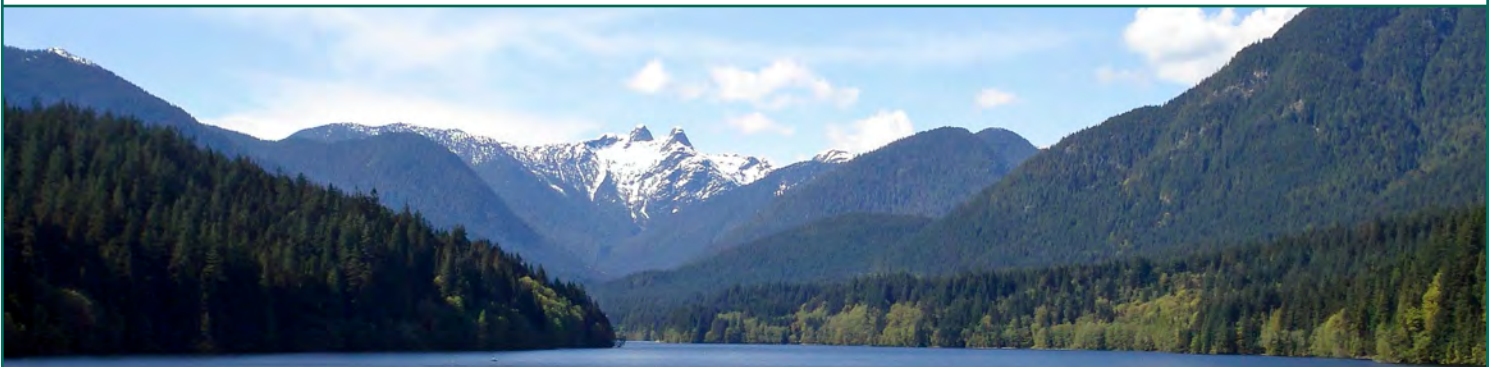
## 2014 Oil Sands Bird Contact Monitoring Program Report

**March 2015**

*Prepared for:*

**Shell Canada Energy**  
Fort McMurray, Alberta

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March 12, 2014

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**RE: Shell Albian Sands Oil Sands Bird Monitoring Program 2014 Annual Report**  
**JPM: Approval #153125-00-00 (as amended), MRM: Approval #20809-01-00 (as amended)**

---

Dear Mr. Liu;

Shell Canada Energy (Shell) is pleased to provide Alberta Energy Regulator (AER) with the 2014 annual report for the Shell Albian Sands Oil Sands Bird Contact Monitoring Program (OSBCMP). This report will also be included in the regional report that the OSBCMP Program Manager, Owl Moon Environmental Inc., will be submitting by March 15, 2015.

If you require further information please feel free to contact Paul Knaga (Environmental Specialist – Wildlife and Biodiversity) at 1-780-713-4507 ([paul.knaga@shell.com](mailto:paul.knaga@shell.com)).

Yours truly,

**SHELL CANADA ENERGY.**

**Paul Knaga**  
Environment Specialist – Wildlife and Biodiversity

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Joann Skilnick, Alberta Environment and Sustainable Resource Development  
Richard Wiacek, Environment Canada  
Shell Environment Regulatory Files



# 2014 OIL SANDS BIRD CONTACT MONITORING PROGRAM REPORT

*Prepared for:*

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**MARCH 2015**

SHELL6688  
VERSION 4

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## GLOSSARY

|                                          |                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AHD</b>                               | 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).                                                                                     |
| <b>ATV</b>                               | All-terrain vehicle, including amphibious vehicles (e.g., Argo).                                                                                                                                                                                                                                                                                   |
| <b>Bird, Contacted Bitumen; or Oiled</b> | Bird with 5-100% of its body surface oiled, usually when some feathers on the underside or breast are matted or speckled with a black sticky substance. 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.                         |
| <b>Bird, Flew Over (during a survey)</b> | Bird that flew below 100 m of elevation over the <b>survey area</b> , within the survey period. Birds that both flew over and landed were recorded as landed only.                                                                                                                                                                                 |
| <b>Bird, Landed (during a survey)</b>    | Bird that was in contact with a <b>pond</b> , within 500 m of the <b>survey station</b> , within the survey period.                                                                                                                                                                                                                                |
| <b>Bird, Oiled</b>                       | See “ <b>bird, contacted bitumen</b> ”.                                                                                                                                                                                                                                                                                                            |
| <b>Bird Survey</b>                       | Conducted by observers from a <b>survey station</b> ; identification and count of birds that <b>landed</b> within the <b>survey area</b> during the <b>survey period</b> , and birds that <b>flew over</b> , along with the collection of other information (e.g., weather conditions, visibility, bird oiling).                                   |
| <b>Bird Contact</b>                      | Bird (s) observed touching the surface or shore of a freshwater or process affected water pond.                                                                                                                                                                                                                                                    |
| <b>Brood</b>                             | One or a group of <b>chicks</b> , with a parent usually nearby.                                                                                                                                                                                                                                                                                    |
| <b>Chick</b>                             | Young local bird that has not yet developed the ability to fly.                                                                                                                                                                                                                                                                                    |
| <b>Effluent</b>                          | Water and other substances deposited in a <b>process-affected pond</b> , typically through a pipeline.                                                                                                                                                                                                                                             |
| <b>Guild, Non-target</b>                 | Species that peck, fly, glean, stoop/depredate, or scavenge (except gulls) as their primary means of foraging (Appendix A). Includes passerines, raptors, grouse, and woodpeckers.                                                                                                                                                                 |
| <b>Guild, Target; or Waterbird</b>       | Species that wade, dabble, or dive in water as their primary means of foraging (Appendix A). The program targets these birds because they have a greater likelihood of becoming in contact with ponds. Includes ducks, geese, shorebirds, grebes, loons, cranes, cormorants, swans, pelicans, coots, rails, gulls, terns, herons, and kingfishers. |
| <b>ha</b>                                | Hectare; 1 ha = 2.47 acres, or 100 x 100 m; 100 ha = 1 km <sup>2</sup> .                                                                                                                                                                                                                                                                           |
| <b>Incidental Observation</b>            | Bird detected in April–October outside a <b>bird survey</b> or <b>mortality search</b> that was 1) <b>oiled</b> , dead, or euthanized; or 2) a <b>species of conservation concern</b> in contact with a <b>process-affected pond</b> .                                                                                                             |
| <b>Island</b>                            | Structure on a <b>pond</b> , surrounded by water, where birds may stand; may be permanent or temporary, natural or artificial, floating or fixed. Includes mats of floating logs or muskeg.                                                                                                                                                        |
| <b>Monitoring</b>                        | <b>Bird surveys</b> and <b>mortality searches</b> .                                                                                                                                                                                                                                                                                                |

|                                        |                                                                                                                                                                                                                                                                                               |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Mortality</b>                       | Bird of any species found dead or euthanized in association with <b>process-affected ponds</b> , either during a <b>mortality search</b> or as an <b>incidental observation</b> .                                                                                                             |
| <b>Mortality Search</b>                | Search at a <b>pond</b> or section of a pond's surface or <b>shoreline</b> for dead or dying birds. Searches were conducted by boat, truck, or walking.                                                                                                                                       |
| <b>OSBCMP</b>                          | Oil Sands Bird Contact Monitoring Program                                                                                                                                                                                                                                                     |
| <b>Pond</b>                            | Open-air body of water or water storage facility, including its contents, <b>shore</b> , and <b>islands</b> ; may be permanent or temporary.                                                                                                                                                  |
| <b>Pond, Freshwater</b>                | <b>Pond</b> (including its contents, <b>shore</b> , and <b>islands</b> ) containing groundwater, rainwater or runoff water unaffected by the mining process or plant operations.                                                                                                              |
| <b>Pond, Process-affected</b>          | <b>Pond</b> (including its contents, <b>shore</b> , and <b>islands</b> ) containing water and substances that have been used in or affected by the mining process or plant operations, including tailings, runoff and recycled water. Bitumen may be present (floating or sinking) or absent. |
| <b>Shore</b>                           | An area along <b>shorelines</b> that may be reached by changing water levels or effluent.                                                                                                                                                                                                     |
| <b>Shoreline</b>                       | Perimeter, expressed in metres (m) or kilometres (km), along which the pond's water meets land.                                                                                                                                                                                               |
| <b>Species of Conservation Concern</b> | Species designated as Endangered, Threatened, or Special Concern under the Canadian <i>Species at Risk Act</i> , COSEWIC or the Alberta <i>Wildlife Act</i> , or listed within Alberta as At Risk, May Be at Risk, or Sensitive (Appendix A).                                                 |
| <b>Survey Area</b>                     | Area comprising the pond's surface, <b>shores</b> and <b>islands</b> within 500 m of the <b>survey station</b> .                                                                                                                                                                              |
| <b>Survey Period</b>                   | Pre-determined amount of time during which <b>bird surveys</b> were conducted. Surveys were 10 min for stations at ponds smaller than 150 ha and 30 min for stations at ponds of 150 ha or larger.                                                                                            |
| <b>Survey Station</b>                  | A fixed location near the edge of a <b>pond</b> , where <b>bird surveys</b> were conducted at regular intervals.                                                                                                                                                                              |
| <b>Waterbird</b>                       | See " <b>guild, target</b> ".                                                                                                                                                                                                                                                                 |

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## 4.0 SHELL CANADA ENERGY

### 4.1 SUMMARY

#### 4.1.1 Bird Landings and Mortalities at Process-affected Ponds

Monitoring of bird contact with seven process-affected (PA) ponds operated by Shell Canada Energy (Shell) was implemented from April 1 to October 31, 2014. The level of effort involved in monitoring PA ponds is summarized in Table 4.1. A total of 5,436 birds comprising 54 species were documented at PA water ponds (Table 4.2). A total of 2,055 birds (38% of observations) were documented contacting the water in PA ponds (Table 4.2). More contacts occurred at ponds with higher amounts of vegetation. Two deceased diving ducks were documented during designated mortality searches and another 31 birds were recorded as incidental mortalities. A total of 106 birds were documented contacting bitumen during the 2014 monitoring season.

**Table 4.1 Monitoring effort at process-affected ponds at Shell in 2014.**

| Bird Surveys                                           |         |      |       |         |
|--------------------------------------------------------|---------|------|-------|---------|
| # Ponds Surveyed                                       | 7       |      |       |         |
| Total Surface Area (over water) of Ponds Surveyed (ha) | 364.61  |      |       |         |
| # 10-min Surveys Conducted                             | 314     |      |       |         |
| # 30-min Surveys Conducted                             | 1280    |      |       |         |
| Mortality Searches                                     |         |      |       |         |
| # Ponds Searched                                       | 7       |      |       |         |
| Total Surface Area (over water) of Ponds Surveyed (ha) | 1165.58 |      |       |         |
| # Searches                                             | 67      |      |       |         |
| Search Method                                          | Boat    | Walk | Truck | Total   |
| Total Time Searched (h)                                | 200.05  | 0    | 0     | 200.05  |
| Distance Searched <sup>1</sup> (km)                    | 870.77  | 0    | 0     | 870.77  |
| Area Searched <sup>1</sup> (ha)                        | 9657.38 | 0    | 0     | 9657.38 |

<sup>1</sup> For each search, either distance OR area counted towards effort.

**Table 4.2 Bird observations at process-affected ponds at Shell in 2014.**

|                              | Waterbirds |          |                   |            |                  |            | Non-target Guilds |          |                   |            |                  |            |
|------------------------------|------------|----------|-------------------|------------|------------------|------------|-------------------|----------|-------------------|------------|------------------|------------|
|                              | Landed     | Fly Over | Contacted Bitumen |            | Mortality        |            | Landed            | Fly over | Contacted Bitumen |            | Mortality        |            |
|                              |            |          | Bird Survey       | Incidental | Mortality Search | Incidental |                   |          | Bird Survey       | Incidental | Mortality Search | Incidental |
| Number of birds <sup>1</sup> | 1803       | 2310     | 89                | 17         | 2                | 31         | 252               | 1071     | 0                 | 0          | 0                | 1          |
| Number of species            | 43         | 24       | 7                 | 4          | 2                | 10         | 11                | 21       | 0                 | 0          | 0                | 1          |

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times.

### 4.1.2 Bird Landings at Freshwater Pond

Bird contacts with PA ponds were compared with bird contacts on a freshwater pond known as Jackpine Lake, which is a compensation lake. Monitoring efforts at Jackpine Lake are summarized in Table 4.3. A total of 625 birds comprising 43 species were documented at Jackpine Lake (Table 4.4).

**Table 4.3 Survey effort on the freshwater pond at Shell in 2014.**

|                                                          |       |
|----------------------------------------------------------|-------|
| # Pond(s) Surveyed                                       | 1     |
| Total Surface Area (over water) of Pond(s) Surveyed (ha) | 23.88 |
| # 10-min Surveys Conducted                               | 0     |
| # 30-min Surveys Conducted                               | 52    |

**Table 4.4 Bird observations on the freshwater pond at Shell in 2014.**

|                      | Waterbirds |          |                   |            |                        | Non-target Guilds |          |                   |            |                        |
|----------------------|------------|----------|-------------------|------------|------------------------|-------------------|----------|-------------------|------------|------------------------|
|                      | Landed     | Fly Over | Contacted Bitumen |            | Mortality (Incidental) | Landed            | Fly Over | Contacted Bitumen |            | Mortality (Incidental) |
|                      |            |          | Bird Survey       | Incidental |                        |                   |          | Bird Survey       | Incidental |                        |
| # Birds <sup>1</sup> | 413        | 149      | n/a               | n/a        | n/a                    | 21                | 42       | n/a               | n/a        | n/a                    |
| # Species            | 25         | 15       | n/a               | n/a        | n/a                    | 3                 | 9        | n/a               | n/a        | n/a                    |

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times.

### 4.1.3 Standardized Monitoring

Surveys adhered to the OSBCMP protocols (St. Clair et al 2014) and took place from April 1 to October 31, 2014. Bird monitoring was conducted at all tailings PA ponds and at one freshwater pond. Monitoring took place daily for 30 minutes at two stations on each pond >1.5km<sup>2</sup> (ETF and Inpit in MRM and MFT in JPM) and for ten minutes at one station on each pond <1.5km<sup>2</sup> (SEA and Inpit 2B in MRM and TT in JPM). SC2 in JPM (<1.5km<sup>2</sup>) was monitored for 30 minutes at one station due to the high potential of bird contacts. Jackpine Lake is a freshwater waterbody that was monitored for 30 minutes at one station twice per week. All 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 acceptable. Details of the standardized methods for bird surveys are provided in Section 4.3.2.

Mortality surveys were conducted as per the 2014 OSBCMP protocols (St. Clair et al 2014). Route-based and focused searches were conducted every two weeks on each of the PA water ponds included in this program. Route-based mortality surveys attempted to cover the entire pond, while focused searches encompassed smaller areas that were identified as higher risk to birds due to bitumen content and the number of mortalities in the previous year.

Intra-year changes in survey locations (Appendix 4A), required primarily to accommodate construction activities in the tailings area, are summarized below along with the number of weather-related survey cancellations:

- Survey sites inaccessible due to construction or field truck issues – 15 days;
- Alternate monitoring locations used – 19 days; and
- Survey sites inaccessible due to weather-related events – 14 days.

#### 4.1.4 Species of Conservation Concern

In total, 1,033 observations of species of conservation concern, either federal (SARA) or provincial (ESRD) were documented at PA ponds during bird monitoring surveys (Table 4.5).

**Table 4.5 Number of observations of birds of conservation concern at process-affected ponds at Shell in 2014.**

| Species                  | Landed <sup>1</sup> |            | Fly Over <sup>1</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|--------------------------|---------------------|------------|-----------------------|--------------------------------|------------|------------------|------------|
|                          | Bird Survey         | Incidental | Bird Survey           | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>        |                     |            |                       |                                |            |                  |            |
| Lesser scaup             | 430                 | 189        | 44                    | 0                              | 0          | 1                | 1          |
| Horned grebe             | 41                  | 5          | 0                     | 0                              | 0          | 0                | 0          |
| Northern pintail         | 30                  | 93         | 46                    | 0                              | 0          | 0                | 0          |
| Green-winged teal        | 29                  | 12         | 0                     | 12                             | 0          | 0                | 2          |
| White-winged scoter      | 8                   | 0          | 1                     | 0                              | 0          | 0                | 0          |
| Sandhill crane           | 0                   | 6          | 11                    | 0                              | 0          | 0                | 0          |
| Black tern               | 0                   | 0          | 2                     | 0                              | 0          | 0                | 0          |
| Great blue heron         | 0                   | 0          | 1                     | 0                              | 0          | 0                | 0          |
| Pied-billed grebe        | 0                   | 0          | 0                     | 0                              | 0          | 0                | 1          |
| <b>Non-target Guilds</b> |                     |            |                       |                                |            |                  |            |
| American kestrel         | 1                   | 0          | 2                     | 0                              | 0          | 0                | 0          |
| Northern harrier         | 1                   | 0          | 16                    | 0                              | 0          | 0                | 0          |
| Sharp-tailed grouse      | 1                   | 0          | 7                     | 0                              | 0          | 0                | 0          |
| Bald eagle               | 0                   | 1          | 0                     | 0                              | 0          | 0                | 0          |
| Northern goshawk         | 0                   | 1          | 0                     | 0                              | 0          | 0                | 0          |
| Barn swallow             | 0                   | 0          | 53                    | 0                              | 0          | 0                | 0          |
| Peregrine falcon         | 0                   | 0          | 2                     | 0                              | 0          | 0                | 0          |

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times.

### 4.1.5 Adaptive Management

Site management adaptations in 2014 included:

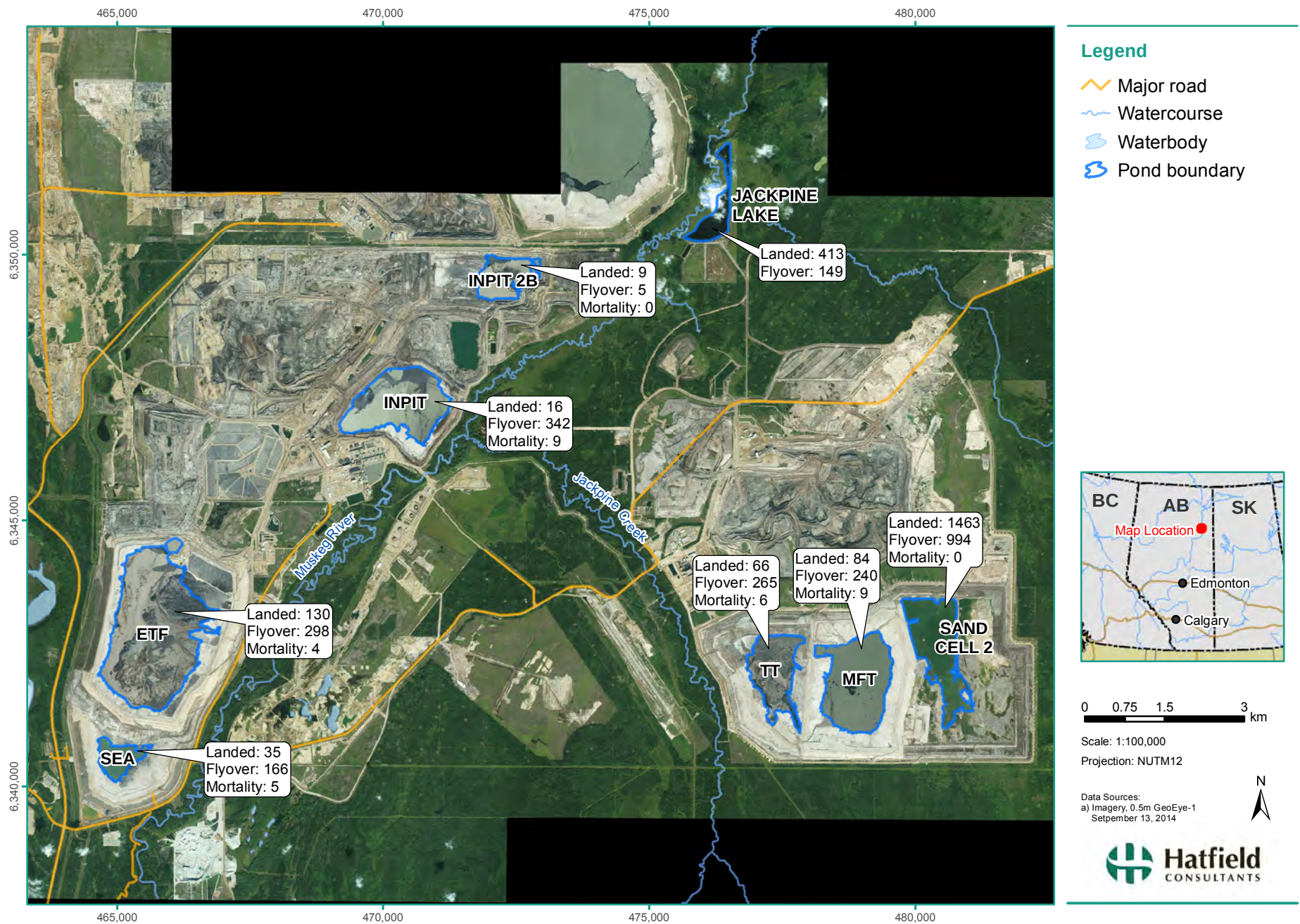
- Testing a new radar head on the marine radars as part of the deterrent detection system. This allows the radars to detect much more and mask less, increasing the detection and deterrent ability. Shell will upgrade all radar heads to the new HD head in 2015;
- Shell Projects finished stripping the muskeg in SC2 that was acting as a green up area and attractant for waterfowl; and
- Argos were used for hazing purposes on SC2, particularly in areas that had not yet been flooded and on small ponds where waterfowl would tend to congregate.

## 4.2 INTRODUCTION

### 4.2.1 Site

The 2014 Shell bird monitoring program was conducted at two mine sites: Muskeg River Mine (MRM) west of Muskeg River and Jackpine Mine (JPM) east of Jackpine Creek (Figure 4.1).

Figure 4.1 Process-affected and freshwater ponds at Shell in 2014.



MRM has been operating since late 2002 (Shell 2015a). It is located on Lease 13 approximately 70 km north of Fort McMurray, and about 500 km northeast of Edmonton, Alberta (Shell 2015a). The MRM is contained within Township 94 and 95, Ranges 9, 10 and 11.

The MRM contains four PA ponds (Figure 4.1):

- External Tailings Facility pond (ETF) located at 12V E 466077 N 6343488;
- South Expansion Area pond (SEA) located at 12V E 465648 N 6340245;
- Cell 1 pond (Inpit) located at 12V E 470698 N 6346877; and
- Cell 2B pond (Inpit 2B) located at 12V E 472414 N 6349342.

The Jackpine Mine has been in operation since August, 2010 (Shell 2015b). JPM is located on the east side of Lease 13, approximately 70 km north of Fort McMurray, Alberta.

The JPM contains three PA ponds (Figure 4.1):

- Sand Cell 1 (MFT) located at 12V E 478574 N 6342134;
- Thickened Tailings pond (TT) located at 12V E 477583 N 6342387; and
- Sand Cell 2 (SC2) located at 12V E 480393 N 6342651.

JPM also contains one freshwater pond, Jackpine Lake that was monitored under the OSBCMP. It is located at 12V E 476307 N 635075 (Figure 4.1).

In addition to the ponds monitored in 2013 under the OSBCMP (ETF, SEA, Inpit, MFT, TT and Jackpine Lake), the 2014 monitoring program included two new ponds: Inpit 2B and SC2 (Figure 4.1). Inpit 2B is an Inpit Tailings Pond and a Dedicated Disposal Area (DDA) for D74 Fines Capture. Consolidated Tailings (CT) are deposited in the pond, which is a mixture of coarse sand tailings, mature fine tailings and alum. SC2 was constructed to increase the tailings capacity at JPM, and acts primarily as a sand storage facility. Construction was not complete during the 2014 OSBCMP, and the pond contained fresh water from rain and snowmelt. A small amount of mature fine tailings was dispensed into a section of the pond on April 29, 2014, but posed no risk to birds contacting the pond surface.

## 4.2.2 Personnel

Minimum qualifications for bird monitoring crew members included a B.Sc. in ecology or terrestrial biology and a minimum of one year experience in avian biology and bird identification. Two of the five crew members had previous experience working with the OSBCMP at Shell. All 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 personnel on the Shell site included the Bird Crew Foremen and Bird Crew Laborers. The Bird Crew Foremen managed the mortality surveys, trained Bird Crew Laborers, and performed QA/QC checks on final mortality search data. Foremen and laborers completed intensive site training,

including mine driving, boat training, flare guns and wildlife hazing training. New personnel were typically given 40 hours of training at the beginning of the summer, but were also mentored over the entire monitoring season. Mortality search personnel were not allowed to perform mortality searches alone until approved by the Bird Crew Foremen. Mortality search protocols were reviewed and evaluated by the Bird Crew Foreman and Shell Canada Energy.

**Table 4.6 Positions fulfilled at Shell in 2014.**

| Position                                               | Crews                         | Shift Length   |
|--------------------------------------------------------|-------------------------------|----------------|
| Site lead, bird hazing, data verification              | One crew,<br>two personnel    | 10hr X 4 days  |
| Bird surveys, data verification                        | Two crews,<br>two personnel   | 10hr X 7 days  |
| Mortality searches, deterrent maintenance, bird hazing | Two crews,<br>three personnel | 12hr X 14 days |
| Program manager                                        | Off-site management personnel |                |

### 4.2.3 Management of Avian Attractants and Control of Hazards

To limit the attractiveness of PA ponds to wildlife, vegetation was regularly removed from the edges of PA ponds and along the perimeter dykes. Vegetation was removed for mine-related purposes, which indirectly benefited waterfowl by reducing attractants on the sites. On TT pond, specifically, two floating backhoes flipped and buried floating muskeg mats throughout the season to prevent green-up and establishment of vegetation on the pond and to eventually sink them. Bitumen containment booms were placed on ETF, MFT, and Inpit.

### 4.2.4 Deterrents

The current deterrent system employed by Shell is an on-demand BirdAvert™ deterrent system, which consists of land-based cannons and water-based floats. Units were deployed between March 18 and April 20, 2014, prior to bird migration in northern Alberta, and were disassembled in November 2014 following fall migration.

PA ponds at MRM are protected by a total of 73 BirdAvert™ units, all linked to radar and established at a density of 0.09 units/ha (Table 4.8, Figure 4A.1). PA ponds at JPM are protected by a total of 94 BirdAvert™ units, all linked to radar and established at a density of 0.15 units/ha (Table 4.8, Figure 4A.2). There are 3 floating units (Bird Guard) that are not hooked to radar, but are used in conjunction with the radar based units.

Implementation and placement of bird deterrent components was similar to last year. Units were placed at 250 m intervals over the ponds and associated shorelines as per the Shell Waterfowl Protection Plan (Shell 2014). On occasion, individual units were re-situated to accommodate construction work at the tailings ponds. The bulk of the deterrents were allocated to ETF and MFT, which have the largest surface area and have generally been the most active ponds for bird contacts and flyovers for the three years of the program. Additional deterrent system components will be placed around the developing SC2 pond in the spring of 2015.

**Table 4.7 Avian deterrents deployed at Shell (as of Fall 2014).**

| Deterrent Name          | Description                                                                                                                                                                                                                                                                                                                                             | Stimuli       | Sound Intensity at 1m (dB) | Activation Control | Placement | Number and Location                                     |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------|--------------------|-----------|---------------------------------------------------------|
| 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 some 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  | 89: JPM - MFT, SC2, TT MRM – ETF, SEA, Inpit, Inpit 2B  |
| Land Cannon             | Propane cannon                                                                                                                                                                                                                                                                                                                                          | Audio         | 118                        | Radar              | Land      | 105: JPM - MFT, SC2, TT MRM – 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: MRM – Inpit 2B                                       |

**Table 4.8**      **Number of avian radars and deterrents at process-affected ponds at Shell (as of Fall 2014).**

| Pond Name | Pond Area (over water; ha) | Number of Radar(s) | Combined Audio & Visual Deterrents <sup>1</sup> |         |            |         | Audio-only Deterrents |         |            |         | Visual-only Deterrents |         |            |         | Total |                    |
|-----------|----------------------------|--------------------|-------------------------------------------------|---------|------------|---------|-----------------------|---------|------------|---------|------------------------|---------|------------|---------|-------|--------------------|
|           |                            |                    | Linked to Radar                                 |         | Not Linked |         | Linked to Radar       |         | Not Linked |         | Linked to Radar        |         | Not Linked |         | Units | Density (units/ha) |
|           |                            |                    | Floating                                        | On Land | Floating   | On Land | Floating              | On Land | Floating   | On Land | Floating               | On Land | Floating   | On Land |       |                    |
| ETF       | 423.06                     | 1                  | 17                                              | 0       | 0          | 0       | 0                     | 16      | 0          | 0       | 0                      | 0       | 0          | 0       | 33    | 0.08               |
| SEA       | 42.21                      | 1                  | 4                                               | 0       | 0          | 0       | 0                     | 11      | 0          | 0       | 0                      | 0       | 0          | 0       | 15    | 0.36               |
| Inpit     | 183.56                     | 1                  | 6                                               | 0       | 0          | 0       | 0                     | 9       | 0          | 0       | 0                      | 0       | 0          | 0       | 15    | 0.08               |
| Inpit 2B  | 67.66                      | 1                  | 4                                               | 0       | 3          | 0       | 0                     | 6       | 0          | 0       | 0                      | 0       | 0          | 0       | 13    | 0.19               |
| MFT       | 194.49                     | 1                  | 17                                              | 0       | 0          | 0       | 0                     | 17      | 0          | 0       | 0                      | 0       | 0          | 0       | 34    | 0.17               |
| TT        | 100.69                     | 1                  | 12                                              | 0       | 0          | 0       | 0                     | 15      | 0          | 0       | 0                      | 0       | 0          | 0       | 27    | 0.27               |
| SC2       | 153.91                     | 1                  | 23                                              | 0       | 0          | 0       | 0                     | 10      | 0          | 0       | 0                      | 0       | 0          | 0       | 33    | 0.21               |
| Total     | 1165.58                    | 7                  | 83                                              | 0       | 3          | 0       | 0                     | 84      | 0          | 0       | 0                      | 0       | 0          | 0       | 170   | 0.15               |

<sup>1</sup> Combined deterrents count as one unit; individual components are described in Table 4.7.

## 4.2.5 Hazing Procedures

Manual hazing involves the use of flare guns, various noise flares (screamers, whistlers, bangers) and boats are used to avert waterfowl that are not deterred from the radar activation. Personnel on the deterrent crews receive classroom and practical training at the beginning of the season on the proper use, handling and storage of the flare guns, and are taught and mentored from experienced individuals on how to initiate effective hazing. Effective hazing may involve assessing the risk to the waterfowl and to personnel and the type of species you are trying to haze, and deciding on the direction and distance of displacement so as to reduce the inadvertent risk of exposure to oil in a different pond.

## 4.3 METHODS

Bird monitoring and bird deterrent methods followed the 2014 OSBCMP protocol as per St. Clair et al. (2014). Details are provided below.

### 4.3.1 Pond Characteristics

Descriptions of PA pond characteristics and contents are required as part of the OSBCMP. Pond contents could potentially include process-affected water, surface bitumen, islands (vegetated and non-vegetated) and floating mats of vegetation. Pond perimeter, pond island perimeter(s), bitumen coverage, and perimeter of emergent vegetation on ponds were traced onto September 2014 satellite images of the MRM and JPM mine sites by the project field crew leader. These tracings were then digitized into polygons using Geographic Information Systems. Once polygons were checked and finalized, measurements were made of total pond area (ha); shoreline length (vegetated and non-vegetated, in meters); total island area (ha); total bitumen coverage (ha), and total emergent vegetation coverage (ha).

### 4.3.2 Bird Surveys

Bird surveys were conducted by Hatfield bird monitors from April 1 to July 6, and from July 25 to October 31, 2014, to document bird activity during migration periods. Monitoring stations on each PA pond were visited daily. In MRM, monitors visited two stations at ETF and Inpit and one station at SEA and Inpit 2B. In JPM, monitors visited two stations at MFT and one station at TT and SC2 (Appendices 4A.3 and 4A.4). One monitoring station at Jackpine Lake (JPM) was visited twice weekly.

Survey methods were conducted as per the 2014 OSBCMP protocol. Bird observations involved pond surface and shoreline scans within a 500 m radius of the observation point and aerial scans 100 m above the observation point. The total survey area was defined as the area within the 500 m radius that included the pond surface and adjacent beach within 45 degrees on either side of the monitoring station. Observers used binoculars and spotting scopes to aid in the detection and identification of birds. Each survey was conducted for 30 minutes at ponds  $>1.5\text{km}^2$  (ETF, Inpit and MFT) and for ten minutes at ponds  $<1.5\text{km}^2$  (SEA and Inpit 2B). One 30 minute survey was conducted for both TT and SC2, which are both  $<1.5\text{km}^2$  but were deemed high risk ponds for waterbirds by ESRD. As an alternative to the timer on the tablets, monitors used stop watches to keep track of survey times. Locations of monitoring stations are presented in Appendix 4A.

Upon observing a bird, observers recorded:

- Pond name;
- Date and time of observation;
- Number of individuals seen;
- Identification of individuals to guild or species level;
- Age, sex and plumage of individuals; and
- Direction of travel, distance and altitude of individuals.

In the event that a bird was observed contacting a pond, observers recorded:

- How many individuals landed;
- Landing location (on water, on shore, in vegetation); and
- Presence and proximity of floating bitumen.

Data were recorded in field notebooks and entered into PC tablets. Results were submitted to OMEI daily for PA ponds and twice weekly for the freshwater pond, as outlined in the OSBCMP.

### 4.3.3 Inter-observer Variability (IOV)

Inter-observer variability (IOV) is the difference in the observed number and species of birds between observers while conducting the same survey. IOV observation surveys were randomly conducted on Wednesdays throughout the entire monitoring period. The IOV comparison surveys are replicate observations of the number of birds and the number of species recorded independently by two observers at the same time and location. They were used to provide a measure of repeatability and consistency in the observation data. The relative percent difference (RPD) in the duplicate observations was calculated according to the following formula:

$$RPD_{\#birds} = \frac{|\alpha - \beta|}{\gamma} * 100$$

Where  $\alpha$  is the number of birds from Observer 1,  $\beta$  is the number of birds observed from Observer 2, and  $\gamma$  is the mean of the number of birds from both observers. The mean number of birds provides the reference value against which the two individual observations are compared and assumes that the correct answer is likely between Observer 1 and Observer 2.

The same equation was used to determine the number of species counted by each observer (i.e., to obtain  $RPD_{\#species}$ ).

### 4.3.4 Mortality Searches

Shell retained the Paradox Environmental bird deterrent crew to conduct the bird mortality searches. Mortality surveys were comprised of boat searches along randomly established transects (route-based) and focussed searches in areas of high risk to birds. Route-based transects were pre-determined and crossed the entire surface of ponds. Focussed searches targeted pre-determined high risk areas on each PA pond. High risk areas were selected based on site-knowledge of the bird crew foreman on where

surface bitumen tends to collect. Each pond was visited at least once every two weeks. Crew members used binoculars to scan the surface and shoreline of the PA pond. Mortality protocols followed the 2014 OSBCMP Monitoring Plan, with crew members collecting the following:

- Date the survey took place;
- Pond name;
- Type of mortality survey;
- Number of birds found during the survey;
- GPS track log information;
- Visibility conditions;
- Minutes spent conducting survey;
- Distance covered during survey;
- Percentage of pond and shoreline searched;
- Percentage of bitumen coverage on pond;
- Cloud cover;
- Wind speed and direction; and
- Precipitation (none, rain, fog, snow, hail).

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

- Identification of individual(s) to guild or species;
- Number of individuals found;
- 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. There were deviations from the mortality search of the Monitoring Plan. For each pond, the number of surveys was not consistent with the 24 (12 route-based, 12 focussed) survey sites recommended in the 2014 OSBCMP protocol. Deviations were as follows:

- Two focussed and four route-based surveys were missed at ETF due to restricted pond access;
- One route-based survey was missed at both SEA and Inpit 2B due to low water levels and access constraints;
- One focussed and three route-based surveys were missed at TT due to low water levels, which made pond access very difficult; and
- One route-based survey was missed at SC2 due to equipment problems.

### 4.3.5 Incidental Observations and Reporting

Incidental observations were made of birds present outside the 500 m radius during a PA pond survey, and outside of a designated survey area at the freshwater ponds.

Supplemental information from incidental observations included: 'new' species that were not detected during standardized bird surveys, species at risk, species that were abundant on site but not well-represented during surveys and any individuals or species exhibiting unusual behaviour.

Incidental observations were documented in the field notebooks and PC tablet and included the following information:

- Location, date and time;
- Identification of individual(s) to guild or species;
- Notes on unusual behavior;
- Number of individuals found; and
- Potential contact with bitumen.

## 4.4 RESULTS

### 4.4.1 Pond Characteristics

Total pond surface cover within survey areas ranged from 48.2 ha at SC2 2 to 1.59 ha at MFT 4. Monitoring stations ETF 1 and ETF 3 had the largest amounts of shoreline within the survey area, while MFT 4 had the lowest (Table 4.9). ETF 1, Inpit 2B 1 and SC2 2 had the greatest proportion of water within the survey area and SC2 1 and SC2 2 were the only stations with islands (Table 4.9).

ETF and MFT had the largest surface areas of all PA ponds (Table 4.10). TT had the highest island coverage and was the only PA pond with emergent vegetation. All of the emergent vegetation on TT was outside of the 500m radius of the survey station. Jackpine Lake was the only pond with vegetation around the perimeter of the pond surface area (Table 4.10).

**Table 4.9 Characteristics of survey stations monitored at Shell in 2014.**

| Pond Name <sup>1</sup> | Survey Station ID | Area (over water; ha) | Island (ha) | Emergent Veg. (ha) | Shoreline (m) |                |
|------------------------|-------------------|-----------------------|-------------|--------------------|---------------|----------------|
|                        |                   |                       |             |                    | Vegetated     | Non-veg.       |
| ETF                    | ETF 1             | 46.83                 | 0           | 0                  | 0             | 2595.07        |
|                        | ETF 3             | 15.87                 | 0           | 0                  | 0             | 2413.57        |
|                        | <b>Subtotal</b>   | <b>62.7</b>           | <b>0</b>    | <b>0</b>           | <b>0</b>      | <b>5008.64</b> |
| SEA                    | SEA 1             | 18.95                 | 0           | 0                  | 0             | 2078.86        |
|                        | SEA 2             | 22.12                 | 0           | 0                  | 0             | 2142.21        |
|                        | <b>Subtotal</b>   | <b>41.07</b>          | <b>0</b>    | <b>0</b>           | <b>0</b>      | <b>4221.07</b> |
| Inpit                  | Inpit 1           | 13.2                  | 0           | 0                  | 0             | 1362.66        |
|                        | Inpit 2           | 22.93                 | 0           | 0                  | 0             | 1601           |
|                        | <b>Subtotal</b>   | <b>36.13</b>          | <b>0</b>    | <b>0</b>           | <b>0</b>      | <b>2963.66</b> |

**Table 4.9 (Cont'd.)**

| Pond Name <sup>1</sup> | Survey Station ID | Area (over water; ha) | Island (ha) | Emergent Veg. (ha) | Shoreline (m) |                |
|------------------------|-------------------|-----------------------|-------------|--------------------|---------------|----------------|
|                        |                   |                       |             |                    | Vegetated     | Non-veg.       |
| Inpit 2B               | Inpit 2B 1        | 44.29                 | 0           | 0                  | 0             | 2041.91        |
| MFT                    | MFT 2             | 16.53                 | 0           | 0                  | 0             | 2011.89        |
|                        | MFT 3             | 15.14                 | 0           | 0                  | 0             | 987.78         |
|                        | MFT 4             | 1.59                  | 0           | 0                  | 0             | 360.13         |
|                        | MFT 5             | 10.51                 | 0           | 0                  | 0             | 1024.12        |
|                        | <b>Subtotal</b>   | <b>88.06</b>          | <b>0</b>    | <b>0</b>           | <b>0</b>      | <b>6425.83</b> |
| TT                     | TT 1              | 9.8                   | 0           | 0                  | 0             | 1148.1         |
| SC2                    | SC2 1             | 34.34                 | 0.07        | 0                  | 0             | 1883.81        |
|                        | SC2 2             | 48.22                 | 0.09        | 0                  | 0             | 1997.84        |
|                        | <b>Subtotal</b>   | <b>82.56</b>          | <b>0.16</b> | <b>0</b>           | <b>0</b>      | <b>3881.65</b> |
| Jackpine Lake          | Comp Lake 1       | 23.88                 | 0           | 0                  | 88.32         | 895.94         |

<sup>1</sup> Blue shading: freshwater pond.

**Table 4.10 Characteristics of ponds monitored at Shell in 2014.**

| Pond Name <sup>1</sup><br>(Year of Origin) | Pond Contents | Bitumen Cover               |                        | Pond Area (over water; ha) | Island (ha) | Emergent Veg. (ha) | Shoreline (m) |          |
|--------------------------------------------|---------------|-----------------------------|------------------------|----------------------------|-------------|--------------------|---------------|----------|
|                                            |               | % <sup>2</sup>              | Area <sup>3</sup> (ha) |                            |             |                    | Vegetated     | Non-veg. |
| ETF (2003)                                 | PA Water      | Range: 0-75<br>Mode: 26-50  | 319.79                 | 423.06                     | 0           | 0                  | 0             | 14392.3  |
| SEA (2008)                                 | PA Water      | Range: 0-25<br>Mode: 1-25   | 0.58                   | 42.21                      | 0           | 0                  | 0             | 4120.6   |
| INPIT (2009)                               | PA Water      | Range: 0-75<br>Mode: 6-15   | 93.4                   | 183.56                     | 0           | 0                  | 0             | 7906.3   |
| INPIT 2B (2014)                            | PA Water      | Range: 0-75<br>Mode: 1-5    | 30.05                  | 67.66                      | 0.02        | 0                  | 0             | 5732.9   |
| MFT (2010)                                 | PA Water      | Range: 1-50<br>Mode: 6-15   | 27.64                  | 194.49                     | 0           | 0                  | 0             | 7498.9   |
| TT (2010)                                  | PA Water      | Range: 6-100<br>Mode: 26-50 | 100.69                 | 108.99                     | 3.19        | 0.15               | 0             | 7822.6   |
| SC2 (2014)                                 | PA Water      | Range: 0.5<br>Mode: 0       | 0                      | 153.91                     | 2.89        | 0                  | 0             | 11980.3  |
| Jackpine Lake                              | Fresh Water   | 0                           | 0                      | 48.81                      | 0           | 0                  | 2764.5        | 2273.7   |

<sup>1</sup> Blue shading: freshwater pond

<sup>2</sup> Estimated during bird surveys

<sup>3</sup> Estimated from satellite imagery

## 4.4.2 Bird Observations

Surveys were conducted during both the spring (April 1 to July 6) and the fall (July 25 to October 31), to coincide with migration periods. PA ponds were surveyed daily for the entire duration of the seasons and involved a total of 1565 visits (Table 4.11), which translates to 680.5 hours of observation. Effort for the freshwater pond was 52 visits (26 hours) (Table 4.12).

**Table 4.11 Bird survey effort by station at Shell in 2014.**

| Pond Name <sup>1</sup> | Duration of Surveys (min) | Survey Station ID | Survey Area (over water; ha) | Number of Surveys Conducted in 2014 | Number of Surveys Conducted in spring 2014 (Apr 1 to July 5) | Number of Surveys Conducted in fall 2014 (July 25 to Oct 31) |
|------------------------|---------------------------|-------------------|------------------------------|-------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------|
| ETF                    | 30                        | ETF 3             | 46.83                        | 167                                 | 82                                                           | 85                                                           |
| ETF                    | 30                        | ETF 2             | 20.93                        | 1                                   | 1                                                            | 0                                                            |
| ETF                    | 30                        | ETF 1             | 15.87                        | 160                                 | 77                                                           | 83                                                           |
| SEA                    | 10                        | SEA 2             | 18.95                        | 120                                 | 49                                                           | 71                                                           |
| SEA                    | 10                        | SEA 1             | 22.12                        | 24                                  | 10                                                           | 14                                                           |
| Inpit                  | 30                        | IP 2              | 13.2                         | 163                                 | 83                                                           | 80                                                           |
| Inpit                  | 30                        | IP 1              | 22.93                        | 170                                 | 85                                                           | 85                                                           |
| Inpit 2B               | 10                        | IP2B 2            | 44.29                        | 8                                   | 7                                                            | 1                                                            |
| Inpit 2B               | 10                        | IP2B 1            | 5.41                         | 162                                 | 78                                                           | 84                                                           |
| MFT                    | 30                        | MFT 4             | 16.53                        | 58                                  | 57                                                           | 1                                                            |
| MFT                    | 30                        | MFT 3             | 15.14                        | 73                                  | 0                                                            | 73                                                           |
| MFT                    | 30                        | MFT 2             | 1.59                         | 148                                 | 68                                                           | 80                                                           |
| TT                     | 30                        | TT 4              | 9.8                          | 21                                  | 21                                                           | 0                                                            |
| TT                     | 30                        | TT 1              | 31.09                        | 162                                 | 82                                                           | 80                                                           |
| SC2                    | 30                        | SC2 2             | 34.34                        | 6                                   | 6                                                            | 0                                                            |
| SC2                    | 30                        | SC2 1             | 48.22                        | 151                                 | 71                                                           | 80                                                           |
| Jackpine Lake          | 30                        | CL 1              | 23.88                        | 52                                  | 20                                                           | 32                                                           |

<sup>1</sup> Blue shading: freshwater pond(s)

Survey effort was highest at ETF and Inpit because two monitoring stations were required for larger ponds. Search effort was lowest at Jackpine Lake because the 2014 OSBCMP protocol requires freshwater ponds to be visited twice per week rather than daily (Table 4.12). Deviations from the monitoring protocol at JPM and MRM are described in Section 4.1.3. Construction-related restraints, poor road conditions, timing of spring ice melt on the ponds, and variability in weather led to greater variation in the number of survey days during the spring. Constraints in station placement resulted in variable amounts of water surface area being surveyed (Table 4.12).

**Table 4.12 Bird survey effort by pond at Shell in 2014.**

| Pond Name <sup>1</sup> | Number of Survey Stations | Survey Area        |                                | Duration of Surveys (min) | Scheduled Monitoring Frequency (days/week) | Number of Surveys Conducted in 2014 | Percent of days with all scheduled surveys conducted |
|------------------------|---------------------------|--------------------|--------------------------------|---------------------------|--------------------------------------------|-------------------------------------|------------------------------------------------------|
|                        |                           | Water Surface (ha) | % of Pond Area Over Water (ha) |                           |                                            |                                     |                                                      |
| ETF                    | 2                         | 49.70              | 73.46                          | 30                        | 6                                          | 328                                 | 96.5                                                 |
| SEA                    | 1                         | 83.63              | 19.77                          | 10                        | 6                                          | 144                                 | 84.7                                                 |
| Inpit                  | 2                         | 36.13              | 19.68                          | 30                        | 6                                          | 333                                 | 97.9                                                 |
| Inpit 2B               | 1                         | 41.07              | 97.29                          | 10                        | 6                                          | 162                                 | 95.3                                                 |
| MFT                    | 2                         | 82.56              | 53.64                          | 30                        | 6                                          | 279                                 | 82.1                                                 |
| TT                     | 1                         | 33.26              | 17.10                          | 10                        | 6                                          | 162                                 | 95.3                                                 |
| SC2                    | 1                         | 40.89              | 37.52                          | 30                        | 6                                          | 157                                 | 92.4                                                 |
| Jackpine Lake          | 1                         | 23.88              | 48.92                          | 30                        | 2                                          | 52                                  | 100                                                  |

<sup>1</sup> Blue shading: freshwater ponds(s)

Bird counts varied among PA ponds. The highest bird counts occurred at SC2; however there were moderately high bird counts at ETF, Inpit, MFT and TT (Table 4.13, Figure 4.2).

The total number of bird contacts differed between ponds. Inpit had the lowest number of contacts relative to the number of birds flying over, whereas SC2 had the highest. Inpit 2B had similar, but very low, numbers of contacts and flyovers. All other ponds had larger proportions of fly-overs than landed birds (Table 4.13 and Table 4.14).

Species guilds documented contacting and flying over PA ponds included dabblers, divers, waders, gulls and non-target species (Table 4.13 and Table 4.14, Figure 4.2). Dabblers accounted for 55% of all flyover observations while divers and waders accounted for 45% and 37% of all pond contacts, respectively (Table 4.13 and Table 4.14, Figure 4.2).

The five most common species observed contacting ponds were lesser scaup (*Aythya affinis*), Canada goose (*Branta canadensis*), unknown sandpiper, eared grebe (*Podiceps nigricollis*), and an unknown small wader of the *Calidris* genus (Appendix 4C). The five most common species observed flying over the ponds were Canada goose, American pipit (*Anthus rubescens*), snow bunting (*Plectrophenax nivalis*), an unidentified shorebird, and common raven (*Corvus corax*) (Appendix 4C).

Total number of bird contacts on Jackpine Lake was greater than the number of flyovers (Table 4.13 and Table 4.14, Figure 4.2). Overall, dabblers and divers were the most commonly-observed species coming into contact with and flying over the freshwater pond. Waders were primarily observed flying over the freshwater pond and in numbers similar to the divers that flew over (Table 4.13 and Table 4.14). Jackpine Lake had a higher mean number of landed birds than any of the PA ponds except SC2 (Table 4.14).

**Table 4.13 Number of bird observations by pond and guild at Shell in 2014<sup>1</sup>.**

| Pond Name <sup>2</sup>          | Dabblers |           | Divers |           | Waders |           | Gulls  |           | Non-target |           | Total <sup>3</sup> |           |
|---------------------------------|----------|-----------|--------|-----------|--------|-----------|--------|-----------|------------|-----------|--------------------|-----------|
|                                 | Landed   | Flew Over | Landed | Flew Over | Landed | Flew Over | Landed | Flew Over | Landed     | Flew Over | Landed             | Flew Over |
| ETF                             | 1        | 114       | 10     | 1         | 116    | 178       | 3      | 5         | 0          | 0         | 130                | 298       |
| SEA                             | 4        | 5         | 16     | 3         | 7      | 155       | 8      | 3         | 0          | 0         | 35                 | 166       |
| Inpit                           | 0        | 195       | 4      | 0         | 5      | 50        | 5      | 97        | 2          | 0         | 16                 | 342       |
| Inpit 2B                        | 3        | 0         | 0      | 0         | 5      | 5         | 0      | 0         | 1          | 0         | 9                  | 5         |
| MFT                             | 15       | 88        | 54     | 8         | 13     | 110       | 1      | 16        | 1          | 18        | 84                 | 240       |
| TT                              | 15       | 213       | 1      | 0         | 50     | 47        | 0      | 5         | 0          | 0         | 66                 | 265       |
| SC2                             | 164      | 656       | 723    | 80        | 463    | 207       | 109    | 46        | 4          | 5         | 1463               | 994       |
| Total of Process Affected Ponds | 202      | 1271      | 808    | 92        | 659    | 752       | 126    | 172       | 8          | 23        | 1803               | 2310      |
| Jackpine Lake                   | 232      | 81        | 153    | 28        | 3      | 23        | 25     | 16        | 0          | 1         | 413                | 149       |

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times

<sup>2</sup> Blue shading: freshwater pond(s)

<sup>3</sup> Including unknown duck species (which may be dabblers or divers)

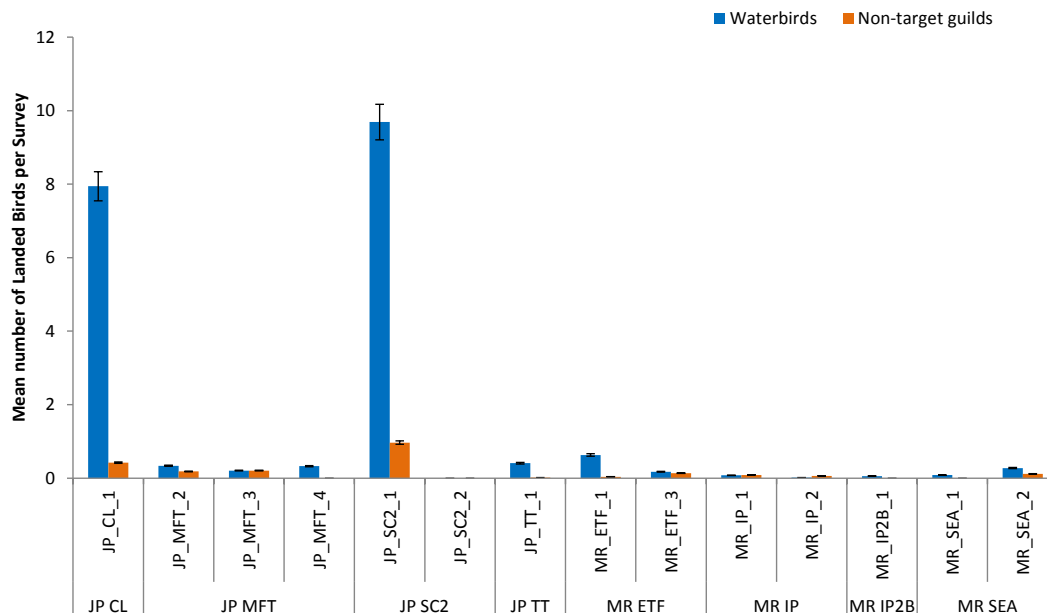
**Table 4.14 Mean number of landed birds per survey at Shell in 2014.**

| Pond Name <sup>1</sup> | Station ID | Dabblers | Divers | Waders | Gulls | Non-target Guilds | All Guilds <sup>2</sup> |
|------------------------|------------|----------|--------|--------|-------|-------------------|-------------------------|
| SEA                    | SEA 1      | 0.04     | 0.04   | 0      | 0     | 0                 | 0.08                    |
| SEA                    | SEA 2      | 0.03     | 0.13   | 0.06   | 0.07  | 0                 | 0.39                    |
| Inpit 2B               | IP2B 1     | 0        | 0.00   | 0.05   | 0     | 0.01              | 0.06                    |
| Inpit                  | IP 1       | 0        | 0.02   | 0.01   | 0.03  | 0.01              | 0.16                    |
| Inpit                  | IP 2       | 0        | 0.00   | 0.02   | 0     | 0                 | 0.08                    |
| ETF                    | ETF 1      | 0        | 0.06   | 0.57   | 0     | 0                 | 0.67                    |
| ETF                    | ETF 3      | 0.01     | 0      | 0.15   | 0.02  | 0                 | 0.31                    |
| TT                     | TT 1       | 0.09     | 0.02   | 0      | 0     | 0.31              | 0.43                    |
| SC2                    | SC2 1      | 1.09     | 4.79   | 3.07   | 0.72  | 0.03              | 10.66                   |
| SC2                    | SC2 2      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| MFT                    | MFT 2      | 0.01     | 0.32   | 0      | 0     | 0.01              | 0.52                    |
| MFT                    | MFT 3      | 0        | 0.01   | 0.18   | 0.01  | 0                 | 0.41                    |
| MFT                    | MFT 4      | 0.22     | 0.10   | 0      | 0     | 0                 | 0.33                    |
| Jackpine Lake          | CL 1       | 4.46     | 2.94   | 0.06   | 0.48  | 0                 | 8.37                    |

<sup>1</sup> Blue shading: freshwater pond(s)

<sup>2</sup> Including unknown duck species (which may be dabblers or divers)

**Figure 4.2 Mean number of landed birds per survey at Shell in 2014.**



Oiled birds were observed at three ponds (Inpit, TT, and ETF) during PA pond monitoring. The rate of detection at these ponds was generally low (0.01 to 0.07 birds per survey) except at ETF 1 where it was 0.44 birds per survey (Table 4.15, Figure 4.3). During scheduled bird surveys, 89 oiled birds were detected, while two were encountered during mortality searches (refer to Section 4.4.4), and 31 were recorded as incidental findings by the deterrent crew (Appendix 4.D), for a total of 114 oiled birds in 2014. Three large groups of shorebirds were documented landing and contacting bitumen at ETF during the spring migration; the largest was a flock of 50 unidentified sandpipers. Due to the distance of the observers from these landings, the fate of these birds could not be determined. Of the ducks that could be identified to the species level, green-winged teal was the most common oiled dabbling duck and long-tailed duck was the most common diver (Table 4.20). None of the oiled birds found by the bird monitors were documented as mortalities (see section 4.4.4).

**Table 4.15 Mean number of oiled birds per survey at Shell in 2014.**

| Pond Name <sup>1</sup> | Station ID | Dabblers | Divers | Waders | Gulls | Non-target Guilds | All Guilds <sup>2</sup> |
|------------------------|------------|----------|--------|--------|-------|-------------------|-------------------------|
| SEA                    | SEA 1      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| SEA                    | SEA 2      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| Inpit 2B               | IP2B 1     | 0        | 0      | 0      | 0     | 0                 | 0                       |
| Inpit                  | IP 1       | 0        | 0.01   | 0      | 0     | 0.01              | 0.02                    |
| Inpit                  | IP 2       | 0        | 0      | 0.01   | 0     | 0                 | 0.01                    |
| ETF                    | ETF 1      | 0        | 0.01   | 0.44   | 0     | 0                 | 0.44                    |
| ETF                    | ETF 3      | 0        | 0      | 0      | 0     | 0                 | 0                       |

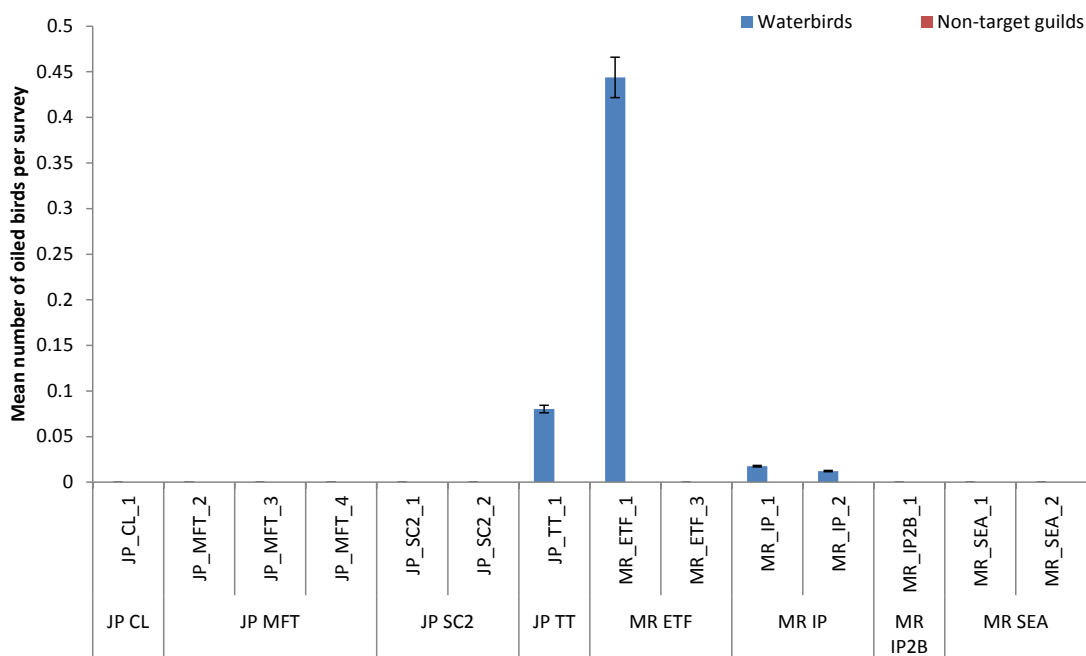
**Table 4.15 (Cont'd.)**

| Pond Name <sup>1</sup> | Station ID | Dabblers | Divers | Waders | Gulls | Non-target Guilds | All Guilds <sup>2</sup> |
|------------------------|------------|----------|--------|--------|-------|-------------------|-------------------------|
| TT                     | TT 1       | 0.07     | 0.01   | 0      | 0     | 0                 | 0.08                    |
| SC2                    | SC2 1      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| SC2                    | SC2 2      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| MFT                    | MFT 2      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| MFT                    | MFT 3      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| MFT                    | MFT 4      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| Jackpine Lake          | CL 1       | 0        | 0      | 0      | 0     | 0                 | 0                       |

<sup>1</sup> Blue shading: freshwater pond(s)

<sup>2</sup> Including unknown duck species (which may be dabblers or divers)

**Figure 4.3 Mean number of oiled birds per survey at Shell in 2014.**



Four broods were observed on SC2 in 2014 (Table 4.16).

**Table 4.16 Brood observations by species at process-affected ponds at Shell in 2014.**

| Species/Species Group | # Brood Observations <sup>1</sup> |
|-----------------------|-----------------------------------|
| Canada goose          | 1                                 |
| Lesser scaup          | 1                                 |
| Unknown scaup         | 2                                 |

<sup>1</sup> Each brood may contain one to multiple chicks; broods may be observed repeatedly and thus be counted multiple times.

### 4.4.3 Inter-observer Variability

IOV surveys were conducted at six ponds during 2014 and differences between observers were measured using RPD. Differences were only detected at two ponds, Sand Cell 2 and Jackpine Lake, and ranged from 0% to 200% (Table 4.17). The large IOV for birds flying over both ponds was the difference between one bird during the May 14 IOV survey at Sand Cell 2, and the difference between six birds and two species during the June 18 survey at Jackpine Lake. Overall the IOV differences were within reasonable limits for the monitors at Shell – 10% difference or less.

**Table 4.17 Inter-observer variability at Shell in 2014.**

| Comparison Survey | Survey Station ID | Landed*                         |                              | Flew Over*                      |                              |
|-------------------|-------------------|---------------------------------|------------------------------|---------------------------------|------------------------------|
|                   |                   | RPD: Number of Individual Birds | RPD: Number of Avian Species | RPD: Number of Individual Birds | RPD: Number of Avian Species |
| 9 April 2014      | TT 1              | 0                               | 0                            | 0                               | 0                            |
| 16 April 2014     | Inpit 2           | 0                               | 0                            | 0                               | 0                            |
| 30 April 2014     | TT 4              | -                               | -                            | -                               | -                            |
| 14 May 2014       | SC2 1             | 25                              | 50                           | 200                             | 200                          |
| 18 June 2014      | CL 1              | 0                               | 0                            | 200                             | 200                          |
| 18 June 2014      | MFT 2             | 0                               | 0                            | 0                               | 0                            |
| 22 Oct 2014       | CL 1              | 0                               | 0                            | 0                               | 0                            |
| <b>Mean</b>       |                   | <b>4.2</b>                      | <b>8.3</b>                   | <b>66.7</b>                     | <b>66.7</b>                  |

\* Dash (-) indicates no birds present. Zero (0) indicates no difference between observers.

### 4.4.4 Mortalities

A total of 154 transects were surveyed across the seven ponds in MRM and JPM (Table 4.18). Total search time was greater for JPM than for MRM; however total distance searched was greater for MRM (Table 4.18). TT had the greatest morality search effort and SEA had the least (Table 4.18).

**Table 4.18 Mortality search effort at Shell in 2014.**

| Pond Name | Number of Days Searched | Boat   |        |         | Walk |    |    | Truck |    |    | Total  |        |         |
|-----------|-------------------------|--------|--------|---------|------|----|----|-------|----|----|--------|--------|---------|
|           |                         | hrs    | km     | ha      | hrs  | km | ha | hrs   | km | ha | hrs    | km     | ha      |
| ETF       | 18                      | 21.35  | 157.60 | 1793.10 | 0    | 0  | 0  | 0     | 0  | 0  | 21.35  | 157.60 | 1793.1  |
| SEA       | 23                      | 9.40   | 74.61  | 757.46  | 0    | 0  | 0  | 0     | 0  | 0  | 9.40   | 74.61  | 757.46  |
| Inpit     | 24                      | 18.10  | 141.52 | 1589.83 | 0    | 0  | 0  | 0     | 0  | 0  | 18.10  | 141.52 | 1589.83 |
| Inpit 2B  | 22                      | 11.78  | 116.30 | 952.79  | 0    | 0  | 0  | 0     | 0  | 0  | 11.78  | 116.30 | 952.79  |
| MFT       | 24                      | 18.85  | 191.49 | 2269.80 | 0    | 0  | 0  | 0     | 0  | 0  | 18.85  | 191.49 | 2269.8  |
| TT        | 20                      | 104.29 | 50.66  | 472.19  | 0    | 0  | 0  | 0     | 0  | 0  | 104.29 | 50.66  | 472.19  |
| SC2       | 23                      | 16.27  | 138.60 | 1822.21 | 0    | 0  | 0  | 0     | 0  | 0  | 16.27  | 138.60 | 1822.21 |
| Total     | 154                     | 200.05 | 870.77 | 9657.38 | 0    | 0  | 0  | 0     | 0  | 0  | 200.05 | 870.77 | 9657.38 |

<sup>1</sup> Including route-based and focused transects; for each search, either distance OR area counted towards effort.

A total of 33 mortalities were documented on site in 2014. One American coot and one unknown scaup were documented during designated mortality searches, and 31 individuals comprising 14 species were documented as incidental mortalities by the deterrent crews (Table 4.19 and Table 4.20, Figure 4.4).

**Table 4.19 Number of mortalities by pond at Shell in 2014.**

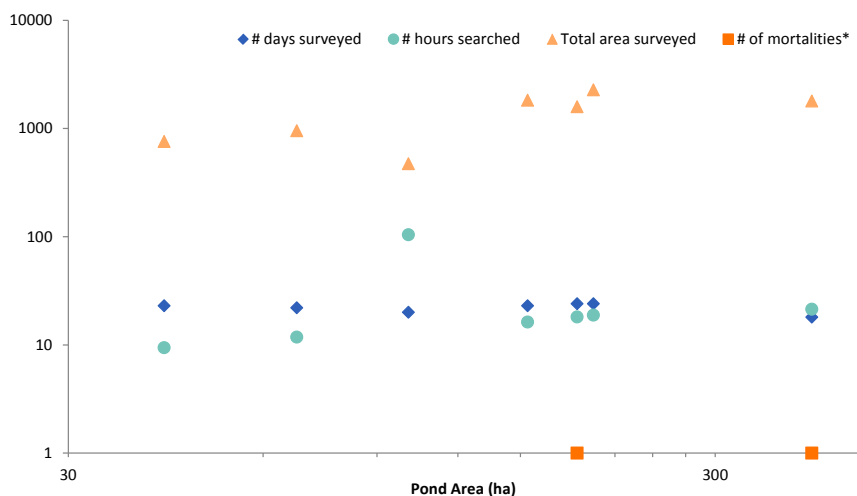
| Pond Name    | Mortality Search | Incidental | Total     |
|--------------|------------------|------------|-----------|
| ETF          | 1                | 3          | 4         |
| SEA          | 0                | 5          | 5         |
| Inpit        | 1                | 8          | 9         |
| Inpit 2B     | 0                | 0          | 0         |
| MFT          | 0                | 9          | 9         |
| TT           | 0                | 6          | 6         |
| SC2          | 0                | 0          | 0         |
| <b>Total</b> | <b>2</b>         | <b>31</b>  | <b>33</b> |

**Table 4.20 Number of observations of oiling and mortalities, by species, at Shell in 2014.**

| Species / Species Group     | Contacted Bitumen |            | Mortality        |            |
|-----------------------------|-------------------|------------|------------------|------------|
|                             | Bird Survey       | Incidental | Mortality Search | Incidental |
| Unknown sandpiper           | 53                | 12         | 0                | 0          |
| Unknown <i>Calidris</i> sp. | 17                | 0          | 0                | 0          |
| Green-winged teal           | 12                | 0          | 0                | 2          |
| Unknown shorebird           | 8                 | 0          | 0                | 0          |
| Unknown duck                | 2                 | 0          | 0                | 3          |
| American golden-plover      | 2                 | 0          | 0                | 0          |
| American coot               | 1                 | 1          | 1                | 2          |
| Ruddy duck                  | 1                 | 0          | 0                | 1          |
| Unknown grebe               | 1                 | 0          | 0                | 5          |
| Unknown diving duck         | 0                 | 3          | 0                | 0          |
| Canada goose                | 0                 | 1          | 0                | 3          |
| Unknown scaup               | 0                 | 0          | 1                | 1          |
| Northern shoveler           | 0                 | 0          | 0                | 6          |
| Long-tailed duck            | 0                 | 0          | 0                | 3          |
| Herring gull                | 0                 | 0          | 0                | 1          |
| Lesser scaup                | 0                 | 0          | 0                | 1          |
| Mallard                     | 0                 | 0          | 0                | 1          |
| Pied-billed grebe           | 0                 | 0          | 0                | 1          |
| Red-winged blackbird        | 0                 | 0          | 0                | 1          |
| <b>Total</b>                | <b>97</b>         | <b>17</b>  | <b>2</b>         | <b>31</b>  |

<sup>1</sup> Individual birds may be observed on multiple days or also observed as mortalities, and thus be counted multiple times.

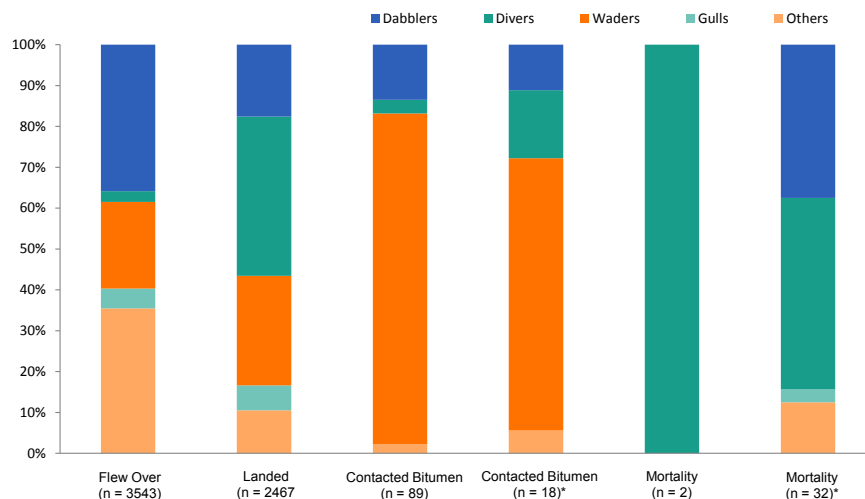
**Figure 4.4 Relationship between pond area, mortality search effort, and mortality search results.**



\*does not include incidental mortalities  
x and y axes have a Log10 scale

Although waders were the guild most commonly observed contacting bitumen, no wading birds were found dead during the 2014 monitoring season. Mortality was most common among dabbling ducks, followed by divers. Dabblers were most commonly seen flying over the ponds. Over 80% of mortalities recorded in 2014 (mortality surveys and incidentals) were ducks, with about 50% being divers and 35% dabbling ducks (Figure 4.5).

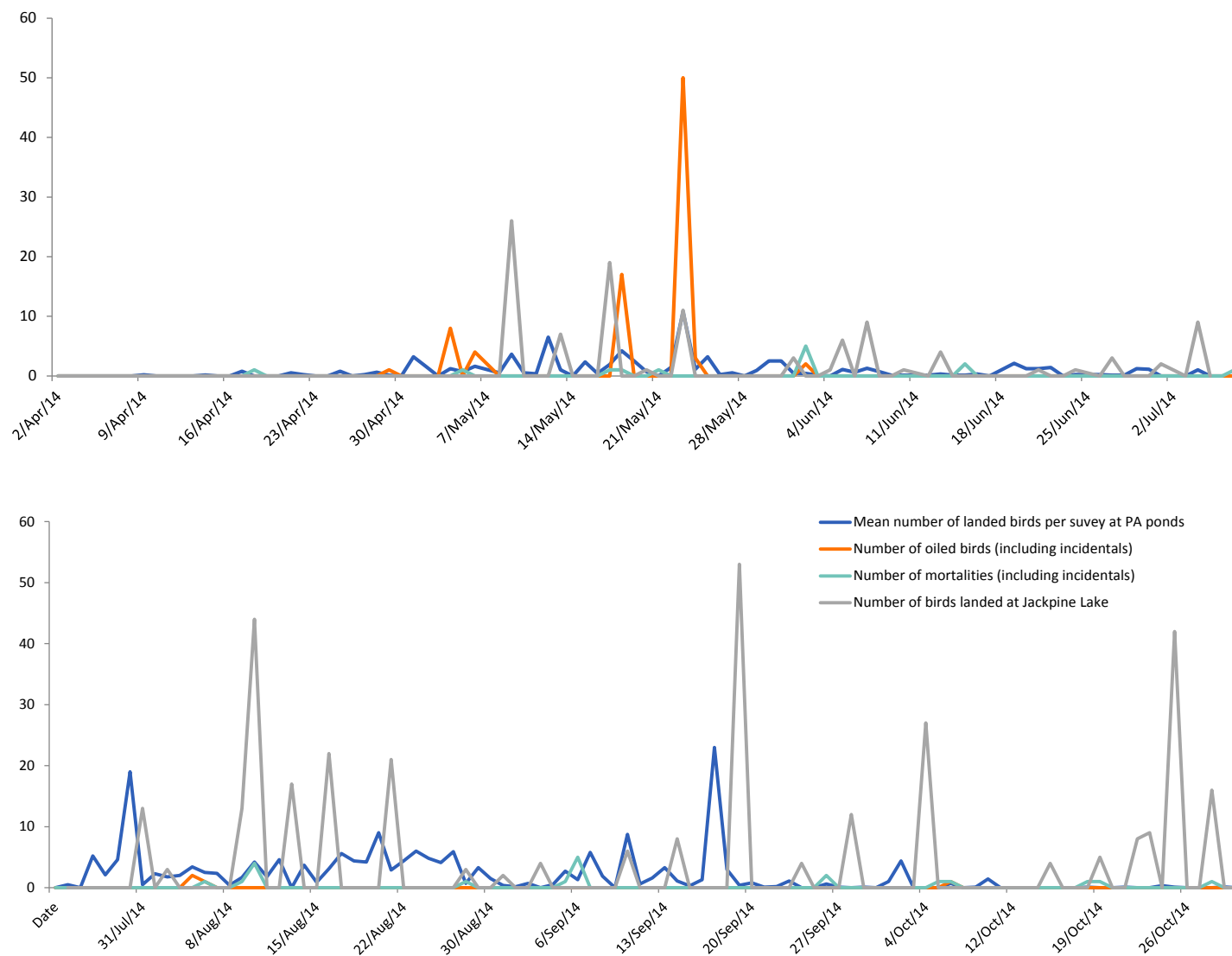
**Figure 4.5 Proportion of each guild for birds that flew over, landed, contacted bitumen, or died at Shell in 2014.**



\*incidental observations

The mean number of landed birds per survey was higher during fall migration than during spring migration at both the PA ponds and at Jackpine Lake (Figure 4.6). The number of oiled birds was highest during May and low during all of the fall migration months. The number of mortalities was spread equally across the entire monitoring session. Jackpine Lake had higher numbers of landed birds during fall migration than during the spring months.

**Figure 4.6** Timing of bird landings, oiling, and mortalities in spring (top) and fall (bottom) 2014 at Shell.



\*Individual birds may be observed repeatedly on consecutive days

**Table 4.21 Summary of bird survey, mortality and incidental results by pond at Shell in 2014.**

| Pond Name <sup>4</sup> | Pond Area<br>(over water; ha) | Potential Attractants                                   | Occurrence<br>of Floating<br>Bitumen | Mean Number of Landed<br>Waterbirds per Survey |        |        |       | Number of<br>Species<br>Landed |                                                    | Observations<br>of Oiled Birds |                         | Number of<br>Mortalities |            |
|------------------------|-------------------------------|---------------------------------------------------------|--------------------------------------|------------------------------------------------|--------|--------|-------|--------------------------------|----------------------------------------------------|--------------------------------|-------------------------|--------------------------|------------|
|                        |                               |                                                         |                                      | Dabblers                                       | Divers | Waders | Gulls | Total <sup>2</sup>             | Species of<br>Conservation<br>Concern <sup>3</sup> | Per Survey <sup>2</sup>        | Incidental <sup>1</sup> | Mortality Search         | Incidental |
| ETF                    | 423.06                        | Sandy shoreline                                         | Always                               | 0                                              | 0.03   | 0.35   | 0.01  | 159                            | 4                                                  | 71                             | 1                       | 1                        | 3          |
| SEA                    | 42.21                         | Sandy shoreline                                         | Always                               | 0.03                                           | 0.11   | 0.05   | 0.06  | 49                             | 2                                                  | 0                              | 0                       | 0                        | 5          |
| Inpit                  | 183.56                        | Sandy shoreline                                         | Always                               | 0                                              | 0.01   | 0.02   | 0.02  | 41                             | 2                                                  | 5                              | 2                       | 1                        | 8          |
| Inpit 2B               | 67.66                         | Inlets                                                  | Always                               | 0.02                                           | 0      | 0.03   | 0     | 9                              | 0                                                  | 0                              | 0                       | 0                        | 0          |
| MFT                    | 194.49                        | Sandy shoreline                                         | Always                               | 0.05                                           | 0.19   | 0.05   | 0     | 126                            | 20                                                 | 0                              | 1                       | 0                        | 9          |
| TT                     | 100.69                        | Islands, floating<br>vegetation, emergent<br>vegetation | Always                               | 0.09                                           | 0.01   | 0.31   | 0     | 69                             | 13                                                 | 13                             | 0                       | 0                        | 6          |
| SC2                    | 153.91                        | Islands, floating<br>vegetation, emergent<br>vegetation | Less than<br>half the days           | 1.04                                           | 4.61   | 2.95   | 0.69  | 1609                           | 481                                                | 0                              | 0                       | 0                        | 0          |
| Jackpine<br>Lake       | 48.81                         | Inlets, shallows                                        | Never                                | 4.46                                           | 2.94   | 0.06   | 0.48  | 435                            | 55                                                 | 0                              | 0                       | 0                        | 0          |

<sup>1</sup> 26 of the 31 oiled birds that were detected incidentally were not associated with any potential attractants

<sup>2</sup> During bird surveys

<sup>3</sup> Including incidental observations

<sup>4</sup> Blue shading: freshwater pond(s)

#### 4.4.5 Species of Conservation Concern

Species of conservation concern, as defined in the OSBCMP, were detected at PA ponds and at Jackpine Lake. At PA ponds, 16 species were observed (Table 4.5):

- Two dabblers – green-winged teal (*Anas crecca*) and northern pintail (*Anas acuta*);
- Five divers – black tern (*Chlidonias niger*), horned grebe (*Podiceps auritus*), lesser scaup (*Aythya affinis*), pied-billed grebe (*Podilymbus podiceps*) and white-winged scoter (*Melanitta fusca*);
- Two waders – great blue heron (*Ardea herodias*) and sandhill crane (*Grus canadensis*); and
- Seven non-target species – American kestrel (*Falco sparverius*), bald eagle (*Haliaeetus leucocephalus*), barn swallow (*Hirundo rustica*), northern goshawk (*Accipiter gentilis*), northern harrier (*Circus cyaneus*), peregrine falcon (*Falco peregrinus*) and sharp-tailed grouse (*Tympanuchus phasianellus*).

The majority of observations during bird surveys were of lesser scaup coming into contact with the PA ponds. Large numbers of this species were also documented flying over as incidental observations (Table 4.5). Non-target species documented were only observed flying over the monitoring station.

At Jackpine Lake, eight species of conservation concern were documented:

- One dabbler – northern pintail (*Anas acuta*);
- Three divers – horned grebe (*Podiceps auritus*), lesser scaup (*Aythya affinis*) and white-winged scoter (*Melanitta fusca*); and
- Three non-target species – barn swallow (*Hirundo rustica*), northern harrier (*Circus cyaneus*) and sharp-tailed grouse (*Tympanuchus phasianellus*).

Two species documented during monitoring surveys are federally listed on Schedule 1 of the Species at Risk Act (SARA). Peregrine falcon is designated as ‘Special Concern’ and barn swallow is designated as ‘Threatened’. These are non-target species that were observed flying over the PA ponds.

### 4.5 DISCUSSION

#### 4.5.1 Bird Deterrents

The density of deterrents at the four oldest ponds (ETF, Inpit, MFT and TT) in the two mine sites has been consistent since 2011. Units are placed at 250 m intervals over the ponds and associated shorelines, such that the effective areas of the units covered the entire tailings pond and shorelines. On occasion, individual units are re-situated to accommodate construction work at the tailings ponds.

The number of deterrents on TT was increased in 2014 from 20 to 27 and this may have contributed to the large decline in the number of flyovers recorded.

Two new ponds, SC2 and Inpit 2B, contained PA water in 2014 and bird deterrents have been placed at these sites in densities similar to those of the other ponds. Additional deterrent system components will be placed around SC2 in 2015 to accommodate the increasing size and pond surface area.

## **4.5.2 Bird Contacts**

### **4.5.2.1 Trends in Bird Contacts**

Over four thousand birds were detected at PA ponds during the 2014 field season. Birds were more frequently observed flying over the survey area than landing on the ponds (56% of all PA pond observations). Total flyovers ranged from five at Inpit 2B to 994 at SC2, with an average of 219 flyovers across all PA ponds. Just under one half of the birds flying over tailings ponds were noted at SC2. The highest percentage of birds making contact with PA ponds in 2014 was at SC2, where 1,463 birds were recorded landing (81% of PA pond observations). The pond with the second highest proportion of bird contacts was ETF, with 130 (7% of PA pond observations), and the lowest number of contacts was documented at Inpit 2B, where only nine birds landed (0.5% of PA pond observations). The average number of landings at all other PA ponds was 57 birds. In comparison, less than 600 birds were detected at Jackpine Lake. Birds were more frequently documented landing on the freshwater pond (74% of all observations). Despite the overall low numbers of birds at this site, the number of bird contacts was substantially higher than at all PA ponds except SC2. This suggests that Jackpine Lake continues to provide refuge to migrating birds passing through disturbed landscapes from oil and gas development in Northern Alberta (St. Clair et al. 2012).

SC2 has a unique composition relative to the other PA ponds at Shell. The very short time during which mature fine tailings was poured into the pond has resulted in a mostly freshwater composition with a relatively high proportion of islands. Some of these islands and the adjacent shoreline are sparsely vegetated, with not enough vegetation to show up on aerial photographs, but enough to be an attractant for dabbling ducks and wading birds. These vegetated areas, combined with areas of deeper water, are providing habitat for all four of the target guilds that are monitored regularly at Shell; however, there is no risk to birds landing on this pond under present conditions, and additional deterrents will be added to this pond in 2015. Inpit 2B is a steep-walled pond with no vegetation or beach area and has very little shoreline for birds to land. These features are probably the reason for few bird observations and landings at this pond.

The peak time for bird landings at PA ponds and at Jackpine Lake was during the months of August and September (Appendix 4B). Greater numbers of flyovers were also recorded during the fall migration. Northeast Alberta experienced a late spring in 2014, with ice covering the two largest PA ponds until the middle of April and Jackpine Lake until May 1. This may have contributed to lower numbers of birds observed in the spring of this year.

### **4.5.2.2 Trends in Species Observed**

Species abundance and diversity within the target foraging guilds was much lower at Jackpine Lake than at PA ponds. More specifically, 54 target species, including 13 dabblers, 16 divers and 16 waders, were documented at PA ponds, whereas 43 target species consisting of eight dabblers, 14 divers and four waders were documented at Jackpine Lake. The ten most abundant species at PA ponds were Canada

goose, lesser scaup, American pipit, an unknown shorebird, snow bunting, an unidentified wader of the genus *Calidris*, unknown white-headed gull, common raven, unknown sandpiper and mallard. Geese in particular, breed in wetlands and are most likely to be associated with open water habitats. At Jackpine Lake, the most common species detected were Canada goose, mallard, ruddy duck, lesser scaup, gadwall, common goldeneye, tree swallow, common loon, bufflehead and greater yellowlegs. All of these species are within their breeding range (Sibley 2003). Tree swallow observations consisted of individuals nesting in the nest boxes along the shoreline.

There were four observations of broods at Shell in 2014, all at SC2. A family of Canada geese was identified on one occasion and lesser scaup was identified on the three other occasions. The lesser scaup were all from the same survey station and may thus represent a single family. All four brood sightings were made in August.

Four species of conservation concern were observed landing on PA ponds in moderate to high numbers, including 600 lesser scaup. Moderate numbers of northern pintail (1 – 24), green-winged teal (1 – 8) and horned grebe (1 – 12) were also recorded contacting these ponds. Just over 90% of these observations were on SC2. These numbers include individuals that were counted on successive days and so individuals may have been counted multiple times.

During the spring migration bird monitoring crews saw two large groups of sandpipers contacting bitumen at ETF. This included a group of 50 unidentified sandpipers landing on the shore on May 23 and another group of 15 on May 18. Due to survey time constraints, the distance between the observers and the birds, and the general flighty behaviour displayed by shorebirds, the outcome of these bird observations could not be determined.

The largest single landing event occurred in the fall when the above mentioned 50 unidentified sandpipers landed on the shore at ETF. Aside from this event no large flocks were documented contacting PA pond surfaces, including the TT pond with its vegetated islands. There were more frequent occurrences of large numbers of individuals landing on Jackpine Lake; the largest involved 45 Canada geese in September 2014.

#### **4.5.2.3 Inter-Year Comparisons**

In the 2013 Shell OSBCMP report, comparisons were made to the previous monitoring years (2012 and 2011). Bird detections at PA ponds were seven times higher in 2012 compared to 2013 and dabblers and pecks were the most frequently documented forging guilds. At Jackpine Lake, dabblers, pecks and divers were the most frequently observed forging guilds. In 2012 and 2013, monitoring at SEA and Inpit consistently resulted in the fewest bird observations. Between the 2012 and 2013 monitoring years, changes in the length of bird surveys (changed from 45 minutes to 30 minutes) and the survey area boundaries (unbounded in 2012 to a 500m radius and 100m ceiling limit in 2013) had substantial impacts on bird detections at both PA ponds and Jackpine Lake (Hatfield 2013).

The 2014 monitoring protocols were most similar to those implemented in 2013; therefore, a comparison of these two years is appropriate. SC2 and Inpit 2B were not monitored during 2013 and as such bird observations from these two ponds are not included. Almost 40% more birds were documented making

contact with Shell PA ponds in 2014 than in 2013, and all survey sites except Inpit had more birds contacting PA water this year than in 2013.

Roughly three times fewer birds were recorded flying over PA ponds. The most noticeable change in the number of flyovers occurred at TT where numbers dropped from 1,456 in 2013 to 265 in 2014. Two significant changes occurred at TT in 2014: the number of deterrents was increased and the percentage of vegetation on the pond was decreased. Both of these factors may have contributed to the decline in flyovers. More flyovers were recorded in 2014 at all ponds except Inpit. The total number of birds both flying over and contacting water in 2013 at Jackpine Lake was considerably higher in 2013 than in 2014, however there were four times as many surveys conducted in 2013 so a direct comparison cannot be made.

In 2013, ponds with greater deterrent density had fewer bird contacts. In general, the larger ponds had lower deterrent density. In comparison, deterrent density was increased at all ponds in 2014; however the number of contacts also increased. This was true for all ponds except Inpit, where the number of bird contacts was lower in 2014. This suggests that the deterrent systems in place at Shell may be effective for some species, but not others. For example, SC2 had the second highest deterrent density of all PA ponds but had substantially more contacts. In addition, the largest ponds also had the greatest amounts of open water and beach characteristics, which may influence contact rates. Without considering these features, as well as vegetated islands, it is difficult to make comparisons.

A total of 16 species with some risk designations under provincial and/or federal legislation were detected in 2014 compared to 17 in 2013, 14 in 2012 and eight in 2011. One species of conservation concern was newly detected in 2014 – a single northern goshawk was documented as an incidental observation at Inpit. One western grebe was observed at Jackpine Lake in 2012, but not during any other monitoring year.

#### **4.5.2.4 Mortalities**

Incidental observations accounted for 100% of the 2013 mortalities (17) and 89% of 2014 mortality observations (31 of 34 birds). Approximately 80% of all oiled birds were first discovered during scheduled bird surveys. These surveys are not only used to quantify the number of birds landing on PA and FW ponds, they are often the first means of detection of a bird on PA ponds. Only two of the 89 oiled birds that were detected during bird surveys had significant amounts of bitumen on their feathers, the rest were not counted as mortalities. That the mortality search crews only found mortalities (both lesser scaup) during designated searches, suggests that very few birds die relative to the number that land on the ponds.

Based on the number of incidentally encountered mortalities relative to the total number of bird observations at PA ponds, it can be suggested that boat transects are not the most effective means of detecting mortalities. This may be due in part to inadequate coverage during searches, the observer's ability to detect oiled birds from a boat, or that oiled birds move or sink and are therefore more difficult to find.

### 4.5.3 Inter Observer Variability

The lack of bird observations during many PA pond surveys limits the effectiveness of the inter-observer variability tests. At Shell, Jackpine Lake and SC2 are the only two ponds that have a sufficient number of landed birds to be able to make usable comparisons between observers and these sites should be used for comparison tests. In addition, if time permits, surveyors may be able to make periodic visits to other local ponds in the area such as Crane Lake to perform IOV tests.

### 4.5.4 Recommendations

TT had the highest proportion of both emergent vegetation and islands and these attributes often serve as an attractant for dabbling ducks and wading birds. Because all of the vegetated islands on TT were outside of the 500m survey radius, all wading birds were recorded as incidental observations during bird surveys. The percent of vegetation on this pond has dropped from 5% in the spring of 2013 to 0.15% in 2014 due floating backhoes removing and submerging vegetation. This task of turning over and sinking islands of floating vegetation should continue on TT through 2015 to reduce the potential for these islands to draw birds down to land on them.

SC2 also has a relatively high proportion of islands. Some of these islands and the adjacent shoreline are sparsely vegetated. Although there is not enough vegetation to show up on aerial photographs, there is enough to attract dabbling ducks and wading birds. SC2 is being prepared to receive bitumen next year and deterrent crews were kept busy hazing birds at this site in anticipation of this. This pond will need careful vegetation management in 2015 to ensure that islands and floating vegetation do not attract nesting or migrant birds.

The distance to water from survey stations varies throughout the monitoring season and is often greater than 250 m at MFT, TT, Inpit and ETF. This reduces the pond surface area of the formal bird surveys considerably. Opportunities to relocate these survey sites to vantage points that are closer to the water's edge should be explored early in the 2015 monitoring season.

## 4.6 DOCUMENTS CITED

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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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## APPENDICES

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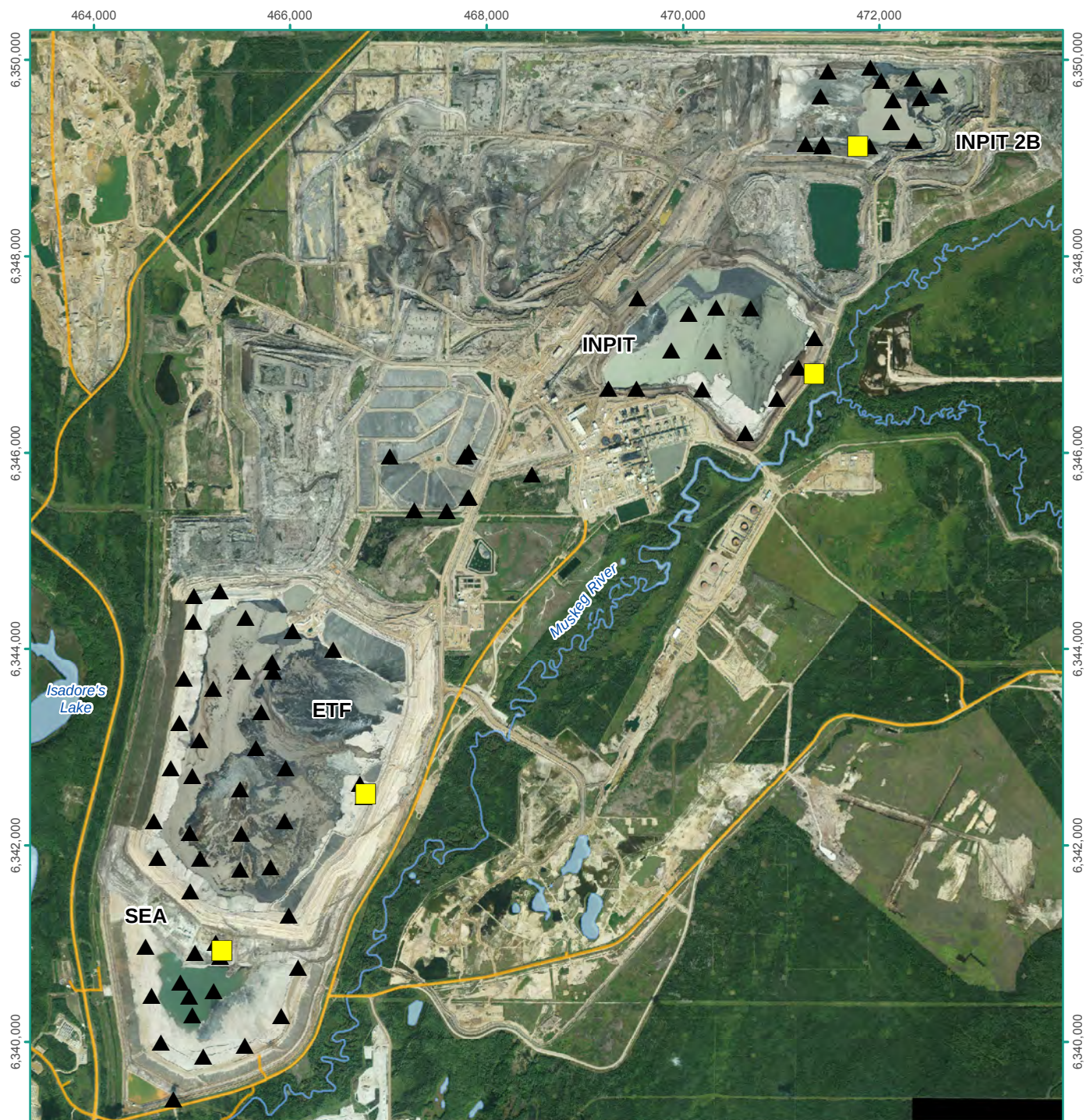
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## **Appendix 4A**

### **Location of Deterrents, Containment Booms and Survey Stations at Shell Ponds in 2014**

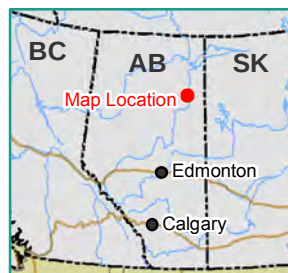
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**Figure 4A.1 Process-affected water ponds and bird deterrent locations at Shell Muskeg River Mine, 2014.**



### Legend

- Radar station
- Bird Avert system location
- Major road
- Watercourse
- Waterbody



0 1 2 km

Scale: 1:60,000  
Projection: NAD 1983 UTM Zone 12N

Data Sources:  
a) Monitoring stations and avert system  
Hatfield 2014.  
b) Imagery, 0.5m GeoEye-1  
September 13, 2014

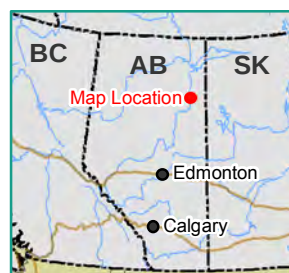


**Figure 4A.2 Process-affected water ponds and bird deterrent locations at Shell Jackpine Mine, 2014.**



### Legend

- Radar station
- Bird Avert system location
- Major road
- Watercourse
- Waterbody



0 0.25 0.5 1 km

Scale: 1:35,000

Projection: NAD 1983 UTM Zone 12N

Data Sources:

- a) Monitoring stations and avert system  
Hatfield 2014.
- b) Imagery, 0.5m GeoEye-1  
September 13, 2014



Figure 4A.3 Bird monitoring stations at Shell Muskeg River Mine, 2014.



- Legend**
- Major road
  - Watercourse
  - Waterbody
  - Pour location
  - Tailings boom
  - Monitoring station
  - Monitoring station range (500m)



0 1 2 km  
Scale: 1:60,000  
Projection: NAD 1983 UTM Zone 12N  
Data Sources:  
a) Monitoring stations and avert system  
Hatfield 2014.  
b) Imagery, 0.5m GeoEye-1  
September 13, 2014



Figure 4A.4 Bird monitoring stations at Shell Jackpine Mine, 2014.



Legend

- Major road
- Watercourse
- Waterbody
- Pour location
- Tailings boom
- Monitoring station
- Monitoring station range (500m)



0 0.5 1 2 km  
Scale: 1:65,000  
Projection: NAD 1983 UTM Zone 12N  
Data Sources:  
a) Monitoring stations and avert system  
Hatfield 2014.  
b) Imagery, 0.5m GeoEye-1  
September 13, 2014

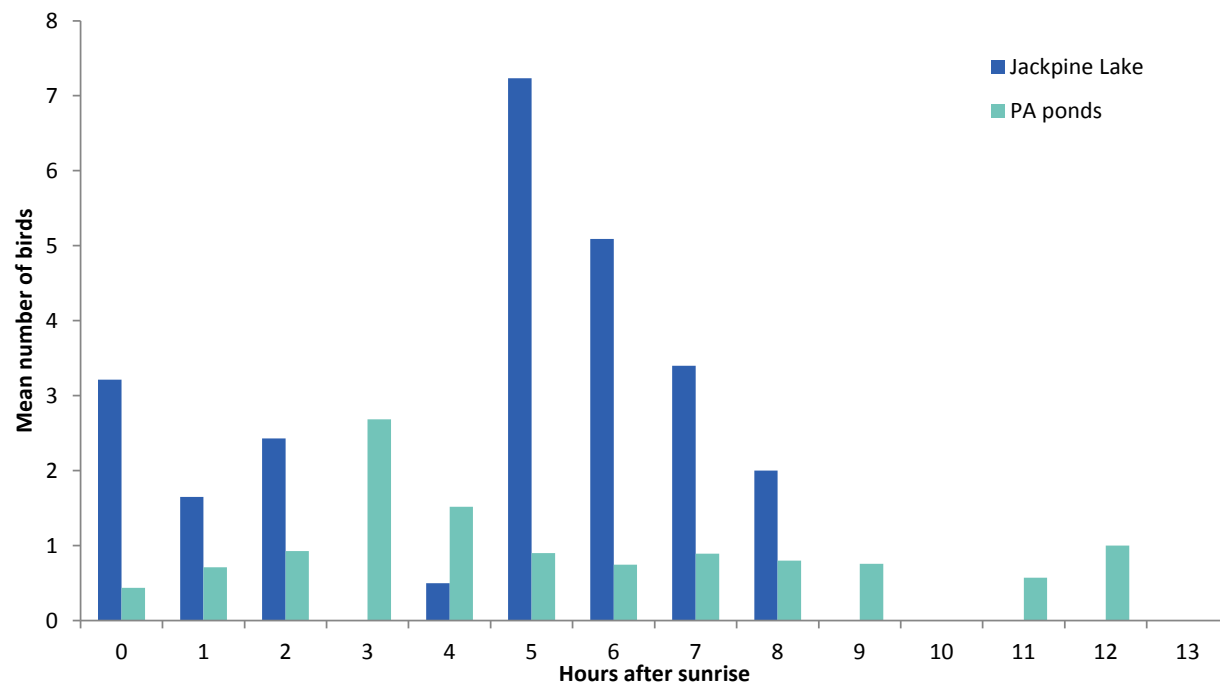


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## **Appendix 4B**

### **Relationship Between the Mean Number of Landed Waterbirds Per Survey and Hour After Sunrise at Shell in 2014**

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## **Appendix 4C**

### **Number of Bird Observations by Species at Shell Process-affected Ponds in 2014**

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| Guild      | Species/Species Group       | Landed <sup>1</sup> |                         | Flew Over <sup>1</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|------------|-----------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|            |                             | Bird Survey         | Incidental <sup>2</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| Waterbirds | Lesser scaup                | 470                 | 189                     | 44                     | 0                              | 0          | 1                | 1          |
|            | Canada goose                | 151                 | 0                       | 1202                   | 0                              | 1          | 0                | 3          |
|            | Mallard                     | 121                 | 0                       | 7                      | 0                              | 0          | 0                | 1          |
|            | Unknown sandpiper           | 110                 | 0                       | 28                     | 53                             | 12         | 0                | 0          |
|            | Eared grebe                 | 86                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Unknown <i>Calidris</i> sp. | 84                  | 0                       | 111                    | 17                             | 0          | 0                | 0          |
|            | American pipit              | 71                  | 0                       | 315                    | 0                              | 0          | 0                | 0          |
|            | Red-necked phalarope        | 66                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Ruddy duck                  | 61                  | 0                       | 0                      | 1                              | 0          | 0                | 1          |
|            | Unknown shorebird           | 60                  | 0                       | 283                    | 0                              | 0          | 0                | 0          |
|            | Unknown white-headed gull   | 60                  | 0                       | 111                    | 0                              | 0          | 0                | 0          |
|            | Unknown scaup               | 59                  | 0                       | 0                      | 0                              | 0          | 1                | 1          |
|            | Lesser yellowlegs           | 58                  | 0                       | 57                     | 0                              | 0          | 0                | 0          |
|            | Semipalmated plover         | 52                  | 0                       | 53                     | 0                              | 0          | 0                | 0          |
|            | Unknown diving duck         | 47                  | 0                       | 23                     | 0                              | 3          | 0                | 0          |
|            | Semipalmated sandpiper      | 42                  | 0                       | 26                     | 0                              | 0          | 0                | 0          |
|            | Bufflehead                  | 42                  | 0                       | 6                      | 0                              | 0          | 0                | 0          |
|            | Unknown phalarope           | 42                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Horned grebe                | 41                  | 5                       | 0                      | 0                              | 0          | 0                | 0          |
|            | American coot               | 33                  | 0                       | 0                      | 1                              | 1          | 1                | 2          |
|            | Common loon                 | 31                  | 0                       | 3                      | 0                              | 0          | 0                | 0          |
|            | Unknown yellowlegs          | 30                  | 0                       | 117                    | 0                              | 0          | 0                | 0          |
|            | Northern pintail            | 30                  | 93                      | 46                     | 0                              | 0          | 0                | 0          |
|            | Baird's sandpiper           | 29                  | 0                       | 14                     | 0                              | 0          | 0                | 0          |
|            | American wigeon             | 29                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Green-winged teal           | 29                  | 12                      | 0                      | 12                             | 0          | 0                | 2          |
|            | Herring gull                | 29                  | 0                       | 0                      | 0                              | 0          | 0                | 1          |
|            | Common goldeneye            | 27                  | 0                       | 12                     | 0                              | 0          | 0                | 0          |
|            | Greater yellowlegs          | 23                  | 0                       | 64                     | 0                              | 0          | 0                | 0          |
|            | Northern shoveler           | 22                  | 0                       | 12                     | 0                              | 0          | 0                | 6          |
|            | Ring-necked duck            | 18                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | California gull             | 17                  | 0                       | 3                      | 0                              | 0          | 0                | 0          |
|            | Bonaparte's gull            | 15                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Least sandpiper             | 13                  | 0                       | 4                      | 0                              | 0          | 0                | 0          |
|            | Unknown dabbling duck       | 13                  | 0                       | 2                      | 0                              | 0          | 0                | 0          |
|            | Blue-winged teal            | 13                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Cackling goose              | 13                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Unknown plover              | 12                  | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Unknown gull                | 11                  | 0                       | 9                      | 0                              | 0          | 0                | 0          |
|            | Unknown grebe               | 11                  | 0                       | 0                      | 1                              | 0          | 0                | 5          |
|            | Gadwall                     | 10                  | 0                       | 15                     | 0                              | 0          | 0                | 0          |
|            | Canvasback                  | 10                  | 0                       | 6                      | 0                              | 0          | 0                | 0          |
|            | Unknown duck                | 8                   | 0                       | 24                     | 2                              | 0          | 0                | 3          |
|            | White-winged scoter         | 8                   | 0                       | 1                      | 0                              | 0          | 0                | 0          |
|            | Mew gull                    | 8                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Redhead                     | 8                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Sanderling                  | 8                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Spotted sandpiper           | 7                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Unknown dowitcher           | 7                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Ring-billed gull            | 6                   | 0                       | 21                     | 0                              | 0          | 0                | 0          |
|            | Killdeer                    | 5                   | 0                       | 6                      | 0                              | 0          | 0                | 0          |
|            | Black-bellied plover        | 5                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | American golden-plover      | 4                   | 0                       | 0                      | 2                              | 0          | 0                | 0          |
|            | Pectoral sandpiper          | 4                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Franklin's gull             | 3                   | 0                       | 41                     | 0                              | 0          | 0                | 0          |
|            | Greater white-fronted goose | 3                   | 0                       | 24                     | 0                              | 0          | 0                | 0          |
|            | Red-breasted merganser      | 3                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Red-necked grebe            | 3                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Unknown black-headed gull   | 2                   | 0                       | 3                      | 0                              | 0          | 0                | 0          |
|            | Greater scaup               | 2                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|            | Common merganser            | 1                   | 0                       | 2                      | 0                              | 0          | 0                | 0          |

| Guild                | Species/Species Group  | Landed <sup>1</sup> |                         | Flew Over <sup>1</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|----------------------|------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                      |                        | Bird Survey         | Incidental <sup>2</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| Waterbirds (Cont'd.) | Stilt sandpiper        | 1                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|                      | Unknown swan           | 0                   | 0                       | 42                     | 0                              | 0          | 0                | 0          |
|                      | Common tern            | 0                   | 0                       | 20                     | 0                              | 0          | 0                | 0          |
|                      | Unknown pecking bird   | 0                   | 0                       | 18                     | 0                              | 0          | 0                | 0          |
|                      | Sandhill crane         | 0                   | 6                       | 11                     | 0                              | 0          | 0                | 0          |
|                      | Black tern             | 0                   | 0                       | 2                      | 0                              | 0          | 0                | 0          |
|                      | Unknown dabbler        | 0                   | 0                       | 2                      | 0                              | 0          | 0                | 0          |
|                      | Great blue heron       | 0                   | 0                       | 1                      | 0                              | 0          | 0                | 0          |
|                      | Surf scoter            | 0                   | 0                       | 1                      | 0                              | 0          | 0                | 0          |
| Non-target           | Horned lark            | 66                  | 0                       | 29                     | 0                              | 0          | 0                | 0          |
|                      | Snow bunting           | 60                  | 0                       | 447                    | 0                              | 0          | 0                | 0          |
|                      | Lapland longspur       | 36                  | 0                       | 38                     | 0                              | 0          | 0                | 0          |
|                      | Common raven           | 18                  | 0                       | 138                    | 0                              | 0          | 0                | 0          |
|                      | Brewer's blackbird     | 9                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|                      | Unknown passerine      | 6                   | 0                       | 108                    | 0                              | 0          | 0                | 0          |
|                      | Clay-colored sparrow   | 4                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|                      | Merlin                 | 3                   | 0                       | 4                      | 0                              | 0          | 0                | 0          |
|                      | Savannah sparrow       | 2                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|                      | Unknown sparrow        | 2                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|                      | Northern harrier       | 1                   | 0                       | 16                     | 0                              | 0          | 0                | 0          |
|                      | Sharp-tailed grouse    | 1                   | 0                       | 7                      | 0                              | 0          | 0                | 0          |
|                      | American kestrel       | 1                   | 0                       | 2                      | 0                              | 0          | 0                | 0          |
|                      | Snowy owl              | 1                   | 0                       | 0                      | 0                              | 0          | 0                | 0          |
|                      | Bald eagle             | 0                   | 1                       | 0                      | 0                              | 0          | 0                | 0          |
|                      | Northern goshawk       | 0                   | 1                       | 0                      | 0                              | 0          | 0                | 0          |
|                      | Unknown swallow        | 0                   | 0                       | 55                     | 0                              | 0          | 0                | 0          |
|                      | Barn swallow           | 0                   | 0                       | 53                     | 0                              | 0          | 0                | 0          |
|                      | Tree swallow           | 0                   | 0                       | 20                     | 0                              | 0          | 0                | 0          |
|                      | Cliff swallow          | 0                   | 0                       | 9                      | 0                              | 0          | 0                | 0          |
|                      | American robin         | 0                   | 0                       | 8                      | 0                              | 0          | 0                | 0          |
|                      | Pine siskin            | 0                   | 0                       | 6                      | 0                              | 0          | 0                | 0          |
|                      | Unknown depredator     | 0                   | 0                       | 6                      | 0                              | 0          | 0                | 0          |
|                      | Yellow-rumped warbler  | 0                   | 0                       | 6                      | 0                              | 0          | 0                | 0          |
|                      | American crow          | 0                   | 0                       | 4                      | 0                              | 0          | 0                | 0          |
|                      | Rough-legged hawk      | 0                   | 0                       | 3                      | 0                              | 0          | 0                | 0          |
|                      | Black-capped chickadee | 0                   | 0                       | 2                      | 0                              | 0          | 0                | 0          |
|                      | Peregrine falcon       | 0                   | 0                       | 2                      | 0                              | 0          | 0                | 0          |
|                      | Red-tailed hawk        | 0                   | 0                       | 2                      | 0                              | 0          | 0                | 0          |
|                      | Brown-headed cowbird   | 0                   | 0                       | 1                      | 0                              | 0          | 0                | 0          |
|                      | Black-billed magpie    | 0                   | 0                       | 1                      | 0                              | 0          | 0                | 0          |
|                      | Long-tailed duck       | 0                   | 0                       | 0                      | 0                              | 0          | 0                | 3          |
|                      | Pied-billed grebe      | 0                   | 0                       | 0                      | 0                              | 0          | 0                | 1          |
|                      | Red-winged blackbird   | 0                   | 0                       | 0                      | 0                              | 0          | 0                | 1          |

Pink shading: Species of Conservation Concern

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times

<sup>2</sup> Only for Species of Conservation Concern

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## **Appendix 4D**

### **Bird Oiling and Mortality Events at Shell in April–October 2014**

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| Date      | Species/Species Group       | Number of Birds | Pond Name (Survey Station ID) | Location Description   | % Oiled | Outcome                                   | Context of Detection         | Method of Detection        | Potential Reason for Mortality/Oiling |
|-----------|-----------------------------|-----------------|-------------------------------|------------------------|---------|-------------------------------------------|------------------------------|----------------------------|---------------------------------------|
| 18/Apr/14 | Canada goose                | 1               | MR_IP                         | unknown                | 75-100  | mortality                                 | found dead but not recovered | incidental                 | unknown                               |
| 29/Apr/14 | Ruddy duck                  | 1               | MR ETF_1                      | floating on open water | unknown | unknown                                   | during bird survey           | using scope and binoculars | floating bitumen nearby               |
| 4/May/14  | Green-winged teal           | 8               | JP_TT_1                       | floating on open water | unknown | unknown                                   | during bird survey           | using scope and binoculars | floating bitumen nearby               |
| 5/May/14  | Herring gull                | 1               | JP_MFT                        | unknown                | 0-25    | mortality                                 | found dead                   | incidental                 | unknown                               |
| 6/May/14  | Green-winged teal           | 4               | JP_TT_1                       | floating on open water | unknown | unknown                                   | during bird survey           | using scope and binoculars | floating bitumen nearby               |
| 17/May/14 | Pied-billed grebe           | 1               | JP_TT_1                       | unknown                | 0-25    | sent to rehab, died after washing process | found oiled                  | incidental                 | unknown                               |
| 18/May/14 | American golden plover      | 2               | MR ETF_1                      | floating vegetation    | unknown | unknown                                   | during bird survey           | using scope and binoculars | bitumen on the floating vegetation    |
| 18/May/14 | Unknown <i>Calidris</i> sp. | 15              | MR ETF_1                      | at shoreline           | unknown | unknown                                   | during bird survey           | using scope and binoculars | bitumen at the shoreline              |
| 18/May/14 | Lesser scaup                | 1               | MR ETF                        | unknown                | 75-100  | mortality                                 | found dead                   | incidental                 | unknown                               |
| 21/May/14 | American coot               | 1               | JP_MFT_2                      | unknown                | 75-100  | found injured, bird died                  | during bird survey           | using scope and binoculars | floating bitumen nearby               |
| 23/May/14 | Unknown sandpiper           | 50              | MR ETF_1                      | at shoreline           | unknown | unknown                                   | during bird survey           | using scope and binoculars | bitumen at the shoreline              |
| 24/May/14 | Unknown sandpiper           | 3               | MR ETF_1                      | at shoreline           | unknown | unknown                                   | during bird survey           | using scope and binoculars | bitumen at the shoreline              |
| 24/May/14 | Unknown sandpiper           | 12              | MR ETF_1                      | at shoreline           | unknown | unknown                                   | during bird survey           | using scope and binoculars | bitumen at the shoreline              |
| 2/Jun/14  | Long-tailed duck            | 3               | MR_IP_1                       | floating on open water | 75-100  | found injured, birds died                 | during bird survey           | using scope and binoculars | floating bitumen nearby               |
| 2/Jun/14  | Ruddy duck                  | 1               | MR_IP_1                       | at shoreline           | 75-100  | found injured, bird died                  | during bird survey           | using scope and binoculars | bitumen at the shoreline              |
| 2/Jun/14  | Unknown duck                | 1               | MR_IP_1                       | at shoreline           | 75-100  | found injured, bird died                  | during bird survey           | using scope and binoculars | bitumen at the shoreline              |
| 15/Jun/14 | Canada goose                | 2               | JP_TT                         | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 7/Jul/14  | Red-winged blackbird        | 1               | JP_TT                         | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 4/Aug/14  | Unknown <i>Calidris</i> sp. | 2               | MR_IP_2                       | at shoreline           | unknown | unknown                                   | during bird survey           | using scope and binoculars | bitumen at the shoreline              |
| 5/Aug/14  | Unknown grebe               | 1               | MR_IP_1                       | floating on open water | 75-100  | found injured, bird died                  | during bird survey           | using scope and binoculars | floating bitumen nearby               |
| 9/Aug/14  | Green-winged teal           | 1               | MR ETF                        | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 10/Aug/14 | Unknown grebe               | 4               | MR_SEA                        | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 28/Aug/14 | Northern shoveler           | 1               | JP_MFT                        | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 5/Sep/14  | Unknown duck                | 1               | MR ETF                        | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 6/Sep/14  | Northern shoveler           | 5               | JP_MFT                        | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 18/Sep/14 | Unknown shorebird           | 8               | MR ETF_1                      | at shoreline           | unknown | unknown                                   | during bird survey           | using scope and binoculars | bitumen at the shoreline              |
| 26/Sep/14 | Green-winged teal           | 1               | JP_MFT                        | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 26/Sep/14 | Unknown duck                | 1               | MR_SEA                        | unknown                | 0       | mortality                                 | found dead                   | incidental                 | unknown                               |
| 5/Oct/14  | American coot               | 1               | MR ETF                        | unknown                | 75-100  | mortality                                 | found injured                | route-based survey         |                                       |
| 6/Oct/14  | American coot               | 1               | JP_TT_1                       | floating vegetation    | 75-100  | found injured, bird died                  | during bird survey           | using scope and binoculars | bitumen on the floating vegetation    |
| 19/Oct/14 | Unknown scaup               | 1               | MR_IP                         | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |
| 25/Oct/14 | Ring-necked duck            | 1               | JP_SC2_1                      | floating on open water | unknown | unknown                                   | during bird survey           | using scope and binoculars | floating bitumen nearby               |
| 28/Oct/14 | Mallard                     | 1               | JP_TT                         | unknown                | 75-100  | mortality                                 | found injured                | incidental                 | unknown                               |

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## **Appendix 4E**

### **2014 Post-Monitoring Migration Landing Event Summary**

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In November 2014, flocks of late southbound migrating birds passed over the Oil Sands Region of Alberta. This was likely influenced by the late spring and abnormally warm fall conditions in Northern Alberta and British Columbia compared to the previous three years of monitoring for the OSBCMP. These events are unpredictable and uncommon given the traditional timing of migration through this region, which ranges from mid to late April for spring migration and mid-September to early October for fall migration. This event occurred after the 2014 OSBCMP was completed for the season. A number of birds landed on PA ponds at Shell, however no birds came into contact with bitumen. Shell personnel responded to this event by documenting and monitoring all PA ponds on site and by actively hazing birds off of the ponds. All results were documented and communicated to ESRD in a timely fashion.



**OIL SANDS BIRD CONTACT MONITORING PROGRAM  
SUNCOR OIL SANDS BASE MINE PROJECT– SUNCOR ENERGY INC.  
2014 WATERFOWL MONITORING PROGRAM REPORT**

**Prepared for:  
Suncor Energy Inc.**

**March 13, 2015**



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March 13, 2015

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Edmonton, AB T6B 2X3

**RE: 2014 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) 296-4665 with any questions or concerns.

Sincerely,

Marlyss Long  
Environmental Compliance  
Suncor Energy Services Inc.

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

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## 5.0 SUNCOR ENERGY INC.

### 5.1 Summary

Suncor Energy Inc. (Suncor) is one of five mining operators in the Alberta oil sands region participating in the regional Oil Sands Bird Contact Monitoring Program (OSBCMP) since 2011. This Suncor report summarizes data collected in 2014 at the Suncor Oil Sands Base Mine Project, and is submitted per Conditions Subsection 6.1.81 to 83 in the Suncor Energy *Environmental Protection & Enhancement Act* Approval No. 94-02-00, issued to Suncor for operation of the Base Mine Project.

#### 5.1.1 Bird Landings and Mortalities at Process-affected Ponds

Bird landings were monitored at 16 process-affected ponds on Suncor Oil Sands Base Mine from April 3 to October 31, 2014. Monitoring effort at these ponds is compiled in Table 5.1. In total, 7,465 birds (5,439 landed, 2,026 flyovers) were recorded at these process-affected ponds in 2014 (Table 5.2). Waterbirds (target guilds) consisted of 35 landed and 15 flyover species while non-target guilds comprised 13 and 18 species, respectively. Landed birds were observed more frequently on ponds with known attractants.

**Table 5.1: Monitoring Effort at Process-affected Ponds at Suncor Base Mine in 2014**

| Bird Surveys               |                                            |          |       |          |
|----------------------------|--------------------------------------------|----------|-------|----------|
| # Ponds Surveyed           | 16                                         |          |       |          |
| # 10-min Surveys Conducted | 1,803                                      |          |       |          |
| # 30-min Surveys Conducted | 2,021                                      |          |       |          |
| Mortality Searches         |                                            |          |       |          |
| # Ponds Searched           | 24 (16 of which are part of the OSBCMP)    |          |       |          |
| # Searches                 | 366 (53 focused and 313 transect searches) |          |       |          |
| Search Method              | Boat                                       | Walk     | Truck | Total    |
| Total Time Searched        | 28.1 h                                     | 82.5 h   | 0 h   | 110.6 h  |
| Distance Searched          | 191.7 km                                   | 172.7 km | 0 km  | 364.4 km |

**Table 5.2: Bird Observations at Process-affected Ponds at Suncor Base Mine in 2014**

|                      | Waterbirds |           |                   |            |                  |            | Non-target Guilds |           |                   |            |                  |            |
|----------------------|------------|-----------|-------------------|------------|------------------|------------|-------------------|-----------|-------------------|------------|------------------|------------|
|                      | Landed     | Flew Over | Contacted Bitumen |            | Mortality        |            | Landed            | Flew over | Contacted Bitumen |            | Mortality        |            |
|                      |            |           | Bird Survey       | Incidental | Mortality Search | Incidental |                   |           | Bird Survey       | Incidental | Mortality Search | Incidental |
| # Birds <sup>1</sup> | 5,305      | 891       | 1 <sup>2</sup>    | 0          | 5                | 13         | 134               | 1,135     | 0                 | 0          | 1                | 0          |
| # Species            | 35         | 15        | 1                 | 0          | 2                | 7          | 13                | 18        | 0                 | 0          | 1                | 0          |

**Notes:**

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times.

<sup>2</sup> This bird was also recorded as an incidental mortality.

Mortality searches were conducted at the 16 OSBCMP ponds as well as eight other process-affected ponds not included in the OSBCMP (effort summarized in Table 5.1). Six bird mortalities were documented during designated mortality searches and 13 were documented as incidental mortalities. In the 2014 monitoring season, a total of 19 birds were reported as contacting bitumen and an additional six were recorded post- monitoring season from November 4 to 5 after a weather event (Appendices 5.D and 5.E).

### 5.1.2 Bird Landings at Freshwater Ponds

Suncor's freshwater ponds, Crane Lake and Weir 1 South Mine Drainage, are included in the OSBCMP. Monitoring efforts at these ponds are summarized in Table 5.3. In 2014, a total of 2,932 birds (2,630 landed, 302 fly-overs) were recorded at these freshwater ponds (Table 5.4). Target guilds consisted of 23 landed and 12 flyover species; whereas, non- target guilds comprised 6 and 10, respectively.

**Table 5.3: Monitoring Effort at Freshwater Ponds at Suncor Base Mine in 2014**

| Bird Surveys               |     |
|----------------------------|-----|
| # Ponds Surveyed           | 2   |
| # 10-min Surveys Conducted | 223 |
| # 30-min Surveys Conducted | 0   |

**Table 5.4: Bird Observations at Freshwater Ponds at Suncor Base Mine in 2014**

|                      | Waterbirds |           |                   |            |                        | Non-target Guilds |           |                   |            |                        |
|----------------------|------------|-----------|-------------------|------------|------------------------|-------------------|-----------|-------------------|------------|------------------------|
|                      | Landed     | Flew Over | Contacted Bitumen |            | Mortality (Incidental) | Landed            | Flew over | Contacted Bitumen |            | Mortality (Incidental) |
|                      |            |           | Bird Survey       | Incidental |                        |                   |           | Bird Survey       | Incidental |                        |
| # Birds <sup>1</sup> | 2,589      | 202       | 0                 | 0          | 0                      | 41                | 100       | 0                 | 0          | 0                      |
| # Species            | 23         | 12        | 0                 | 0          | 0                      | 6                 | 10        | 0                 | 0          | 0                      |

**Note:**

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times.

### 5.1.3 Standardized Monitoring

Survey Stations were monitored according to the OSBCMP protocol (St. Clair et al. 2014). Bird monitoring surveys were conducted from April 3 to October 31, 2014, and were applied at all 16 process-affected ponds and the two freshwater ponds. On a daily basis, 30 minute surveys were done on ponds greater than 1.5 km<sup>2</sup>, per station (Pond 2/3, Pond 6, Pond 7, Pond 8B, South Tailings Pond) and 10 minute surveys were done on ponds less than 1.5 km<sup>2</sup>, per station (Extraction Waste Water Pond East, Millennium API Surge Pond, Mine North Gate Sump, PAW Pond, Pond 1A, Pond 8A, Pond B East, Pond F, Sand Dump 8, Upgrader Ponds A, B, D, and Weir 10 Mid Plant Drainage). Crane Lake was monitored for 10 minutes at one station, twice a week. Weir 1 South Mine Drainage was originally scheduled to be monitored twice a week, as per protocol; however, because of the proximity to other process-affected ponds this pond was monitored approximately six times a week. Details of the standardized methods for bird surveys are provided in Section 5.3.2.

Upgrader Ponds A, B, D were monitored from a single survey station, whereas, typically there would be one survey station for each pond. Access restrictions and poor viewpoint availability did not allow for establishment of separate survey stations at each of Upgrader Ponds A, B, D.

Survey stations, including alternate stations, were not monitored if safe access to the survey location was not available (e.g., construction, poor road conditions, vehicle malfunction). Missed surveys were made up mostly on Sundays, the Suncor Comparison Day.

All mortality searches were conducted by foot and boat, and according to 2014 OSBCMP protocol (St. Clair et al 2014). Route-based and focused mortality searches were conducted at least every two weeks on each of the OSBCMP process-affected ponds. Route-based mortality transects were standardized, recorded using tracking options on portable GPS units, and covered as much ground as possible. Focused searches were conducted in areas where there was bitumen present and where previous bird mortalities had been found. Route-based search transects were later revised to include high risk areas after they were revealed during the focused searches in early spring.

### 5.1.4 Species of Conservation Concern

Landed species of conservation concern from target guilds (Table 5.5) are all listed as Sensitive (Alberta Sustainable Resource Development 2010): Green-winged Teal (including one oiled greater than 50% that was euthanized), Lesser Scaup, Pied-billed Grebe (including one oiled greater than 50% that was euthanized), American White Pelican, and Black Tern. Landed individuals of species of conservation concern in non-target guilds are all listed as Sensitive in Alberta; Barn Swallow is also listed as Threatened by COSEWIC (2014), and Rusty Blackbird as Special Concern under the *Species at Risk Act* and COSEWIC (2014).

**Table 5.5: Number of Observations of Birds of Conservation Concern  
at Process-affected Ponds at Suncor Base Mine in 2014**

| Species                  | Landed <sup>1</sup> |            | Flew Over <sup>1</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|--------------------------|---------------------|------------|------------------------|--------------------------------|------------|------------------|------------|
|                          | Bird Survey         | Incidental | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>        |                     |            |                        |                                |            |                  |            |
| Lesser Scaup             | 415                 | 111        | 10                     |                                |            |                  |            |
| Green-winged Teal        | 384                 |            |                        |                                |            |                  | 1          |
| American White Pelican   | 48                  |            |                        |                                |            |                  |            |
| Black Tern               | 5                   |            | 9                      |                                |            |                  |            |
| Pied-billed Grebe        | 1                   |            |                        | 1                              |            |                  | 1          |
| Northern Pintail         |                     | 10         |                        |                                |            |                  |            |
| Sandhill Crane           |                     | 2          |                        |                                |            |                  |            |
| <b>Non-target Guilds</b> |                     |            |                        |                                |            |                  |            |
| Barn Swallow             | 34                  |            | 320                    |                                |            |                  |            |
| Rusty Blackbird          | 8                   |            | 11                     |                                |            |                  |            |
| American Kestrel         | 1                   |            | 1                      |                                |            |                  |            |
| Bank Swallow             |                     |            | 166                    |                                |            |                  |            |
| Golden Eagle             |                     |            | 1                      |                                |            |                  |            |
| Northern Harrier         |                     |            | 1                      |                                |            |                  |            |

**Note:**

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times.

### 5.1.5 Adaptive Management

In 2014, Suncor made corrections to address protocol deviations that were recognized in 2013. Corrections made included adjustments to bird survey crew schedules and improved distribution and positioning of bird survey stations. To improve the randomization of bird contact surveys throughout the day and focus surveys as close to sunrise as per the OSBCMP protocol, both observers worked the same hours in 2014, as compared to 2013, where each observer had a different shift time during the late spring and summer periods.

Prior to the beginning of the 2014 monitoring season, some bird survey station barcodes were relocated to ensure distance to water's edge was less than 500 m, while others were moved to space out otherwise overlapping survey stations. Station changes occurred at Pond 2/3, Pond 6, Sand Dump 8, South Tailings Pond, and Upgrader Ponds A, B, D. The new locations for these stations accommodate operational constraints while complying with the protocol. Bird survey barcode locations may need adjustment in 2015 to account for changing pond characteristics, which arise due to operational changes.

Bird scare cannons were adjusted in 2014 to provide better distribution on Pond 6 and Pond 8A (Appendix 5.A). Meanwhile, Secondary Deterrent Unit (SDU) cannons were changed from mechanical to electric to provide greater consistency in cannon effectiveness.

Suncor remains committed to implementing improvements to the program and to site operations in response to program findings. Vegetation management prior to spring on select ponds (e.g., on Pond B East and South Tailings Pond in Q1 2014) is a method used to control attractants. Use and placement of new and existing bitumen booms is a method used to control the risk of oiling across a pond.

## **5.2 Introduction**

### **5.2.1 Site**

Suncor Energy Inc. operates an oil sands mining, extraction and upgrading facility north of Fort McMurray, known as the Suncor Oil Sands Base Mine (Suncor) project, in the Athabasca Oil Sands region of northeastern Alberta, Canada (Figure 5.1). Operations at this facility began in 1967. In 2011, Suncor along with the four other operators in the Athabasca Oil Sands Region, changed the monitoring of their process-affected ponds to improve understanding of bird landings and mortalities, using the Oil Sands Bird Contact Monitoring Program protocol (St. Clair et al. 2014, 2013, 2012; Ronconi 2011).

Monitoring at Suncor includes 16 process-affected ponds, covering a total area of 2,676 ha, and two freshwater bodies (Crane Lake and Weir 1 South Mine Drainage) covering 24.5 ha. There are eight other process-affected ponds (totalling 18.6 ha) on site on which deterrents were deployed, and were searched for bird mortalities.

Suncor is committed to minimizing and understanding interactions between birds and the process-affected ponds required for its operations. Deployment of a variety of deterrents, reducing bird attractants where possible, monitoring for bird contacts, hazing of landed waterbirds, searching for bird mortalities, as well as developing and implementing a Waterfowl Protection Plan are among a few of the ways Suncor addresses these interactions, some of which are actions performed outside of the OSBCMP.

The OSBCMP states five objectives (St. Clair et al. 2014):

1. Estimate bird landings and mortalities at process-affected ponds;
2. Estimate bird landings at freshwater ponds;
3. Develop a standardized monitoring program across ponds, sites, seasons, and years;
4. Identify species of conservation concern potentially affected by process-affected water; and
5. Provide direction on adaptive management for long-term monitoring and bird deterrent programs.



**Figure 5.1: Process-affected and Freshwater Ponds at Suncor Base Mine in 2014**

This report summarizes data collected and findings in 2014 at the Suncor Oil Sands Base Mine Project in relation to the five objectives of the regional program.

### **5.2.2 Personnel**

Suncor contracted qualified personnel to conduct bird surveys, mortality searches and hazing, deterrent maintenance, verification of data collected in these three processes, and manage and coordinate these on-site activities. Each crew worked a 12-hour day for a one week on, one week off rotation, except the program coordinator and data verifier who worked Monday through Thursday for 10 hours per day.

Each bird survey crew consisted of two observers who worked independently of each other, with shifts from 5 a.m. to 5 p.m. Due to the later sunrise in April, September and October, the monitoring shift was from 7 a.m. to 7 p.m. From April 3 to 15, 2014 observers were oriented to the protocol, procedures for bird surveys, and roads on-site before the official monitoring period commenced on April 16, 2014. All observers participated in Inter-observer Variation Studies (IOV) through the spring and fall monitoring periods.

Mortality search and hazing crews completed two weeks of training prior to April. There were a total of three per crew, with a shift from 7 a.m. to 7 p.m. Four personnel inspected and maintained the bird deterrent system on a daily basis from 7 a.m. to 7 p.m. to ensure deterrents remained functional.

### **5.2.3 Management of Avian Attractants and Control of Hazards**

Vegetation management and removal is a practice used to reduce avian attractants. Prior to spring of 2014, and prior to peak spring migration, all emergent vegetation was removed from Pond B East, and the southeast corner of the South Tailings Pond underwent shoreline vegetation control. Vegetation removal is performed at select ponds, as required each year, in response to new or reoccurring growth that may have developed since the last season.

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 only minor adjustments made when necessary. These booms were used to contain bitumen and reduce the chances of birds landing or coming into contact with bitumen. Booms may be deployed at other ponds for operational reasons.

### **5.2.4 Deterrents**

The 2014 bird deterrent program was implemented and maintained by a qualified contractor under the direction of Suncor's Extraction Tailings department. Suncor implemented a combination of radar linked and non-radar linked deterrents, and managed pond attributes to discourage waterfowl from landing on tailings and other process-affected ponds. The combination, placement, and number of deterrents deployed were designed to address the characteristics and risks unique to each pond. The deterrent systems were inspected weekly to ensure proper function, and maintenance (including adjustments to cannon firing frequency) was performed as required. On process-affected ponds monitored within the OSBCMP,

64 audio deterrents, 439 visual deterrents, and 45 combined audio/visual deterrents (linked to radar) were deployed in 2014 (Tables 5.6 and 5.7, Appendix 5.A). Another nine audio deterrents and four visual deterrents were deployed at nine process-affected ponds not monitored within the OSBCMP.

### **Radar Linked Deterrents**

Some deterrents were programmed to trigger randomly, and 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 up to 5.6 km away. 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 haze or provoke a flight response, while minimizing habituation risk. In the event that communications between the BCRS and deterrent devices are interrupted, the deterrents revert 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 2014 was the LRAD 1000™ Long Range Acoustic Device®. 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 provide visual deterrence to 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, SDUs were deployed. SDUs consist of smaller mobile trailers equipped with a combination of propane powered bird scare cannons, omni-directional Bird Gard Super Pro Amps, and 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 Suncor Oil Sands Base Mine site, one on Pond 2/3, one that covered Pond 7 and Sand Dump 8, and one that covered Pond 8B and the South Tailings Pond (Tables 5.6 and 5.7). Radars were activated on March 4, 2014 and their locations did not change through the season. Both satellite and Secondary Deterrent units were deployed on the same day on the shores of Pond 2/3, Pond 7, Pond 8B, Sand Dump 8, and the South Tailings Pond (Appendix 5.A). Radar systems were turned off on November 16, 2014.

### **Non-radar Linked Deterrents**

Non-radar linked deterrent units were deployed on all process-affected ponds monitored within the OSBCMP (Tables 5.6 and 5.7). Propane powered bird scare cannons produce a loud, shotgun-like noise that is created by igniting propane. Bird scare cannons were deployed on pond shores by March 4, 2014 and recovered between November 14 and 23 as ponds began to freeze. Bird scare cannons were deployed (November 12 to 14) at areas on Pond 2/3, Pond 7, Pond 8B, and the South Tailings Pond that were expected to remain open throughout the winter. Pond Cannons remain operational at Extraction Waste Water Pond East, Millennium API Surge Pond, Pond 1A (two cannons near discharge pipes), and Upgrader Ponds A, B, D all months of the year.

**Table 5.6: Avian Deterrents Deployed at Suncor Base Mine (as of Fall 2014)**

| Deterrent Name           | Description                          | Stimuli          | Sound Intensity at 1 m (dB) | Activation Control | Placement            | Number and Location                                                  |
|--------------------------|--------------------------------------|------------------|-----------------------------|--------------------|----------------------|----------------------------------------------------------------------|
| Primary Deterrent Unit   | Acoustic Hailing Device<br><br>Laser | Audio and visual | 149                         | radar              | on land              | Pond 2/3 2                                                           |
|                          |                                      |                  |                             |                    |                      | Pond 7 2                                                             |
|                          |                                      |                  |                             |                    |                      | Pond 8B 4                                                            |
|                          |                                      |                  |                             |                    |                      | Sand Dump 8 2                                                        |
|                          |                                      |                  |                             |                    |                      | South Tailings Pond 4                                                |
| Secondary Deterrent Unit | Wailer                               | Audio and visual | 125                         | radar              | on land              | Pond 2/3 6                                                           |
|                          | Bird scare cannon                    |                  |                             |                    |                      | Pond 7 4                                                             |
|                          | Inflatable effigy                    |                  |                             |                    |                      | Pond 8B 10                                                           |
|                          |                                      |                  |                             |                    |                      | South Tailings Pond 11                                               |
| Bird scare cannon        | Propane powered cannon               | Audio            | 125                         | random             | on land              | Extraction Waste Water Pond East 2                                   |
|                          |                                      |                  |                             |                    |                      | Millennium API Surge Pond 2                                          |
|                          |                                      |                  |                             |                    |                      | Mine North Gate Sump 1                                               |
|                          |                                      |                  |                             |                    |                      | PAW Pond 2                                                           |
|                          |                                      |                  |                             |                    |                      | Pond 1A 12                                                           |
| Effigy                   | Human effigies dressed as workers    | Visual           | -                           | -                  | on land and floating | Extraction Waste Water Pond East 2                                   |
|                          |                                      |                  |                             |                    |                      | Millennium API Surge Pond 1                                          |
|                          |                                      |                  |                             |                    |                      | Mine North Gate Sump 1                                               |
|                          |                                      |                  |                             |                    |                      | PAW Pond 2                                                           |
| Avian wire               | Physical deterrent                   | Visual           | -                           | -                  | -                    | Millennium API Surge Pond<br>Extraction Waste Water Pond<br>Paw Pond |

**Note:**

\* Ponds not included in the OSBCMP.

**Table 5.7: Number of Avian Radars and Deterrents at Process-affected Ponds at Suncor Base Mine (as of Fall 2014)**

| Pond Name                        | Pond Area (over water; ha) | Number of Radar(s) | Combined Audio & Visual Deterrents <sup>1</sup> |         |            |         | Audio-only Deterrents |         |            |         | Visual-only Deterrents |         |            |         | Total |                    |
|----------------------------------|----------------------------|--------------------|-------------------------------------------------|---------|------------|---------|-----------------------|---------|------------|---------|------------------------|---------|------------|---------|-------|--------------------|
|                                  |                            |                    | Linked to Radar                                 |         | Not Linked |         | Linked to Radar       |         | Not Linked |         | Linked to Radar        |         | Not Linked |         | Units | Density (units/ha) |
|                                  |                            |                    | Floating                                        | On Land | Floating   | On Land | Floating              | On Land | Floating   | On Land | Floating               | On Land | Floating   | On Land |       |                    |
| Extraction Waste Water Pond East | 4.79                       |                    |                                                 |         |            |         |                       |         |            | 2       |                        |         |            | 2       | 4     | 0.84               |
| Millennium API Surge Pond        | 0.90                       |                    |                                                 |         |            |         |                       |         |            | 2       |                        |         |            | 1       | 3     | 3.33               |
| Mine North Gate Sump             | 3.04                       |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            | 1       | 2     | 0.66               |
| PAW Pond                         | 3.68                       |                    |                                                 |         |            |         |                       |         |            | 2       |                        |         |            | 2       | 4     | 1.09               |
| Pond 1A                          | 51.39                      |                    |                                                 |         |            |         |                       |         |            | 12      |                        |         | 13         |         | 25    | 0.49               |
| Pond 2/3                         | 249.36                     | 1                  |                                                 | 8       |            |         |                       |         |            |         |                        |         | 53         |         | 62    | 0.25               |
| Pond 6                           | 269.41                     |                    |                                                 |         |            |         |                       |         |            | 31      |                        |         | 75         |         | 106   | 0.39               |
| Pond 7                           | 479.82                     | 0.5                |                                                 | 6       |            |         |                       |         |            |         |                        |         | 65         |         | 71    | 0.15               |
| Pond 8A                          | 33.67                      |                    |                                                 |         |            |         |                       |         |            | 5       |                        |         | 21         |         | 26    | 0.77               |
| Pond 8B                          | 713.42                     | 0.5                |                                                 | 14      |            |         |                       |         |            |         |                        |         | 65         |         | 79.5  | 0.11               |
| Pond B East                      | 1.83                       |                    |                                                 |         |            |         |                       |         |            | 2       |                        |         |            | 1       | 3     | 1.64               |
| Pond F                           | 1.64                       |                    |                                                 |         |            |         |                       |         |            | 2       |                        |         |            | 1       | 3     | 1.83               |
| Sand Dump 8                      | 58.14                      | 0.5                |                                                 | 2       |            |         |                       |         |            |         |                        |         |            | 8       | 11    | 0.19               |
| South Tailings Pond              | 794.41                     | 0.5                |                                                 | 15      |            |         |                       |         |            |         |                        |         | 125        |         | 140.5 | 0.18               |
| Upgrader Ponds A, B, D           | 8.82                       |                    |                                                 |         |            |         |                       |         |            | 4       |                        |         |            | 4       | 8     | 0.91               |
| Weir 10 Mid Plant Drainage       | 1.57                       |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            | 2       | 3     | 1.91               |
| DDA-1*                           | 0.92                       |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            |         | 1     | 1.09               |
| Mist Pond*                       | 0.97                       |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            | 1       | 2     | 2.06               |
| North Booster Pump House Sump*   | 0.18                       |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            | 1       | 2     | 11.11              |
| South Booster Pump House Sump*   | 0.43                       |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            | 1       | 2     | 4.65               |
| System 4 Sump*                   | 0.46                       |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            |         | 1     | 2.17               |
| System 5 Sump*                   | 3.77                       |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            |         | 1     | 0.27               |
| System 7 Sump*                   | 10.80                      |                    |                                                 |         |            |         |                       |         |            | 1       |                        |         |            |         | 1     | 0.09               |
| Upper Wood Creek*                | 1.03                       |                    |                                                 |         |            |         |                       |         |            | 2       |                        |         |            | 1       | 3     | 2.91               |

**Notes:**

<sup>1</sup> Combined deterrents count as one unit; individual components are described in Table 5.6.

\* Ponds not included in the OSBCMP.

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 were deployed on all OSBCMP ponds and remain deployed year round.

Avian wires function as a physical deterrent to approaching waterfowl. 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). The wire is hung on a level plane over the area from which birds are to be excluded. Avian wires remain in place on Extraction Waste Water Pond East, Millennium API Surge Pond, and PAW Pond from previous seasons.

### **Deterrent Placement and Adaptations made in 2014**

Bird scare cannons were distributed as evenly as possible by March 4, 2014, given access restrictions, on Pond 6 and Pond 8A (Appendix 5.A). Early in the season, blowing sand and sub-zero temperatures compromised SDU cannon effectiveness. The cannons would misfire in freezing temperatures and sandy conditions due to the oil thickening inside the cannon, as well as the propane blowing away in the wind since it was not a sealed unit. Installation of new electric cannons that included moving parts and a direct propane feed resulted in greater consistency in cannon operation. None of the deterrents deployed in the spring required relocation during the year.

#### **5.2.5 Hazing Procedures**

Hazing crews had CAPA™ launchers, pyrotechnic scare cartridges (bangers, screamers and howlers), air horns, and boats on hand as possible bird hazing instruments. Hazing effort was focused on birds on process-affected ponds. Hazing strategy was decided on a case-by-case basis, taking into account the relative risk posed to birds at different ponds, including consideration if birds were divers or dabblers. Shorebirds typically respond to hazing by circling and landing again and were, therefore, hazed less frequently. 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 with limited potential for hazing success. Bird survey monitors did not haze birds on a regular basis and any hazing occurred after the bird survey was completed. Observation of a bird on any of the process-affected ponds that could not be hazed by a bird survey crew would be called directly into the hazing crew.

All personnel on site could 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.

### **5.3 Methods**

Monitoring activities at Suncor were consistent with the 2014 OSBCMP protocol (St Clair et al. 2014). From April 3 to July 5, and July 26 to October 31, 2014, monitoring surveys were conducted daily and mortality searches conducted every two weeks. These methods are described in detail in this section. The procedures described in the protocol were followed with the exception of the few deviations described below.

#### **5.3.1 Pond Characteristics**

Suncor pond characteristics were derived from interpretation of a May 2014 satellite image. Areas of open water, floating bitumen, islands, and emergent vegetation, and vegetated and non-vegetated shoreline length were delineated in a Geographic Information System. These were adjusted based on field observations taken during monitoring activities. Results from this analysis are presented in Tables 5.8 and 5.9.

#### **5.3.2 Bird Surveys**

##### **Schedule and Description of Activities**

Bird monitoring surveys were conducted at each process-affected pond survey location six times per week, while freshwater ponds, Crane Lake and Weir 1 South Mine Drainage, were monitored twice weekly (refer to Appendix 5.A to show survey stations). There were 13 ponds that had one station surveyed for 10 minutes, three ponds that had two stations surveyed for 30 minutes, and two ponds that had three stations surveyed for 30 minutes (Table 5.10). Surveys included all avian species landed on the pond surface, islands, and shores within 500 m of the survey station, and flying within 100 m above that area. Shores, as defined by the protocol, encompassed areas that could be water-covered at any time of the year (due to changing water levels).

Two observers were available to perform bird surveys at all times. Each observer would follow an independent six-day randomized monitoring schedule, except in May and June when Crane Lake was monitored by two observers for safety reasons. The path to the lake required walking through natural habitat in which frequent bear sightings had been reported.

##### **Materials**

Surveys were conducted using a Zeiss Diascope FL85 spotting scope on a tripod and 10X42 binoculars. Data were entered into Google Drive forms (fields provided by the University of Alberta in 2014) on electronic tablets and immediately exported to Microsoft Office Excel for Quality Assurance/Quality Control (QA/QC), a system put in place by Suncor. All other equipment required by the protocol was available for use when it was needed (St. Clair et al. 2014). Following the site-level data QA/QC, data files were transmitted to the OSBCMP program manager for additional review and QA/QC processes. Finalized data were returned to Suncor for use in reporting.

**Table 5.8: Characteristics of Survey Stations Monitored at Suncor Base Mine in 2014**

| Pond Name <sup>1</sup>           | Survey Station ID          | Area<br>(over water; ha) | Island<br>(ha) | Emergent Veg.<br>(ha) | Shoreline (m) |          |
|----------------------------------|----------------------------|--------------------------|----------------|-----------------------|---------------|----------|
|                                  |                            |                          |                |                       | Vegetated     | Non-veg. |
| Extraction Waste Water Pond East | EWWP_1                     | 3.68                     | 0              | 0                     | 0             | 1,085    |
| Millennium API Surge Pond        | MAPISS_1                   | 0.90                     | 0              | 0                     | 0             | 371      |
| Mine North Gate Sump             | MMNGS_1                    | 3.04                     | 0              | 0                     | 0             | 744      |
| PAW Pond                         | PAW                        | 3.68                     | 0              | 0                     | 0             | 800      |
| Pond 1A                          | Pond1A_1                   | 25.28                    | 0.03           | 0                     | 0             | 1,267    |
| Pond 2/3                         | Pond23_1                   | 34.99                    | 0              | 0                     | 0             | 1,778    |
|                                  | Pond23_2                   | 29.00                    | 0              | 0                     | 0             | 1,182    |
|                                  | Total (2 regular stations) | 63.99                    | 0              | 0                     | 0             | 2,960    |
| Pond 6                           | Pond6_1                    | 20.44                    | 0              | 0                     | 238           | 898      |
|                                  | Pond6_1A*                  | 16.18                    | 0              | 0                     | 0             | 1,445    |
|                                  | Pond6_2                    | 0.50                     | 0              | 0                     | 0             | 257      |
|                                  | Pond6_2A*                  | 0                        | 0              | 0                     | 0             | 0        |
|                                  | Total (2 regular stations) | 20.94                    | 0              | 0                     | 238           | 1,155    |
| Pond 7                           | Pond7_1                    | 26.57                    | 0              | 0                     | 0             | 1,799    |
|                                  | Pond7_2                    | 27.96                    | 0              | 0                     | 0             | 1,066    |
|                                  | Pond7_2A*                  | 35.35                    | 0              | 0                     | 0             | 1,134    |
|                                  | Total (2 regular stations) | 54.53                    | 0              | 0                     | 0             | 2,865    |
| Pond 8A                          | Pond8A_1                   | 7.82                     | 0              | 0                     | 0             | 1,053    |
| Pond 8B                          | Pond8B_1                   | 35.02                    | 0              | 0                     | 0             | 1,200    |
|                                  | Pond8B_2                   | 33.63                    | 0              | 0                     | 0             | 1,080    |
|                                  | Pond8B_2A*                 | 35.77                    | 0              | 0                     | 0             | 1,097    |
|                                  | Pond8B_3                   | 29.00                    | 0              | 0                     | 0             | 1,266    |
|                                  | Total (3 regular stations) | 97.65                    | 0              | 0                     | 0             | 3,546    |
| Pond B East                      | PondBEast_1                | 1.83                     | 0              | 0                     | 0             | 589      |
| Pond F                           | PondF_1                    | 1.64                     | 0              | 0                     | 0             | 600      |
| Sand Dump 8                      | SD8_1                      | 12.63                    | 0              | 0                     | 0             | 1,136    |
| South Tailings Pond              | STP_1                      | 12.00                    | 0              | 0                     | 0             | 1,146    |
|                                  | STP_2                      | 40.72                    | 0.07           | 0                     | 0             | 3,467    |
|                                  | STP_3                      | 17.99                    | 0              | 0                     | 0             | 1,327    |
|                                  | Total (3 regular stations) | 70.71                    | 0.07           | 0                     | 0             | 5,940    |
| Upgrader Ponds A, B, D           | UABD_1                     | 8.67                     | 0              | 0                     | 0             | 2,305    |
| Weir 10 Mid Plant Drainage       | W10_1                      | 1.57                     | 0              | 0.13                  | 306           | 318      |
| Crane Lake                       | CL_1                       | 10.47                    | 0.03           | 0                     | 1,147         | 0        |
| Weir 1 South Mine Drainage       | W1_1                       | 5.73                     | 0              | 0.02                  | 1,233         | 0        |

**Notes:**

<sup>1</sup> Blue shading: freshwater ponds.

\* Alternative Survey Station (not included in total).

**Table 5.9: Characteristics of ponds monitored at Suncor Base Mine in 2014**

| Pond Name <sup>1</sup><br>(Year of Origin) | Pond Content       | Bitumen Cover                      |                        | Pond Area<br>(over water; ha) | Island (ha) | Emergent<br>Veg. (ha) | Shoreline (m) |          |
|--------------------------------------------|--------------------|------------------------------------|------------------------|-------------------------------|-------------|-----------------------|---------------|----------|
|                                            |                    | % <sup>2</sup> : Mode<br>(Min-Max) | ha <sup>3</sup> : Mean |                               |             |                       | Vegetated     | Non-veg. |
| Extraction Waste Water Pond East           | Industrial waste   | 16-25<br>(1-5 to 76-100)           | 2.27                   | 4.79                          | 0           | 0                     | 0             | 1,660    |
| Millennium API Surge Pond                  | Industrial waste   | 1-5<br>(0 to 51-75)                | 0                      | 0.90                          | 0           | 0                     | 0             | 371      |
| Mine North Gate Sump                       | Mine drainage      | 0<br>(0 to 0)                      | 0                      | 3.04                          | 0           | 0                     | 0             | 744      |
| PAW Pond<br>(2001)                         | Industrial run-off | 0<br>(0 to 1-25)                   | 0                      | 3.68                          | 0           | 0                     | 0             | 800      |
| Pond 1A<br>(1976)                          | Tailings           | 1-5<br>(0 to 51-75)                | 0.72                   | 51.39                         | 0.03        | 0                     | 0             | 3,173    |
| Pond 2/3<br>(1976)                         | Tailings           | 6-15<br>(1-5 to 76-100)            | 5.89                   | 249.36                        | 0           | 0                     | 0             | 8,246    |
| Pond 6<br>(2002)                           | Tailings           | 1-5<br>(0 to 26-50)                | 0.45                   | 269.41                        | 0           | 0                     | 635           | 7,845    |
| Pond 7<br>(2007)                           | Tailings           | 1-5<br>(0 to 26-50)                | 15.83                  | 479.82                        | 0           | 0                     | 0             | 10,478   |
| Pond 8A<br>(2001)                          | Tailings           | 6-15<br>(1-5 to 76-100)            | 3.99                   | 33.67                         | 0           | 0                     | 0             | 3,351    |
| Pond 8B<br>(2003)                          | Tailings           | 1-5<br>(0 to 16-25)                | 0                      | 713.42                        | 0           | 0                     | 0             | 11,358   |
| Pond B East                                | Industrial waste   | 1-5<br>(0 to 26-50)                | 0.01                   | 1.83                          | 0           | 0                     | 0             | 589      |
| Pond F                                     | Industrial waste   | 0<br>(0 to 0)                      | 0                      | 1.64                          | 0           | 0                     | 0             | 600      |
| Sand Dump 8<br>(2012)                      | Tailings           | 26-50<br>(6-15 to 76-100)          | 26.55                  | 58.14                         | 0           | 0                     | 0             | 3,643    |
| South Tailings Pond<br>(2006)              | Tailings           | 1-5<br>(0 to 26-50)                | 11.47                  | 794.41                        | 0.55        | 0                     | 0             | 20,809   |
| Upgrader Ponds A, B, D                     | Industrial waste   | 6-15<br>(0 to 51-75)               | 0                      | 8.82                          | 0           | 0                     | 0             | 2,345    |
| Weir 10 Mid Plant Drainage                 | Industrial run-off | 0<br>(0 to 1-25)                   | 0                      | 1.57                          | 0           | 0.13                  | 306           | 319      |
| Crane Lake                                 | Freshwater         | 0                                  | 0                      | 18.72                         | 0.05        | 0                     | 2,119         | 0        |
| Weir 1 South Mine Drainage                 | Freshwater         | 0                                  | 0                      | 5.75                          | 0           | 0.02                  | 1,268         | 0        |

**Notes:**

<sup>1</sup> Blue shading: freshwater ponds.

<sup>2</sup> Estimated during bird surveys.

<sup>3</sup> Estimated from satellite imagery.

**Table 5.10: Bird Survey Effort by Station at Suncor Base Mine in 2014**

| Pond Name <sup>1</sup>           | Survey Duration (min) | Survey Station ID | Survey Area (over water; ha) | # Surveys Conducted in 2014 |
|----------------------------------|-----------------------|-------------------|------------------------------|-----------------------------|
| Extraction Waste Water Pond East | 10                    | EWWP_1            | 3.68                         | 168                         |
| Millennium API Surge Pond        | 10                    | MAPISS_1          | 0.90                         | 166                         |
| Mine North Gate Sump             | 10                    | MMNGS_1           | 3.04                         | 168                         |
| PAW Pond                         | 10                    | PAW               | 3.68                         | 159                         |
| Pond 1A                          | 10                    | Pond1A_1          | 25.28                        | 166                         |
| Pond 2/3                         | 30                    | Pond23_1          | 34.99                        | 178                         |
|                                  |                       | Pond23_2          | 29.00                        | 174                         |
| Pond 6                           | 30                    | Pond6_1           | 20.44                        | 140                         |
|                                  |                       | Pond6_1A          | 16.18                        | 38                          |
|                                  |                       | Pond6_2           | 0.50                         | 173                         |
|                                  |                       | Pond6_2A          | 0                            | 5                           |
| Pond 7                           | 30                    | Pond7_1           | 26.57                        | 168                         |
|                                  |                       | Pond7_2           | 27.96                        | 82                          |
|                                  |                       | Pond7_2A          | 35.35                        | 85                          |
| Pond 8A                          | 10                    | Pond8A_1          | 7.82                         | 161                         |
| Pond 8B                          | 30                    | Pond8B_1          | 35.02                        | 161                         |
|                                  |                       | Pond8B_2          | 33.63                        | 159                         |
|                                  |                       | Pond8B_2A         | 35.77                        | 3                           |
|                                  |                       | Pond8B_3          | 29.00                        | 163                         |
| Pond B East                      | 10                    | PondBEast_1       | 1.83                         | 167                         |
| Pond F                           | 10                    | PondF_1           | 1.64                         | 173                         |
| Sand Dump 8                      | 10                    | SD8_1             | 12.63                        | 149                         |
| South Tailings Pond              | 30                    | STP_1             | 12.00                        | 164                         |
|                                  |                       | STP_2             | 40.72                        | 166                         |
|                                  |                       | STP_3             | 17.99                        | 162                         |
| Upgrader Ponds A, B, D           | 10                    | UABD_1            | 8.67                         | 168                         |
| Weir 10 Mid Plant Drainage       | 10                    | W10_1             | 1.57                         | 158                         |
| Crane Lake                       | 10                    | CL_1              | 10.47                        | 55                          |
| Weir 1 South Mine Drainage       | 10                    | W1_1              | 5.73                         | 168*                        |

**Notes:**

<sup>1</sup>Blue shading: freshwater ponds.

\* Weir 1 South Mine Drainage based on monitoring six days a week.

### **Deviations from Protocol**

Observers followed procedures described in the Oil Sands Bird Monitoring Plan (St. Clair et al. 2014), with three exceptions. Only one survey station could safely be established to conduct the surveys on each of the Upgrader A, B, and D process-affected ponds, nor could an alternate station be safely established for these ponds.

Second, the 2014 Protocol requires that freshwater ponds be monitored twice weekly. However, due to close proximity to other process-affected ponds on site, Weir 1 South Mine Drainage was monitored more frequently (Tables 5.10 and 5.11).

### **Oiled Birds Seen During Bird Surveys**

Birds were identified as oiled when observers were confident that the bird was in contact with bitumen. Observers were also trained to recognize unusual bird behaviour that may offer clues that a bird may be oiled, such as excessive preening without removing the substance.

#### **5.3.3 Inter-observer Variability (IOV)**

Inter-observer variability (IOV) surveys were conducted by two observers who completed separate, but simultaneous surveys, with similar equipment and field of view, at the same location at intervals through the monitoring season. This included recordings of the number of birds and number of species. These sessions were often held on Sundays, Suncor's Comparison Day, unless another opportunity presented itself.

Of the ponds on site, only five ponds met the size criteria of greater than 1.5 km<sup>2</sup> for an IOV survey as outlined in the protocol: Pond 2/3, Pond 6, Pond 7, Pond 8B, and South Tailings Pond. IOVs that were done outside of these five ponds, were removed from the analyses. If there were no birds observed landed or flying by both observers during an IOV session, data from the session would also be removed from the analyses to prevent bias towards a zero Relative Percent Difference (RPD).

Duplicate observations of the number of birds and species between each observer provide a measure of repeatability and consistency of the observation data. The RPD in the duplicate observations is calculated according to the following formula:

$$RPD_{\#birds} \text{ or } RPD_{\#species} = \frac{|x_1 - x_2|}{\bar{x}} * 100$$

where

$x_1$  is the number of birds or species from Observer 1,  $x_2$  is the number of birds or species from Observer 2, and  $\bar{x}$  is the mean of the number of birds or species from both observers. The mean number of birds or species provides the reference value against which the two individual observations are compared by assuming that the correct answer is likely between Observer 1 and Observer 2.

**Table 5.11: Bird Survey Effort by Pond at Suncor Base Mine in 2014**

| Pond Name <sup>1</sup>           | # Survey Stations | Survey Area (over water; ha) | Survey Area as % of Pond Area (over water; ha) | Duration of Surveys (min) | Scheduled Monitoring Frequency (days/week) | # Surveys Conducted in 2014 | % Days with all Scheduled Surveys Conducted |
|----------------------------------|-------------------|------------------------------|------------------------------------------------|---------------------------|--------------------------------------------|-----------------------------|---------------------------------------------|
| Extraction Waste Water Pond East | 1                 | 3.68                         | 77                                             | 10                        | 6                                          | 168                         | 101                                         |
| Millennium API Surge Pond        | 1                 | 0.90                         | 100                                            | 10                        | 6                                          | 166                         | 99                                          |
| Mine North Gate Sump             | 1                 | 3.04                         | 100                                            | 10                        | 6                                          | 168                         | 101                                         |
| PAW Pond                         | 1                 | 3.68                         | 100                                            | 10                        | 6                                          | 159                         | 96                                          |
| Pond 1A                          | 1                 | 25.28                        | 49                                             | 10                        | 6                                          | 166                         | 101                                         |
| Pond 2/3                         | 2                 | 63.99                        | 26                                             | 30                        | 6                                          | 352                         | 108                                         |
| Pond 6                           | 2                 | 20.94                        | 8                                              | 30                        | 6                                          | 356                         | 111                                         |
| Pond 7                           | 2                 | 54.53                        | 11                                             | 30                        | 6                                          | 335                         | 103                                         |
| Pond 8A                          | 1                 | 7.82                         | 23                                             | 10                        | 6                                          | 161                         | 99                                          |
| Pond 8B                          | 3                 | 97.65                        | 14                                             | 30                        | 6                                          | 486                         | 101                                         |
| Pond B East                      | 1                 | 1.83                         | 100                                            | 10                        | 6                                          | 167                         | 102                                         |
| Pond F                           | 1                 | 1.64                         | 100                                            | 10                        | 6                                          | 173                         | 105                                         |
| Sand Dump 8                      | 1                 | 12.63                        | 22                                             | 10                        | 6                                          | 149                         | 90                                          |
| South Tailings Pond              | 3                 | 70.71                        | 9                                              | 30                        | 6                                          | 492                         | 101                                         |
| Upgrader Ponds A, B, D           | 1                 | 8.67                         | 98                                             | 10                        | 6                                          | 168                         | 102                                         |
| Weir 10 Mid Plant Drainage       | 1                 | 1.57                         | 100                                            | 10                        | 6                                          | 158                         | 102                                         |
| Crane Lake                       | 1                 | 10.47                        | 56                                             | 10                        | 2                                          | 55                          | 92                                          |
| Weir 1 South Mine Drainage       | 1                 | 5.73                         | >99                                            | 10                        | 6                                          | 168                         | 102*                                        |

**Notes:**

<sup>1</sup> Blue shading: freshwater ponds.

\* Weir 1 South Mine Drainage based on monitoring six days a week.

An RPD<sub>#birds</sub> and an RPD<sub>#species</sub> of less than 10% is considered optimum, up to 25% may be acceptable, but greater than 25% would suggest that the reasons for the difference be examined. This is based on subjective evaluation of how much variability is expected and acceptable to the program given the type of data collected. As such, there is no standard means by which a definitive percent cutoff can be determined. The results of the IOV analyses will be reviewed to evaluate consistency and to also help identify what other factors might be responsible for observer variability in the results.

#### **5.3.4 Mortality Searches**

##### **Schedule of Activities**

Standardized mortality searches were conducted at process-affected ponds at a minimum of every two weeks during spring and fall migration periods, by foot, and boat, as set out in the protocol.

Mortality search transects conducted by boat were done on Pond 1A, Pond 2/3, Pond 6, Pond 7, Pond 8B, and the South Tailings Pond. Search routes were recorded using the tracking options on portable GPS units. Where accessible, 100% of the pond shoreline and area were searched every two weeks, and were not necessarily standardized. If searching the pond perimeter by foot was not possible, due to weather for example, it was rescheduled for later that week.

Focused searches were situated in high-risk areas (e.g., bitumen mats or where previous mortalities were found). Focused searches could change location depending on operational activities and wind direction. Route-based search transects were later revised to include high risk areas revealed during the focused searches conducted in early spring.

##### **Data Analysis**

Mortality search data were recorded on paper data sheets and entered in an Excel spreadsheet within 24 hours of a search being completed. Data proofing and verification was completed internally, with data files transmitted to the OSBCMP manager approximately every two weeks.

The OSBCMP manager conducted a second QA/QC process on the entire Suncor dataset at the end of the season. Discrepancies were identified and corrected in collaboration with the contractor on-site and Suncor personnel.

#### **5.3.5 Incidental Observations and Reporting**

##### **Live Incidentals**

Observers that collected bird survey data also recorded live bird incidental observations using tablet forms. Live incidental observations were only recorded and included in the data if a species of conservation concern was viewed contacting process-affected water outside of a bird survey, as specified in the direction provided by the OSBCMP manager in July 2014.

## **Incidental Mortalities**

Any observations of landed dead and/or oiled birds resulting in a mortality outside of a scheduled mortality search were recorded as incidental mortalities.

### **5.4 Results**

#### **5.4.1 Pond Characteristics**

Pond attributes are presented in Tables 5.8 and 5.9. Of the 16 process-affected ponds surveyed in the OSBCMP, eight contained tailings, five contained industrial wastewater, two contained industrial run-off water and one contained mine drainage water. Based on a May 2014 satellite image and confirmation from monitoring crews, floating bitumen was identified on the image as being present on Extraction Waste Water Pond East, Pond 1A, Pond 2/3, Pond 6, Pond 7, Pond 8A, Pond B East, Sand Dump 8, and the South Tailings Pond. These nine ponds pose a potential risk of oiling to birds if they come in contact with bitumen on the pond surface area or shore. Small amounts of bitumen, not visible from the satellite images but observed by field personnel, were also present on the remaining five process-affected ponds.

Based on the same satellite image, the GIS specialist and site contacts confirmed two process-affected ponds with vegetation along their perimeter, for a total of 635 m at Pond 6 and 306 m at Weir 10 Mid Plant Drainage. Islands covered 0.55 ha on the South Tailings Pond and 0.03 ha at Pond 1A. Emergent vegetation covered 0.13 ha at Weir 10 Mid Plant Drainage, but was not present on any of the other process-affected ponds.

The freshwater ponds, Crane Lake and Weir 1 South Mine Drainage, consisted of 1,147 m and 1,233 m of perimeter vegetation, respectively, both potential attractants for avian species (Table 5.8). Weir 1 South Mine Drainage had 0.02 ha of emergent vegetation and Crane Lake had 0.03 ha of islands.

#### **5.4.2 Bird Observations**

##### **Survey Effort**

In 2014, a total of 4,047 monitoring surveys were conducted over 1,348.2 hours: 3,824 surveys (1,311 hours) at process-affected ponds (Table 5.10) and 223 surveys (37.2 hours) at the two freshwater ponds, Crane Lake and Weir 1 South Mine Drainage (Table 5.11).

##### **Process-affected Ponds**

A total of 5,439 observations of landed birds and 2,026 observations of bird flyovers within the survey areas were recorded at all process-affected ponds (Table 5.12, Figure 5.2). Landed birds included 5,305 detections of birds from target guilds and 134 detections from non-target guilds. Considering all guilds, 50.2% of landed birds were divers, 41.3% dabblers, 5.6% waders, 0.3% gulls, and 2.5% were from non-target guilds, with the remainder being of birds that could not be identified beyond an “unknown” designation (e.g., Unknown Duck) (Table 5.12).

**Table 5.12: Number of Bird Observations by Pond and Guild at Suncor Base Mine in 2014<sup>1</sup>**

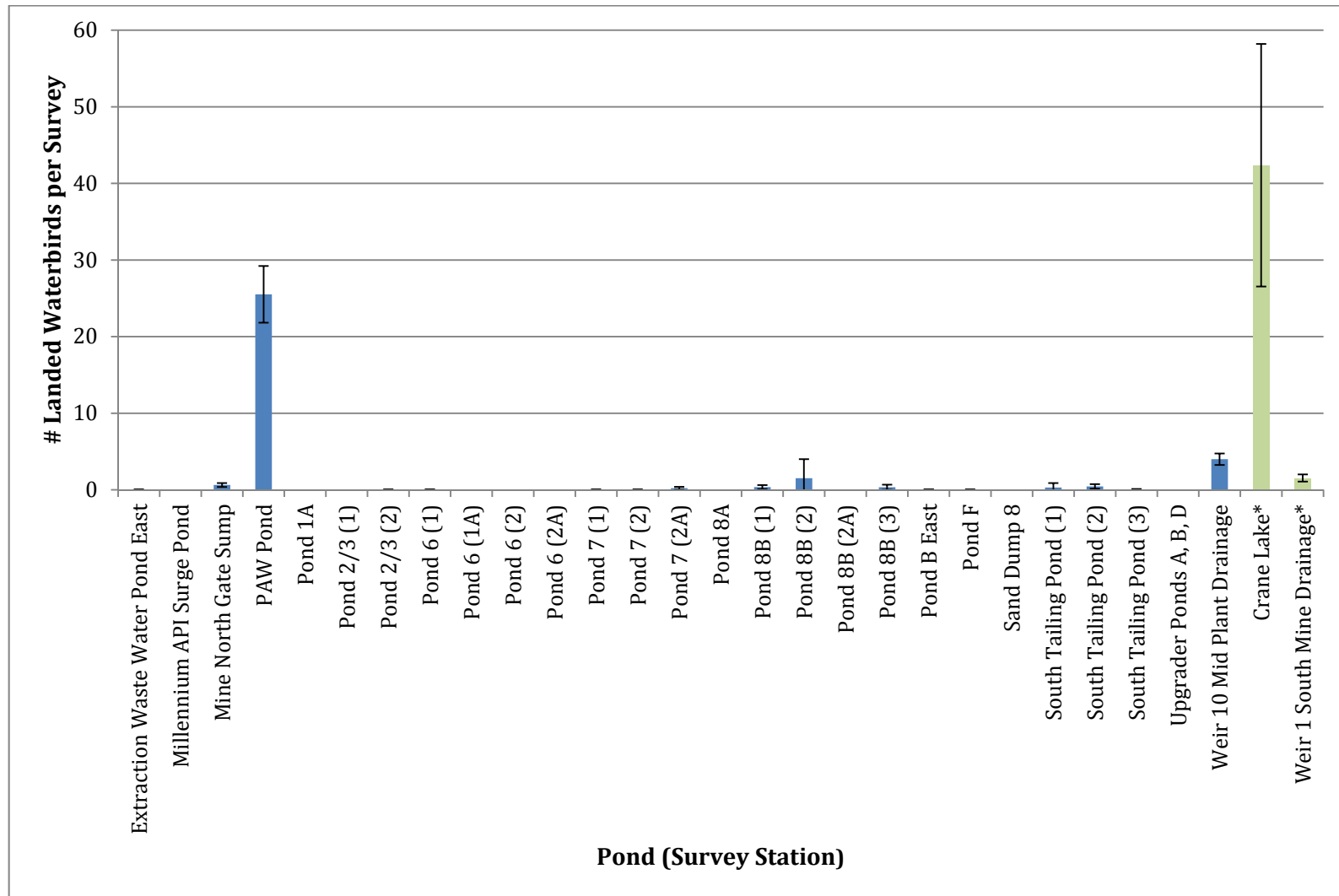
| Pond Name <sup>2</sup>                | Dabblers     |            | Divers       |            | Waders     |           | Gulls      |            | Non-target |              | Total <sup>3</sup> |              |
|---------------------------------------|--------------|------------|--------------|------------|------------|-----------|------------|------------|------------|--------------|--------------------|--------------|
|                                       | Landed       | Flew Over  | Landed       | Flew Over  | Landed     | Flew Over | Landed     | Flew Over  | Landed     | Flew Over    | Landed             | Flew Over    |
| Extraction Waste Water Pond East      | 0            | 0          | 0            | 0          | 1          | 0         | 0          | 0          | 0          | 1            | 1                  | 1            |
| Millennium API Surge Pond             | 0            | 0          | 0            | 0          | 0          | 1         | 0          | 70         | 0          | 49           | 0                  | 120          |
| Mine North Gate Sump                  | 2            | 28         | 45           | 0          | 55         | 2         | 3          | 2          | 0          | 13           | 105                | 45           |
| PAW Pond                              | 1,774        | 9          | 2,037        | 0          | 236        | 6         | 11         | 0          | 0          | 20           | 4,058              | 35           |
| Pond 1A                               | 0            | 0          | 0            | 2          | 0          | 0         | 0          | 1          | 0          | 15           | 0                  | 18           |
| Pond 2/3                              | 0            | 28         | 1            | 8          | 0          | 0         | 0          | 39         | 24         | 81           | 25                 | 156          |
| Pond 6                                | 0            | 58         | 1            | 6          | 2          | 0         | 0          | 19         | 2          | 70           | 5                  | 153          |
| Pond 7                                | 2            | 286        | 14           | 0          | 1          | 2         | 2          | 0          | 34         | 137          | 54                 | 516          |
| Pond 8A                               | 0            | 0          | 0            | 0          | 0          | 0         | 0          | 0          | 0          | 35           | 0                  | 35           |
| Pond 8B                               | 26           | 21         | 319          | 15         | 0          | 16        | 1          | 12         | 1          | 442          | 353                | 510          |
| Pond B East                           | 0            | 0          | 2            | 0          | 2          | 4         | 0          | 0          | 2          | 6            | 6                  | 10           |
| Pond F                                | 0            | 0          | 1            | 0          | 0          | 0         | 0          | 3          | 0          | 8            | 1                  | 11           |
| Sand Dump 8                           | 0            | 0          | 0            | 0          | 0          | 0         | 0          | 0          | 0          | 1            | 0                  | 1            |
| South Tailings Pond                   | 71           | 52         | 58           | 4          | 0          | 0         | 0          | 5          | 1          | 93           | 130                | 154          |
| Upgrader Ponds A, B, D                | 0            | 0          | 0            | 0          | 0          | 0         | 0          | 9          | 0          | 9            | 0                  | 18           |
| Weir 10 Mid Plant Drainage            | 371          | 0          | 253          | 4          | 7          | 2         | 0          | 82         | 70         | 155          | 701                | 243          |
| <b>Total (Process-affected Ponds)</b> | <b>2,246</b> | <b>482</b> | <b>2,731</b> | <b>39</b>  | <b>304</b> | <b>33</b> | <b>17</b>  | <b>242</b> | <b>134</b> | <b>1,135</b> | <b>5,439</b>       | <b>2,026</b> |
| Crane Lake                            | 342          | 2          | 1,499        | 92         | 0          | 4         | 490        | 0          | 10         | 24           | 2,341              | 122          |
| Weir 1 South Mine Drainage            | 4            | 7          | 253          | 37         | 0          | 0         | 1          | 60         | 31         | 76           | 289                | 180          |
| <b>Total (Freshwater Ponds)</b>       | <b>346</b>   | <b>9</b>   | <b>1,752</b> | <b>129</b> | <b>0</b>   | <b>4</b>  | <b>491</b> | <b>60</b>  | <b>41</b>  | <b>100</b>   | <b>2,630</b>       | <b>302</b>   |

**Notes:**

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times.

<sup>2</sup> Blue shading: freshwater ponds.

<sup>3</sup> Includes unknown duck species (which may be dabblers or divers).



\* Freshwater Ponds (in green). Bars = 95% Confidence Intervals.

**Figure 5.2: Mean Number of Landed Waterbirds per Survey at Suncor Base Mine in 2014**

In total, 59 species were observed during bird surveys (Appendix 5.C). Of these species, 48 were reported as landed: 35 from target guilds (divers, dabblers, waders, and gulls) and 13 from non-target guilds. The most common landed target guild species (>100 detections each) on process-affected ponds, in descending order, were American Wigeon, Bufflehead, Mallard, Ring-necked Duck, Lesser Scaup, Green-winged Teal, Common Goldeneye, Ruddy Duck, Redhead, and Lesser Yellowlegs (Appendix 5.C).

Of the total landings, the majority (88%) were observed at the lowest risk ponds with smaller pond areas; PAW Pond (3.68ha) and Weir 10 Mid Plant Drainage (1.57), containing industrial run-off water (Table 5.9, Table 5.12). The mean number of landed target birds per survey was highest at PAW Pond with a mean of 25.5 (50.2% divers, 43.7% dabblers, 5.8% waders, and 0.3% gulls) and then Weir 10 Mid Plant Drainage (Table 5.13) with a mean of 4.4 (53% dabblers, 36% divers, 1% waders, and 10% non-target birds). Pond 8B had the third highest mean number of landed birds per survey at 0.7. Landings observed at survey station Pond 8B\_2 (mean of 1.53) were higher than Pond8B\_1 (mean of 0.4) and PondB\_3 (mean of 0.3). At six of the 16 process-affected ponds, no landed birds from target guilds were detected: Millennium API Surge Pond, Pond 1A, Pond 2/3, Pond 8A, Sand Dump 8, and Upgrader Ponds A, B, D.

The number of detections of landed birds from target guilds peaked during the periods of May 2 to 9 and August 10 to September 7 (Figure 5.6). There was an increase of landed birds detected on June 3: 10 different species were seen at PAW Pond including 11 Canada goose. A relatively high number of landed bird observations occurred on July 27 (113), including five Black Tern at survey station STP\_3 (South Tailings Pond), with the majority of sightings at Crane Lake (27 American Wigeon, 23 American Coot, 15 Mallard, 14 Ring-necked Duck, 11 Bufflehead, 10 Common Goldeneye and eight Green-winged Teal). Additionally, an increase in observations also occurred on October 12 at Crane Lake (65 Bufflehead and 28 Ring-necked Duck).

Detection rates for landings of all bird guilds at process-affected ponds varied between 0 to 16 hours after sunrise, peaking at midday, 8 to 10 hours after sunrise (Appendix 5.B). High variability is associated with observations taken 12 hours after sunrise, this is likely due to only five surveys being completed at this time of day. Two of the five surveys monitored at this time were at PAW Pond, a pond that generally has more landed birds per survey, potentially introducing an artifact into the dataset. For example, one PAW Pond survey included 24 landed birds (June 14).

There was only one observation of an oiled bird during a bird survey, a Pied-billed Grebe (target guild), at Pond 2/3 (Table 5.14, Appendix 5.D.). Consequently, the Pond23\_2 survey station at Pond 2/3 had a mean of 0.01 oiled birds per survey (Figure 5.3). Field observations from both the bird survey and the mortality incidental records indicate that the Pied-billed Grebe was greater than 50% oiled (Appendix 5.D).

**Table 5.13: Mean Number of Landed Birds per Survey at Suncor Base Mine in 2014**

| Pond Name <sup>1</sup>            | Survey Station ID        | Dabblers    | Divers       | Waders      | Gulls       | Non-target Guilds | All Guilds <sup>2</sup> |
|-----------------------------------|--------------------------|-------------|--------------|-------------|-------------|-------------------|-------------------------|
| Extraction Waste Water Pond East  | EWWP_1                   | 0           | 0            | 0.01        | 0           | 0                 | 0.01                    |
| Millennium API Surge Pond         | MAPISS_1                 | 0           | 0            | 0           | 0           | 0                 | 0                       |
| Mine North Gate Sump              | MMNGS_1                  | 0.01        | 0.27         | 0.33        | 0.02        | 0                 | 0.63                    |
| PAW Pond                          | PAW                      | 11.16       | 12.81        | 1.48        | 0.07        | 0                 | 25.52                   |
| Pond 1A                           | Pond1A_1                 | 0           | 0            | 0           | 0           | 0                 | 0                       |
| Pond 2/3                          | Pond23_1                 | 0           | 0            | 0           | 0           | 0.10              | 0.10                    |
|                                   | Pond23_2                 | 0           | 0.01         | 0           | 0           | 0.03              | 0.04                    |
|                                   | Mean across surveys      | 0           | <0.01        | 0           | 0           | 0.07              | 0.07                    |
| Pond 6                            | Pond6_1                  | 0           | 0.01         | 0.01        | 0           | 0.01              | 0.03                    |
|                                   | Pond6_1A                 | 0           | 0            | 0           | 0           | 0                 | 0                       |
|                                   | Pond6_2                  | 0           | 0            | 0           | 0           | 0.01              | 0.01                    |
|                                   | Pond6_2A                 | 0           | 0            | 0           | 0           | 0                 | 0                       |
|                                   | Mean across surveys      | 0           | <0.01        | 0.01        | 0           | 0.01              | 0.01                    |
| Pond 7                            | Pond7_1                  | 0.01        | 0            | 0           | 0           | 0.20              | 0.21                    |
|                                   | Pond7_2                  | 0           | 0            | 0           | 0           | 0                 | 0.01                    |
|                                   | Pond7_2A                 | 0.01        | 0.16         | 0.01        | 0.02        | 0                 | 0.21                    |
|                                   | Mean across surveys      | 0.01        | 0.04         | <0.01       | 0.01        | 0.10              | 0.16                    |
| Pond 8A                           | Pond8A_1                 | 0           | 0            | 0           | 0           | 0                 | 0                       |
| Pond 8B                           | Pond8B_1                 | 0           | 0.30         | 0           | 0.01        | 0                 | 0.35                    |
|                                   | Pond8B_2                 | 0.01        | 1.51         | 0           | 0           | 0.01              | 1.53                    |
|                                   | Pond8B_2A                | 0           | 0            | 0           | 0           | 0                 | 0                       |
|                                   | Pond8B_3                 | 0.15        | 0.18         | 0           | 0           | 0                 | 0.33                    |
|                                   | Mean across surveys      | 0.05        | 0.66         | 0           | <0.01       | <0.01             | 0.73                    |
| Pond B East                       | PondBEast_1              | 0           | 0.01         | 0.01        | 0           | 0.01              | 0.04                    |
| Pond F                            | PondF_1                  | 0           | 0.01         | 0           | 0           | 0                 | 0.01                    |
| Sand Dump 8                       | SD8_1                    | 0           | 0            | 0           | 0           | 0                 | 0                       |
| South Tailings Pond               | STP_1                    | 0           | 0.30         | 0           | 0           | 0                 | 0.30                    |
|                                   | STP_2                    | 0.43        | <0.01        | 0           | 0           | 0                 | 0.43                    |
|                                   | STP_3                    | 0           | 0.04         | 0           | 0           | 0.01              | 0.05                    |
|                                   | Mean across surveys      | 0.14        | 0.12         | 0           | 0           | <0.01             | 0.26                    |
| Upgrader Ponds A, B, D            | UABD_1                   | 0           | 0            | 0           | 0           | 0                 | 0                       |
| Weir 10 Mid Plant Drainage        | W10_1                    | 2.35        | 1.60         | 0.04        | 0           | 0.44              | 4.44                    |
| <b>All Process-affected Ponds</b> | <b>Mean across ponds</b> | <b>0.86</b> | <b>0.97</b>  | <b>0.12</b> | <b>0.01</b> | <b>0.04</b>       | <b>1.99</b>             |
| Crane Lake                        | CL_1                     | 6.22        | 27.25        | 0           | 8.91        | 0.18              | 42.56                   |
| Weir 1 South Mine Drainage        | W1_1                     | 0.02        | 1.51         | 0           | 0.01        | 0.18              | 1.72                    |
| <b>All Freshwater Ponds</b>       | <b>Mean across ponds</b> | <b>3.12</b> | <b>14.38</b> | <b>0</b>    | <b>4.46</b> | <b>0.18</b>       | <b>22.14</b>            |

**Notes:**

<sup>1</sup> Blue shading: freshwater ponds.

<sup>2</sup> Includes unknown duck species (which may be dabblers or divers).

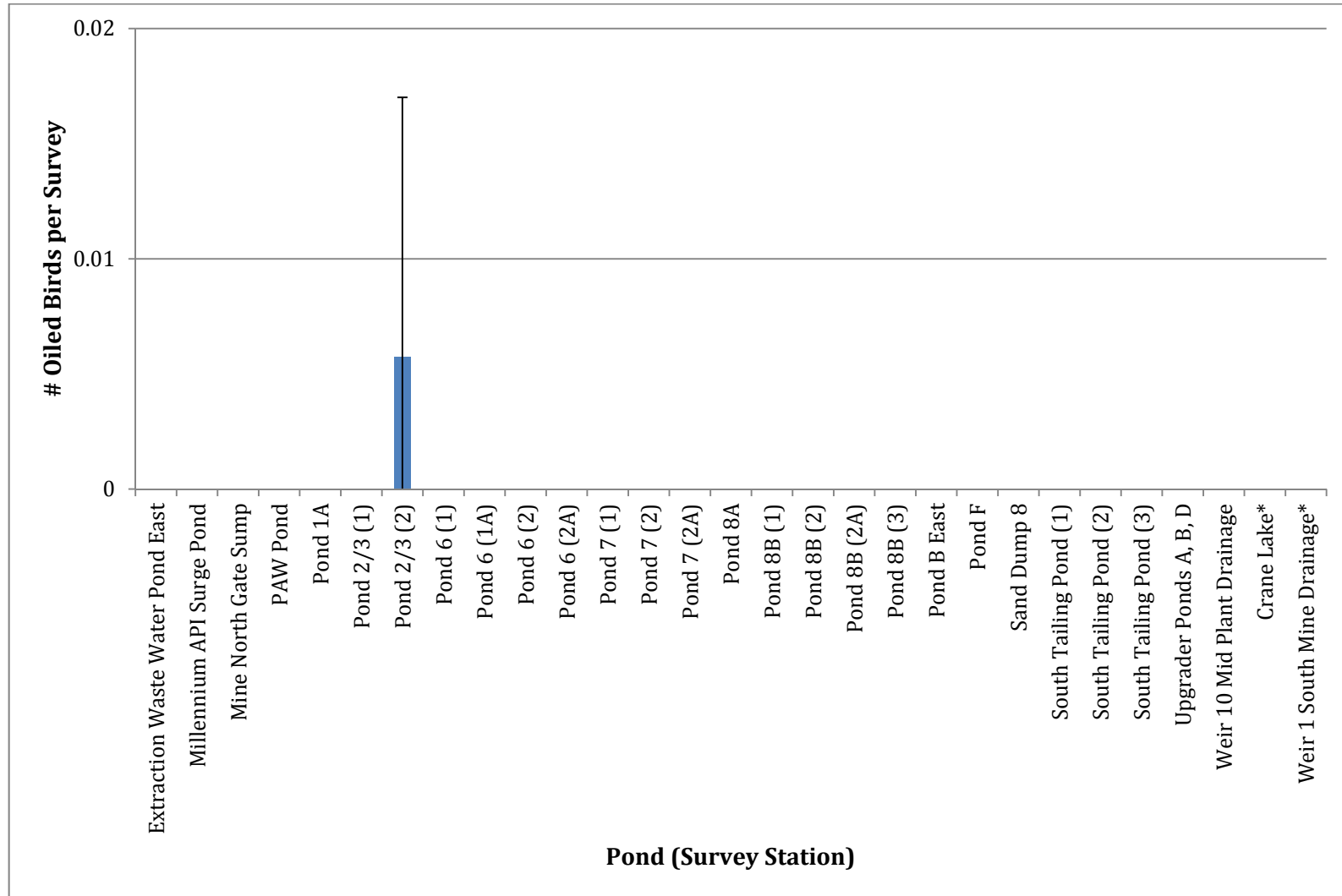
**Table 5.14: Mean Number of Oiled Birds per Survey at Suncor Base Mine in 2014**

| Pond Name <sup>1</sup>            | Survey Station ID        | Dabblers | Divers           | Waders   | Gulls    | Non-target<br>Guilds | All Guilds <sup>2</sup> |
|-----------------------------------|--------------------------|----------|------------------|----------|----------|----------------------|-------------------------|
| Extraction Waste Water Pond East  | EWWP_1                   | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Millennium API Surge Pond         | MAPISS_1                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Mine North Gate Sump              | MMNGS_1                  | 0        | 0                | 0        | 0        | 0                    | 0                       |
| PAW Pond                          | PAW                      | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Pond 1A                           | Pond1A_1                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Pond 2/3                          | Pond23_1                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond23_2                 | 0        | 0.006            | 0        | 0        | 0                    | 0.006                   |
|                                   | Mean across surveys      | 0        | 0.003            | 0        | 0        | 0                    | 0.003                   |
| Pond 6                            | Pond6_1                  | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond6_1A                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond6_2                  | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond6_2A                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Mean across surveys      | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Pond 7                            | Pond7_1                  | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond7_2                  | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond7_2A                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Mean across surveys      | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Pond 8A                           | Pond8A_1                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Pond 8B                           | Pond8B_1                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond8B_2                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond8B_2A                | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Pond8B_3                 | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Mean across surveys      | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Pond B East                       | PondBEast_1              | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Pond F                            | PondF_1                  | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Sand Dump 8                       | SD8_1                    | 0        | 0                | 0        | 0        | 0                    | 0                       |
| South Tailings Pond               | STP_1                    | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | STP_2                    | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | STP_3                    | 0        | 0                | 0        | 0        | 0                    | 0                       |
|                                   | Mean across surveys      | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Upgrader Ponds A, B, D            | UABD_1                   | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Weir 10 Mid Plant Drainage        | W10_1                    | 0        | 0                | 0        | 0        | 0                    | 0                       |
| <b>All Process-affected Ponds</b> | <b>Mean across ponds</b> | <b>0</b> | <b>&lt;0.001</b> | <b>0</b> | <b>0</b> | <b>0</b>             | <b>&lt;0.001</b>        |
| Crane Lake                        | CL_1                     | 0        | 0                | 0        | 0        | 0                    | 0                       |
| Weir 1 South Mine Drainage        | W1_1                     | 0        | 0                | 0        | 0        | 0                    | 0                       |
| <b>All Freshwater Ponds</b>       | <b>Mean across ponds</b> | <b>0</b> | <b>0</b>         | <b>0</b> | <b>0</b> | <b>0</b>             | <b>0</b>                |

**Notes:**

<sup>1</sup> Blue shading: freshwater ponds.

<sup>2</sup> Includes unknown duck species (which may be dabblers or divers).



\* Freshwater Ponds. Bar = 95% Confidence Interval.

**Figure 5.3: Mean Number of Oiled Birds per Survey at Suncor Base Mine in 2014**

Incidental live bird observations contained no records of oiled birds, only species of conservation concern (Appendix 5.C). All live incidental observations (species of concern in contact with process-affected ponds) occurred at Pond 8B (108 Lesser Scaup, two Northern Pintail) and the South Tailings Pond (three Lesser Scaup, two Sandhill Crane).

### **Freshwater Ponds**

Crane Lake had more birds per survey (42.7) than other ponds on-site. At Crane Lake, 64% of landed birds were divers, 21% gulls, 14.6% dabblers, 0.4% non-target guilds (Tables 5.12 and 5.13). There was a mean of 42.56 landed birds from target guilds per survey.

### **Broods**

Broods were found at PAW Pond (125), Weir 10 Mid Plant Drainage (45), Mine North Gate Sump (6), STP (2), Pond 8B (1), and freshwater ponds, Crane Lake (29) and Weir 1 South Mine Drainage (15). Broods included 13 species; most were Bufflehead, American Wigeon and Mallard ducklings (Table 5.15). At process-affected ponds, a mean of 0.05 broods were detected per survey, whereas freshwater ponds had a mean of 0.20 broods detected per survey.

**Table 5.15: Brood Observations by Species at Process-affected Ponds at Suncor Base Mine in 2014**

| Species/Species Group | # Brood Observations <sup>1</sup> |
|-----------------------|-----------------------------------|
| Bufflehead            | 51                                |
| American Wigeon       | 31                                |
| Mallard               | 30                                |
| Ruddy Duck            | 17                                |
| Ring-necked Duck      | 12                                |
| Common Goldeneye      | 10                                |
| Green-winged Teal     | 10                                |
| Canada Goose          | 5                                 |
| Lesser Scaup          | 4                                 |
| Redhead               | 4                                 |
| Northern Shoveler     | 3                                 |
| Blue-winged Teal      | 1                                 |
| Canvasback            | 1                                 |

**Notes:**

Pink shading: Species of Conservation Concern

<sup>1</sup> Each brood may contain one to multiple chicks; broods may be observed repeatedly and thus be counted multiple times

### **5.4.3 Inter-observer Variability (IOV)**

A total of 165 IOVs were conducted at 17 ponds across the Suncor site during the 2014 season. Fifty-two IOVs were conducted at Pond 2/3, Pond 6, Pond 7, Pond 8B, and South Tailings Pond, and were subject to analyses. Of these 52, 39 were removed from the analyses due to no birds observed landed or flying during the IOV. The inter-observer comparisons from the remaining 13 IOVs, with either flying or landed birds present, are found in Table 5.16. The RPD between observers varied from 0 to 200% (Table 5.16).

**Table 5.16: Inter-observer Variability in Terms of Relative Percent Difference at Suncor Base Mine in 2014**

| Comparison Survey <sup>1</sup> | Survey Station ID | Landed <sup>2</sup>                       |                                        | Flew Over <sup>2</sup>                    |                                        |
|--------------------------------|-------------------|-------------------------------------------|----------------------------------------|-------------------------------------------|----------------------------------------|
|                                |                   | RPD (%):<br>Number of<br>Individual Birds | RPD (%):<br>Number of<br>Avian Species | RPD (%):<br>Number of<br>Individual Birds | RPD (%):<br>Number of<br>Avian Species |
| 1                              | Pond23_2          | –                                         | –                                      | 0                                         | 0                                      |
| 2                              | Pond6_2           | –                                         | –                                      | 0                                         | 0                                      |
| 3                              | Pond8B_2          | –                                         | –                                      | 200                                       | 200                                    |
| 4                              | Pond6_1A          | –                                         | –                                      | 200                                       | 200                                    |
| 5                              | Pond7_1           | –                                         | –                                      | 0                                         | 0                                      |
| 6                              | Pond8B_1          | 12                                        | 67                                     | –                                         | –                                      |
| 7                              | Pond23_2          | –                                         | –                                      | 0                                         | 0                                      |
| 8                              | Pond6_1           | –                                         | –                                      | 200                                       | 200                                    |
| 9                              | Pond7_1           | 14                                        | 0                                      | –                                         | –                                      |
| 10                             | Pond6_1           | –                                         | –                                      | 67                                        | 0                                      |
| 11                             | Pond7_1           | –                                         | –                                      | 0                                         | 0                                      |
| 12                             | Pond8B_2          | –                                         | –                                      | 200                                       | 200                                    |
| 13                             | Pond23_1          | –                                         | –                                      | 0                                         | 0                                      |

**Notes:**

<sup>1</sup> Comparisons where no landed or flying birds were observed were removed prior to analysis.

<sup>2</sup> Dash = no birds were observed by either observer.

Two surveys are available to compare RPD percentages for landed birds. On May 25, both observers recorded 16 Lesser Scaup at survey station Pond8B\_1 (Pond 8B). One of the observers also observed two landed American Coot, two more individual birds and one more species than were noted by the other observer, an RPD of 12% and 67%, respectively (Table 5.16). On June 29, both observers saw Barn Swallows at survey station Pond7\_1 (Pond 7), which is designated as 0% variance in number of avian species (comparison survey 9, Table 5.16); however the number of individual birds varied, the first observer recorded 20 and the second recorded 23 (an RPD of 14%).

RPDs for flyover birds were derived using 11 surveys' worth of data. RPD values of 200% are reasonable for flyover birds, as these observations are more subjective (e.g., likely due to differences in height perception combined with low bird numbers) (Table 5.16).

Other potential sources of variability in observers may include differences in equipment used and monitoring style. Observer variability could simply arise from one observer looking at a different field of view than the other observer, as when one observer is looking through a spotting scope while the other is noting flyovers. The IOV's are most useful in highlighting the reasons for observer differences, such that they can be minimized in subsequent monitoring sessions.

#### 5.4.4 Mortalities

Mortality search transects covered 191.7 km (28.1 hours) by boat and 172.7 km (82.5 hours) by foot (Tables 5.17 and 5.18, Figure 5.4).

**Table 5.17: Mortality Search Effort at Suncor Base Mine in 2014<sup>1</sup>**

| Pond Name                        | # Days Searched | Boat        |              | Walk        |              | Total        |              |
|----------------------------------|-----------------|-------------|--------------|-------------|--------------|--------------|--------------|
|                                  |                 | h           | km           | h           | km           | h            | km           |
| Extraction Waste Water Pond East | 15              |             |              | 2.3         | 7.9          | 2.3          | 7.9          |
| Millennium API Surge Pond        | 15              |             |              | 2.3         | 3.6          | 2.3          | 3.6          |
| Mine North Gate Sump             | 15              |             |              | 2.0         | 2.1          | 2.0          | 2.1          |
| PAW Pond                         | 16              |             |              | 3.3         | 8.0          | 3.3          | 8.0          |
| Pond 1A                          | 16              | 3.8         | 8.7          | 0.8         | 6.4          | 4.7          | 15.1         |
| Pond 2/3                         | 16              | 4.1         | 14.9         | 9.0         | 19.2         | 13.1         | 34.1         |
| Pond 6                           | 17              | 2.7         | 3.7          | 2.9         | 5.6          | 5.6          | 9.3          |
| Pond 7                           | 16              | 3.6         | 27.4         | 2.2         | 7.7          | 5.8          | 35.1         |
| Pond 8A                          | 15              |             |              | 2.1         | 4.2          | 2.1          | 4.2          |
| Pond 8B                          | 14              | 5.8         | 81.9         | 2.2         | 1.0          | 8.0          | 82.9         |
| Pond B East                      | 15              |             |              | 6.5         | 6.8          | 6.5          | 6.8          |
| Pond F                           | 15              |             |              | 3.3         | 9.0          | 3.3          | 9.0          |
| Sand Dump 8                      | 15              |             |              | 14.7        | 14.6         | 14.7         | 14.6         |
| South Tailings Pond              | 16              | 8.1         | 55.1         | 4.5         | 15.8         | 12.6         | 70.9         |
| Upgrader Ponds A, B, D           | 16              |             |              | 4.1         | 9.2          | 4.1          | 9.2          |
| Weir 10 Mid Plant Drainage       | 14              |             |              | 2.1         | 3.5          | 2.1          | 3.5          |
| DDA-1*                           | 15              |             |              | 2.0         | 4.5          | 2.0          | 4.5          |
| Mist Pond*                       | 15              |             |              | 2.7         | 7.0          | 2.7          | 7.0          |
| North Booster Pump House Sump*   | 15              |             |              | 1.8         | 3.3          | 1.8          | 3.3          |
| South Booster Pump House Sump*   | 15              |             |              | 2.0         | 2.9          | 2.0          | 2.9          |
| System 4 Sump*                   | 15              |             |              | 2.2         | 7.4          | 2.2          | 7.4          |
| System 5 Sump*                   | 15              |             |              | 2.5         | 9.1          | 2.5          | 9.1          |
| System 7 Sump*                   | 15              |             |              | 2.6         | 11.7         | 2.6          | 11.7         |
| Upper Wood Creek*                | 15              |             |              | 2.4         | 2.2          | 2.4          | 2.2          |
| <b>Total</b>                     | <b>366</b>      | <b>28.1</b> | <b>191.7</b> | <b>82.5</b> | <b>172.7</b> | <b>110.6</b> | <b>364.4</b> |

**Notes:**

<sup>1</sup> Includes route-based and focused transects; for each search, either distance OR area counted towards effort.

\* Ponds not included in the OSBCMP.

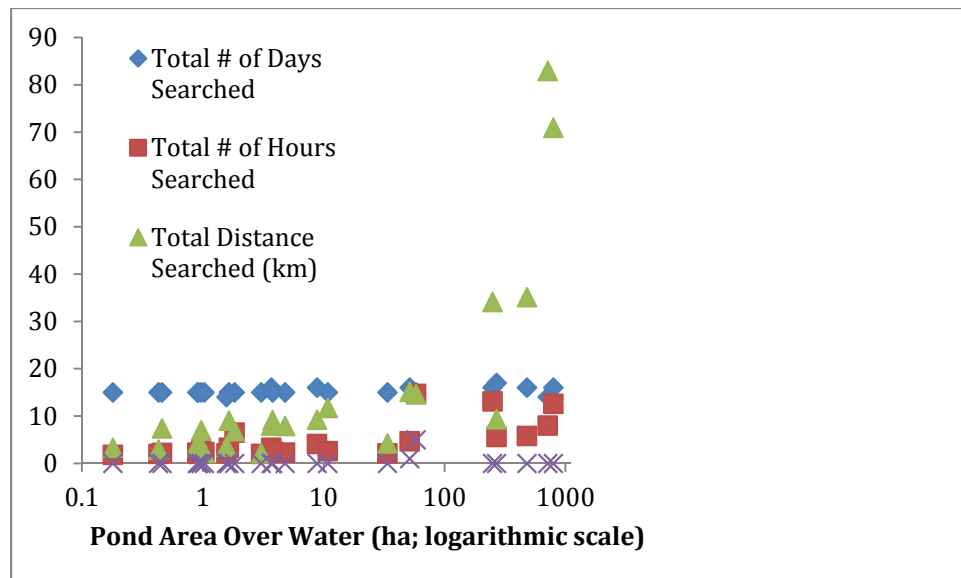
**Table 5.18: Number of Mortalities by Pond at Suncor Base Mine  
in April to October 2014**

| Pond Name <sup>1</sup>           | Mortality Search | Incidental | Total     |
|----------------------------------|------------------|------------|-----------|
| Extraction Waste Water Pond East |                  |            |           |
| Millennium API Surge Pond        |                  |            |           |
| Mine North Gate Sump             |                  |            |           |
| PAW Pond                         |                  |            |           |
| Pond 1A                          | 1                |            | 1         |
| Pond 2/3                         |                  | 2          | 2         |
| Pond 6                           |                  | 6          | 6         |
| Pond 7                           |                  | 1          | 1         |
| Pond 8A                          |                  |            |           |
| Pond 8B                          |                  |            |           |
| Pond B East                      |                  |            |           |
| Pond F                           |                  |            |           |
| Sand Dump 8                      | 5                | 3          | 8         |
| South Tailings Pond              |                  | 1          | 1         |
| Upgrader Ponds A, B, D           |                  |            |           |
| Weir 10 Mid Plant Drainage       |                  |            |           |
| DDA-1*                           |                  |            |           |
| Mist Pond*                       |                  |            |           |
| North Booster Pump House Sump*   |                  |            |           |
| South Booster Pump House Sump*   |                  |            |           |
| System 4 Sump*                   |                  |            |           |
| System 5 Sump*                   |                  |            |           |
| System 7 Sump*                   |                  |            |           |
| Upper Wood Creek*                |                  |            |           |
| <b>Total</b>                     | <b>6</b>         | <b>13</b>  | <b>19</b> |

**Notes:**

<sup>1</sup> Blue shading: freshwater ponds.

\* Ponds not included in the OSBCMP.



**Figure 5.4: Relationship Between Pond Area (over water), Mortality Search Effort, and Mortality Search Results**

In total, six mortalities were detected during scheduled searches, all oiled greater than 50% (Table 5.18, Appendix 5.D.). Five mortalities were recorded during searches at Sand Dump 8: two Unknown Waterbirds, one juvenile Unknown Gull, 1 Unknown Duck and one Savannah Sparrow. All but the sparrow (later euthanized) were found dead. Pond 1A also had one mortality (an Unknown Gull) recorded during a scheduled boat search. Gulls and non-target guilds represented 67% and 33% of mortalities found during scheduled searches, respectively.

A further 13 pond-associated mortalities were observed incidentally (Appendix 5.D.). Most incidental mortalities were found alive and oiled, and were euthanized. Species in the diving guild accounted for the majority of the incidental mortalities at 82% while both dabblers and waders accounted for 9% each (Table 5.19, Figure 5.5). Mortalities were observed in all months from June to October.

**Table 5.19: Number of Observations of Oiling and Mortalities, by Species, at Suncor Base Mine in 2014**

| Species/Species Group <sup>2</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|------------------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>                  |                                |            |                  |            |
| Pied-billed Grebe                  | 1                              |            |                  | 1          |
| Unknown Gull                       |                                |            | 2                |            |
| Unknown Waterfowl                  |                                |            | 2                |            |
| Unknown Duck                       |                                |            | 1                | 2          |
| American Coot                      |                                |            |                  | 2          |
| Ring-necked Duck                   |                                |            |                  | 2          |
| Bufflehead                         |                                |            |                  | 1          |
| Canvasback                         |                                |            |                  | 1          |
| Green-winged Teal                  |                                |            |                  | 1          |
| Unknown Diver                      |                                |            |                  | 1          |
| Unknown Diving Duck                |                                |            |                  | 1          |
| Unknown Shorebird                  |                                |            |                  | 1          |
| <b>Non-target Guilds</b>           |                                |            |                  |            |
| Savannah Sparrow                   |                                |            | 1                |            |
| <b>Total</b>                       | <b>1</b>                       | <b>0</b>   | <b>6</b>         | <b>13</b>  |

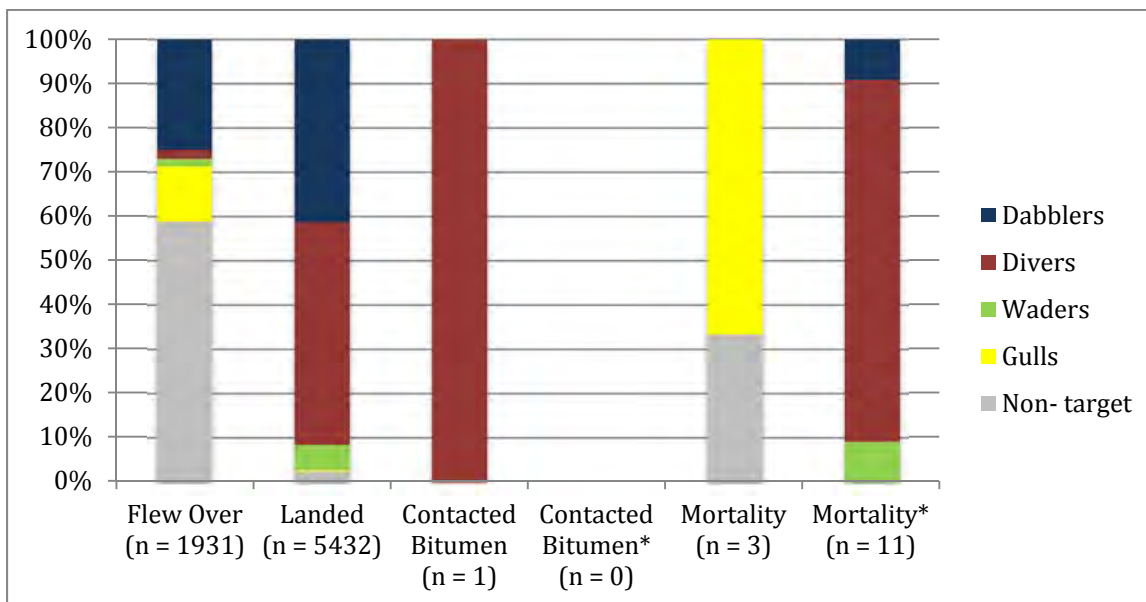
**Notes:**

<sup>1</sup> Individual birds may be observed on multiple days or also observed as mortalities, and thus be counted multiple times (e.g., Pied-billed Grebe found in the bird survey is the same bird found in the incidental mortality).

<sup>2</sup> Pink shading: Species of Conservation Concern.

Sand Dump 8 had a majority of the mortalities at 42% of the total, and Pond 6 represented 32% of the mortalities (Table 5.18).

Detections of mortalities do not appear to be correlated with the number of landings throughout the year, nor were they correlated with pond area (Table 5.20, Figures 5.4 and 5.6). The presence of habitat attractants (Table 5.21), particularly at Crane Lake and Weir 1 South Mine Drainage Pond appears to be associated with the higher number of landed bird observations at these ponds.



\* Incidental observations

Note: Species with unknown designations are not included

**Figure 5.5: Proportion of each Guild for Birds that Flew Over or Landed at Process-affected Ponds, Contacted Bitumen, or Died at Suncor Base Mine in 2014**

**Table 5.20: Summary of Bird Survey, Mortality and Incidental Results by Pond at Suncor Base Mine in 2014**

| Pond Name <sup>1</sup>            | Pond Area<br>(over water;<br>ha) | % Days with<br>Floating<br>Bitumen<br>Present | Mean # Landed Waterbirds per Survey |              |             |             | # Species<br>Landed |                                      | # Observations of<br>Oiled Birds |            | # Mortalities       |            |
|-----------------------------------|----------------------------------|-----------------------------------------------|-------------------------------------|--------------|-------------|-------------|---------------------|--------------------------------------|----------------------------------|------------|---------------------|------------|
|                                   |                                  |                                               | Dabblers                            | Divers       | Waders      | Gulls       | Total <sup>2</sup>  | Conservation<br>Concern <sup>3</sup> | Per Survey                       | Incidental | Mortality<br>Search | Incidental |
| South Tailings Pond               | 794.41                           | 98                                            | 0.14                                | 0.12         | 0           | 0           | 7                   | 4                                    | 0                                | 0          | 0                   | 1          |
| Pond 8B                           | 713.42                           | 99                                            | 0.05                                | 0.66         | 0           | <0.01       | 8                   | 2                                    | 0                                | 0          | 0                   | 0          |
| Pond 7                            | 479.82                           | 99                                            | 0.01                                | 0.04         | <0.01       | 0.01        | 9                   | 2                                    | 0                                | 0          | 0                   | 1          |
| Pond 6                            | 269.41                           | 98                                            | 0                                   | <0.01        | 0.01        | 0           | 4                   | 1                                    | 0                                | 0          | 0                   | 6          |
| Pond 2/3                          | 249.36                           | 100                                           | 0                                   | <0.01        | 0           | 0           | 4                   | 1                                    | 0.003                            | 0          | 0                   | 2          |
| Sand Dump 8                       | 58.14                            | 100                                           | 0                                   | 0            | 0           | 0           | 0                   | 0                                    | 0                                | 0          | 5                   | 3          |
| Pond 1A                           | 51.39                            | 98                                            | 0                                   | 0            | 0           | 0           | 0                   | 0                                    | 0                                | 0          | 1                   | 0          |
| Pond 8A                           | 33.67                            | 100                                           | 0                                   | 0            | 0           | 0           | 0                   | 0                                    | 0                                | 0          | 0                   | 0          |
| Upgrader Ponds A, B, D            | 8.82                             | 99                                            | 0                                   | 0            | 0           | 0           | 0                   | 0                                    | 0                                | 0          | 0                   | 0          |
| Extraction Waste Water Pond East  | 4.79                             | 100                                           | 0                                   | 0            | 0.01        | 0           | 1                   | 0                                    | 0                                | 0          | 0                   | 0          |
| PAW Pond                          | 3.68                             | 14                                            | 11.16                               | 12.81        | 1.48        | 0.07        | 25                  | 2                                    | 0                                | 0          | 0                   | 0          |
| Mine North Gate Sump              | 3.04                             | 0                                             | 0.01                                | 0.27         | 0.33        | 0.02        | 9                   | 0                                    | 0                                | 0          | 0                   | 0          |
| Pond B East                       | 1.83                             | 98                                            | 0                                   | 0.01         | 0.01        | 0           | 4                   | 0                                    | 0                                | 0          | 0                   | 0          |
| Pond F                            | 1.64                             | 0                                             | 0                                   | 0.01         | 0           | 0           | 0                   | 0                                    | 0                                | 0          | 0                   | 0          |
| Weir 10 Mid Plant Drainage        | 1.57                             | 22                                            | 2.35                                | 1.60         | 0.04        | 0           | 20                  | 1                                    | 0                                | 0          | 0                   | 0          |
| Millennium API Surge Pond         | 0.90                             | 94                                            | 0                                   | 0            | 0           | 0           | 0                   | 0                                    | 0                                | 0          | 0                   | 0          |
| System 7 Sump*                    | 10.80                            | N/A                                           | N/A                                 | N/A          | N/A         | N/A         | N/A                 | 0                                    | N/A                              | 0          | 0                   | 0          |
| System 5 Sump*                    | 3.77                             | N/A                                           | N/A                                 | N/A          | N/A         | N/A         | N/A                 | 0                                    | N/A                              | 0          | 0                   | 0          |
| Upper Wood Creek*                 | 1.03                             | N/A                                           | N/A                                 | N/A          | N/A         | N/A         | N/A                 | 0                                    | N/A                              | 0          | 0                   | 0          |
| Mist Pond*                        | 0.97                             | N/A                                           | N/A                                 | N/A          | N/A         | N/A         | N/A                 | 0                                    | N/A                              | 0          | 0                   | 0          |
| DDA-1*                            | 0.92                             | N/A                                           | N/A                                 | N/A          | N/A         | N/A         | N/A                 | 0                                    | N/A                              | 0          | 0                   | 0          |
| System 4 Sump*                    | 0.46                             | N/A                                           | N/A                                 | N/A          | N/A         | N/A         | N/A                 | 0                                    | N/A                              | 0          | 0                   | 0          |
| South Booster Pump House Sump*    | 0.43                             | N/A                                           | N/A                                 | N/A          | N/A         | N/A         | N/A                 | 0                                    | N/A                              | 0          | 0                   | 0          |
| North Booster Pump House Sump*    | 0.18                             | N/A                                           | N/A                                 | N/A          | N/A         | N/A         | N/A                 | 0                                    | N/A                              | 0          | 0                   | 0          |
| <b>All Process-affected Ponds</b> |                                  |                                               | <b>0.86</b>                         | <b>0.97</b>  | <b>0.12</b> | <b>0.01</b> | <b>48</b>           | <b>10</b>                            | <b>&lt;0.001</b>                 | <b>0</b>   | <b>6</b>            | <b>13</b>  |
| Crane Lake                        | 18.72                            | 0                                             | 6.22                                | 27.25        | 0           | 8.91        | 26                  | 4                                    | 0                                | 0          | N/A                 | 0          |
| Weir 1 South Mine Drainage        | 5.75                             | 0                                             | 0.02                                | 1.51         | 0           | 0.01        | 14                  | 2                                    | 0                                | 0          | N/A                 | 0          |
| <b>All Freshwater Ponds</b>       |                                  |                                               | <b>3.12</b>                         | <b>14.38</b> | <b>0</b>    | <b>4.46</b> | <b>29</b>           | <b>5</b>                             | <b>0</b>                         | <b>0</b>   | <b>N/A</b>          | <b>0</b>   |

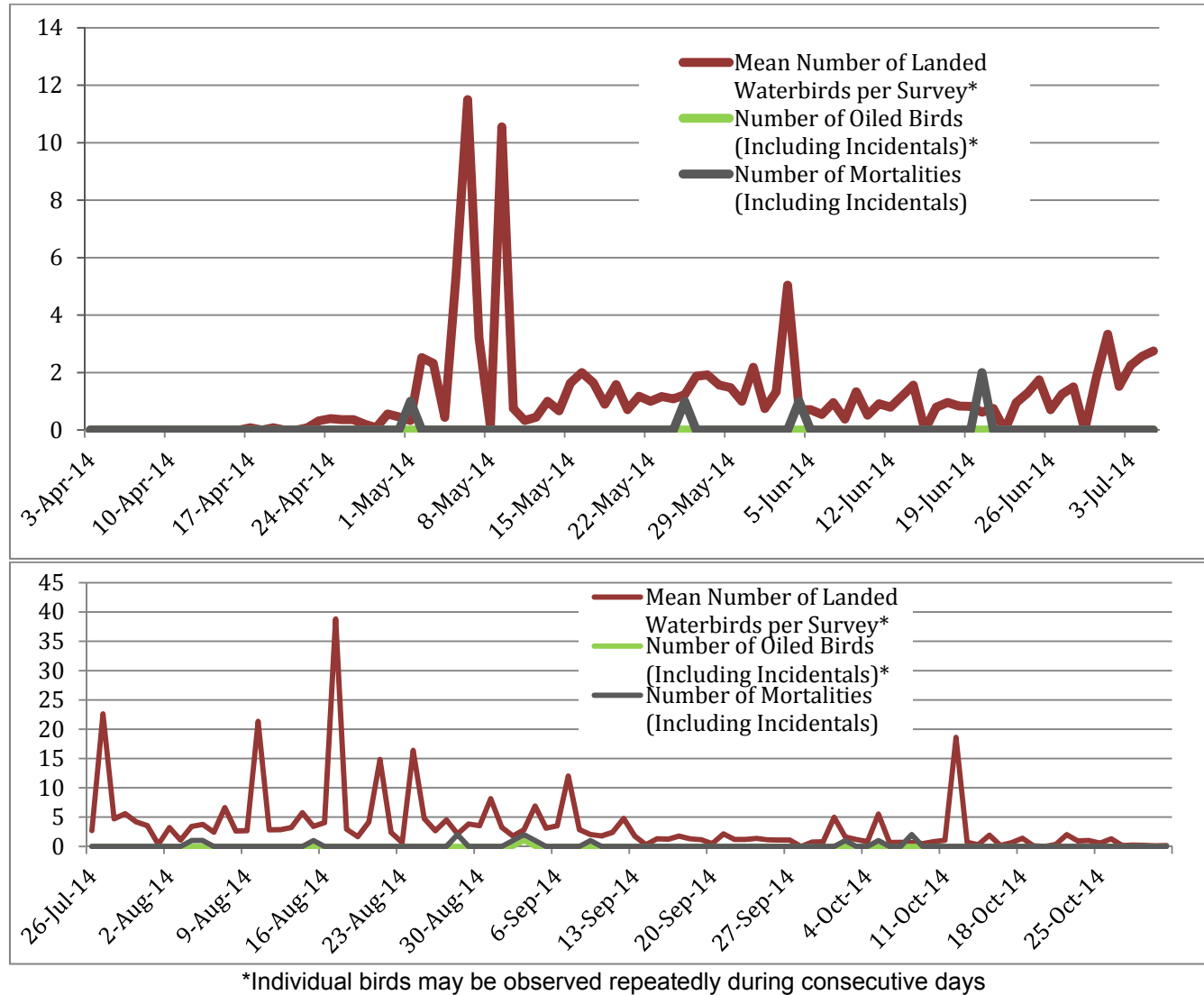
**Notes:**

<sup>1</sup> Blue shading: freshwater ponds.

<sup>2</sup> During bird surveys.

<sup>3</sup> Includes incidental observations.

\* Ponds not included in the OSBCMP.



**Figure 5.6: Timing of Bird Landings, Oiling, and Mortalities in Spring (top) and Fall (bottom) 2014 at Suncor Base Mine**

**Table 5.21: Summary of Potential Attractants by Pond at Suncor Base Mine in 2014**

| Pond Name <sup>1</sup>     | Potential Attractants                                                         |
|----------------------------|-------------------------------------------------------------------------------|
| PAW Pond                   | Adjacent to natural wetland                                                   |
| Pond 6                     | Small portion of perimeter is vegetated                                       |
| Weir 10 Mid Plant Drainage | Part of perimeter is vegetated (~ half), small amounts of emergent vegetation |
| Crane Lake                 | Perimeter is vegetated, lower industrial activity                             |
| Weir 1 South Mine Drainage | Perimeter is vegetated                                                        |

**Note:**

<sup>1</sup> Blue shading: freshwater ponds.

#### 5.4.5 Species of Conservation Concern

Target guild species of conservation concern detected at or near process-affected ponds, primarily included Lesser Scaup, Green-winged Teal, American White Pelican, Black Tern, and Northern Pintail (Appendix 5.C). Those detected during monitoring surveys were at Pond 8B (616 detections), PAW Pond (500), Crane Lake (276), Pond 7 (156), South Tailings Pond (74), Weir 1 South Mine Drainage (69), Pond 6 (30), Weir 10 Mid Plant Drainage (15), Pond 2/3 (11), Millennium API Surge Pond (4), Mine North Gate Sump (4), Pond 1A (3), and Pond 8A (2).

All species of conservation concern recorded as live incidentals were found at Pond 8B (118 observations) and the South Tailings Pond (5) (Appendix 5.C). Lesser Scaup, Northern Pintail, and Sandhill Crane were the three species of conservation concern found during these incidentals.

Two birds of conservation concern were captured and euthanized: a greater than 50% oiled Green-winged Teal found as an incidental observation on September 2 and a Pied-billed Grebe found during a bird survey on September 3 (Appendices 5.C, 5.D).

#### 5.5 Discussion

##### Bird Deterrents

The recommended industry-standard for cannon placement on tailings ponds is a density of 0.08 cannons per hectare of pond (Golder 2000). In recent years, cannons have been applied at a much higher average density of 0.125 cannons per hectare (Ronconi and St. Clair 2006); Suncor has, therefore, targeted an average deterrent density of 0.125 cannons per hectare of open water. Prior to the 2014 monitoring season, bird scare cannons were re-positioned at Pond 6 and Pond 8A to provide a more even distribution, while meeting the deterrent density target.

Crane Lake, a freshwater pond with no deterrents had a mean of 42.7 birds per survey (Table 5.13), the highest for any Suncor pond in the monitoring program. Weir 1 South Mine Drainage, another freshwater pond on-site with no deterrents, had a mean of 1.72 birds per survey, and was in close proximity to process-affected ponds with deterrents. All process-

affected ponds, with deterrents, had lower numbers of landed birds per survey than were observed at Crane Lake. The presence of deterrents, coupled with the absence of habitat, at process-affected ponds appear to correlate well with observed numbers of landed birds.

### **Bird Contacts**

During the standardized bird surveys in 2014, 5,431 birds were observed contacting process-affected ponds, compared to the 3,343 observed in 2013. This increase in the number of landed birds may be due to a number of factors, including adjustments made in scheduling of surveys, and annual variations in migrating and resident ducks in the area. As expected, landed bird numbers peaked during the spring and fall migration periods (Figure 5.6).

Resident birds in particular, are likely to be counted numerous times throughout the season, adding to the total landed detections (e.g., the family of Bufflehead at PAW Pond could have been counted over multiple surveys). Nesting habitat was available at Crane Lake (freshwater), Weir 1 South Mine Drainage (freshwater) and Weir 10 Mid Plant Drainage. The four remaining process-affected ponds with broods had neighboring ponds with nesting habitat that may have served as an attractant.

The majority of contacts on process-affected water were birds of target guilds; 5,305 of the 5,431 detections (97.6%). Similar to 2013, the most common target guild was divers (Bufflehead, Ring-necked Duck, Lesser Scaup), followed by dabblers (American Wigeon, Mallard and Green-winged Teal), and were predominantly observed at PAW Pond and Weir 10 Mid Plant Drainage, the low risk industrial runoff ponds (88% of total landings recorded). Divers and dabblers were attracted to the natural wetland adjacent to PAW Pond, which provided suitable habitat (Table 5.21). PAW Pond's close proximity to this freshwater pond was a likely attractant to nearby birds. A lack of vegetation and beach make PAW Pond unsuitable habitat for any guild. The partially vegetated perimeter and emergent vegetation present at Weir 10 Mid Plant Drainage may be potential attractants for both divers and dabblers.

The large size of the South Tailings Pond, Pond 8B, and Pond 7 may act as an avian attractant, but they did not have as many birds landed per survey as Crane Lake (freshwater), PAW Pond, and Weir 10 Mid Plant Drainage (Figure 5.2). South Tailings Pond, Pond 8B, and Pond 7 had no vegetation and few gently sloping beaches, and present a low risk for oiling (Table 5.9). Several of the remaining smaller process-affected ponds where few birds were observed may have been associated with small pond sizes, limited vegetation, lack of beaches, close proximity of industrial and human activity, and/or presence of deterrents. The highest risk ponds, those with higher bitumen coverage and mortalities had the fewest observed landings (Tables 5.9 and 5.12).

Crane Lake had more birds per survey than other ponds on-site (Figure 5.2), likely a result of the presence of attractants including vegetation cover, bays, islands, and food (e.g., invertebrates, fish, vegetation), deep open water for diving birds, lower human activity and the absence of deterrents. Ultimately, all ponds on site had some level of attraction for birds, due to the proximity of nearby suitable habitat, presence of vegetation or a gently sloping beach.

### **Oiled Birds and Mortalities**

In the 2014 season, Suncor documented 19 bird mortalities, which occurred across six of its process-affected ponds. This is a 47% reduction compared to the 36 mortalities in 2013 and a 72% reduction compared to the 67 bird mortalities in 2012. Effort was focused on hazing birds at risk of oiling with a success rate of 88%. The hazing crew considered birds successfully hazed if they flew off from the pond (out of sight) and did not return. Of the 19 mortalities, 11 were found alive and euthanized, and two oiled birds could not be captured and were assumed to have died (Appendix 5.D). In total, 16 out of the 19 birds were confirmed as greater than 50% oiled. Individuals that came into contact with bitumen often attempted to preen and free themselves, leading to increased bitumen coverage on the body.

Individuals from target guilds accounted for 95% of the observed mortalities, including those from scheduled searches and as incidental observations. Of the target guilds, 50% were divers (one Canvasback, one Bufflehead, one Pied-billed Grebe, two Ring-necked Duck, two American Coot, one Unknown Diver, and one Unknown Diving Duck), 28% were target guilds with unknown designations (three Unknown Ducks, two Unknown Waterfowl), 11% were Gulls (two Unknown Gulls), 5.5% were dabblers (one Green-winged Teal), and 5.5% were waders (one unknown shorebird) (Table 5.19). A Savannah sparrow, a non-target species, was found oiled at Sand Dump 8.

During bird surveys, eight species of conservation concern were observed landing on process-affected ponds. Approximately 18% of all recorded landings on process-affected water were species of conservation concern, of which individuals of two species were observed oiled. These included two incidental mortalities, a Green-winged Teal and a Pied-billed Grebe. The Pied-billed Grebe was the only oiled bird observed during a formal bird survey during 2014. Consequently, the mean number of oiled bird detections per survey was very low at 0.003 on Pond 2/3 (Table 5.14, Figure 5.3). Northern Pintail and Sandhill Crane were two additional species of conservation concern that were recorded as incidental observations, but these birds were not oiled.

On average, Sand Dump 8 possessed the highest coverage of bitumen, and also had the most associated mortalities (8, 42% of the total). Sand Dump 8 had no obvious attractants for birds, and three mortalities occurring at this pond may be associated with weather events (e.g., hail, heavy rain, high winds). Four of the other mortality-associated ponds also had no noticeable attractants. Pond 6 had six incidental mortalities; this may be associated with its partially vegetated perimeter.

Detections of mortalities were not necessarily correlated with any particular time of the year, the number of landings throughout the year, nor pond area (Figures 5.4 and 5.6). Only six of the 19 mortalities were found during systematic searches. The other mortalities were found during hazing, monitoring surveys, or other routine work. In 2013, the trend was similar, 12 mortalities were located during searches while 24 were found incidentally (Suncor 2013). Walking covered less distance than boat searches, but was used more often as a tool for more extensive mortality searches and accounted for 83% of all search-based mortalities.

Route-based search transects were readjusted in early spring to address areas of high risk to birds which, increased the detection probability of finding oiled or dead birds. Even with realignment of search patterns to improve coverage and detection probability, very few bird mortalities were observed during formal searches.

### **Oiled Birds and Mortalities: Post-Monitoring Season**

The largest landing event occurred in November following a storm after the fall monitoring period (Appendix 5.E). It is believed that a relatively rare combination of weather conditions forced birds to land on Pond 2/3, Pond 6, Pond 7, Pond 8B and the South Tailings Pond. The majority of the approximately 200 landed birds did not come into contact with bitumen. Six were either oiled and euthanized or found dead, all found on foot at Pond 2/3. Three Ring-necked and two Unknown Diving ducks were recovered on November 4 and 1 Ring-necked Duck was collected on November 5. All deterrents were in operation during this landing event.

### **Inter- observer Variability (IOV)**

There were few bird observations documented during the IOV surveys on process-affected ponds at Suncor in 2014. In the IOV's that were conducted and during which birds were observed, variability (RPD) varied from 0 to 200%. The larger RPD values were associated with small differences between observers when few birds were present to observe.

### **Adaptations and Recommendations**

Suncor made adaptations to ensure all observers and mortality search crew members followed the 2014 OSBCMP protocols (St. Clair et al. 2014). To establish a standard survey start time, both observers worked the same 12-hour shifts, whereas shift times in 2013 were staggered. To maintain the standard, start time will remain the same for 2015.

Some survey stations at Pond 6 and the South Tailings Pond were moved to be within 500 m of the pond surface, thus increasing the total survey area over water. Survey locations were also adjusted at Pond 2/3, Sand Dump 8, and Upgrader Ponds A, B, D. Survey stations may be resituated in 2015 if required due to site activities.

Adjustments also included better spatial distribution of bird scare cannons on Pond 6 and Pond 8A as part of the bird deterrent program before the 2014 monitoring season commenced. SDU cannons were changed from mechanical to electric to provide greater consistency in cannon operations. No changes to deterrents are planned for 2015.

Vegetation in Pond B East and at the Southeast corner of the Tailings Pond was removed prior to April 16, 2014, reducing vegetated shore from 15% and 8% in 2013, respectively, to less than 1% each (Table 5.9). In early spring of 2015, vegetation presence will be assessed for each pond, and where necessary, vegetation control measures taken.

Additionally, Suncor has requested non-process-affected ponds, such as mine drainage sumps and industrial run-off ponds be removed from the bird contact surveys due to the associated low risk of oiling. These ponds will continue to be actively searched for mortalities and maintain an adequate amount of deterrents. If approval is granted prior to the 2015 monitoring season, bird contact surveys will not continue on PAW Pond, Mine North Gate Sump, and Weir 10 Mid Plant Drainage. Crane Lake is recommended as the only freshwater pond for inclusion in Suncor's monitoring program in 2015.

## 5.6 Documents Cited

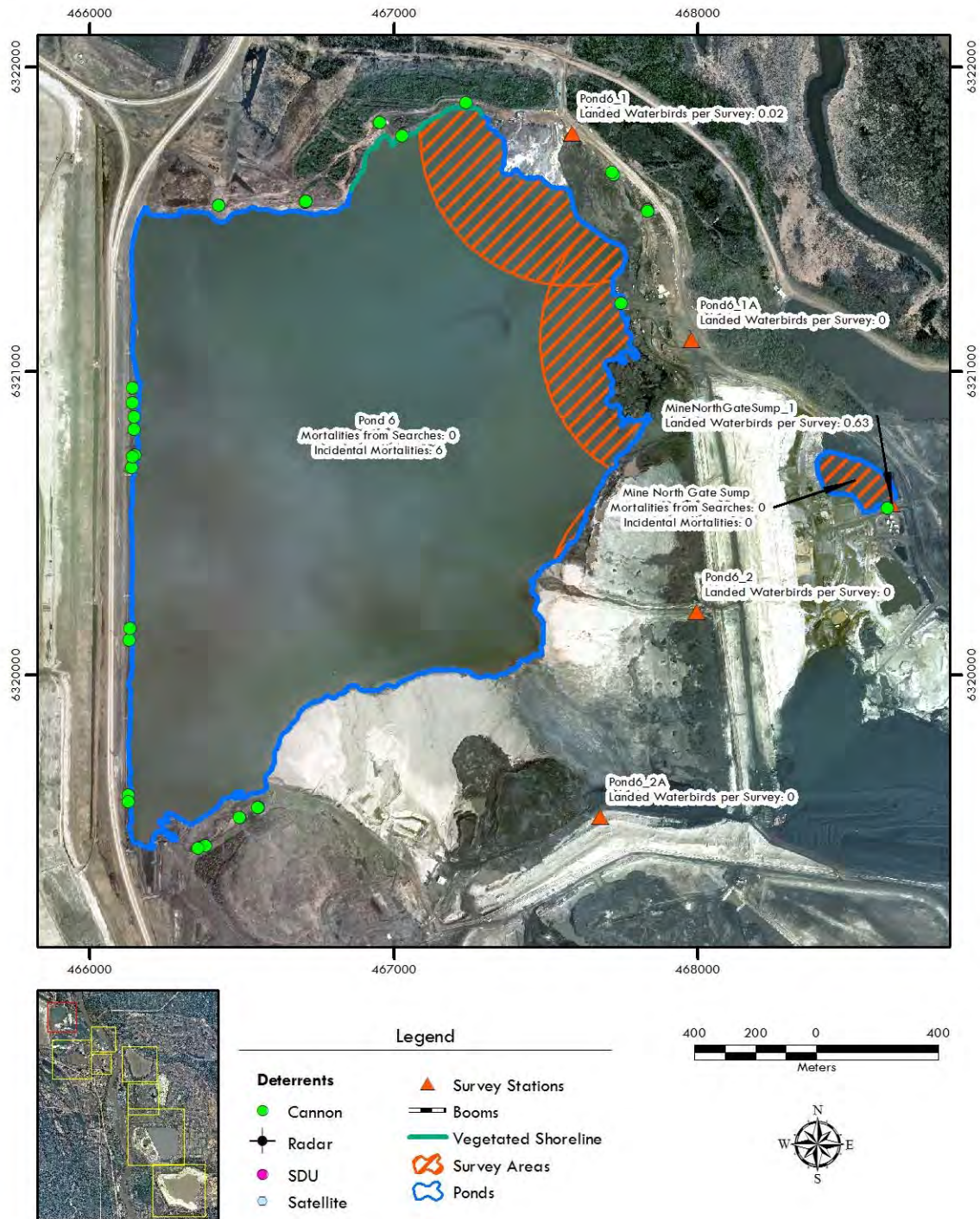
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- St. Clair C.C., Loots S., Ronconi R.A. (2014) 2014 Protocol: Oil Sands Bird Contact Monitoring Program. Department of Biological Sciences, University of Alberta. Prepared for Oil Sands Operators and Alberta Environment and Sustainable Resource Development. April 2014, 50 pp.

## **5.7 Appendices 5.A to 5.E**

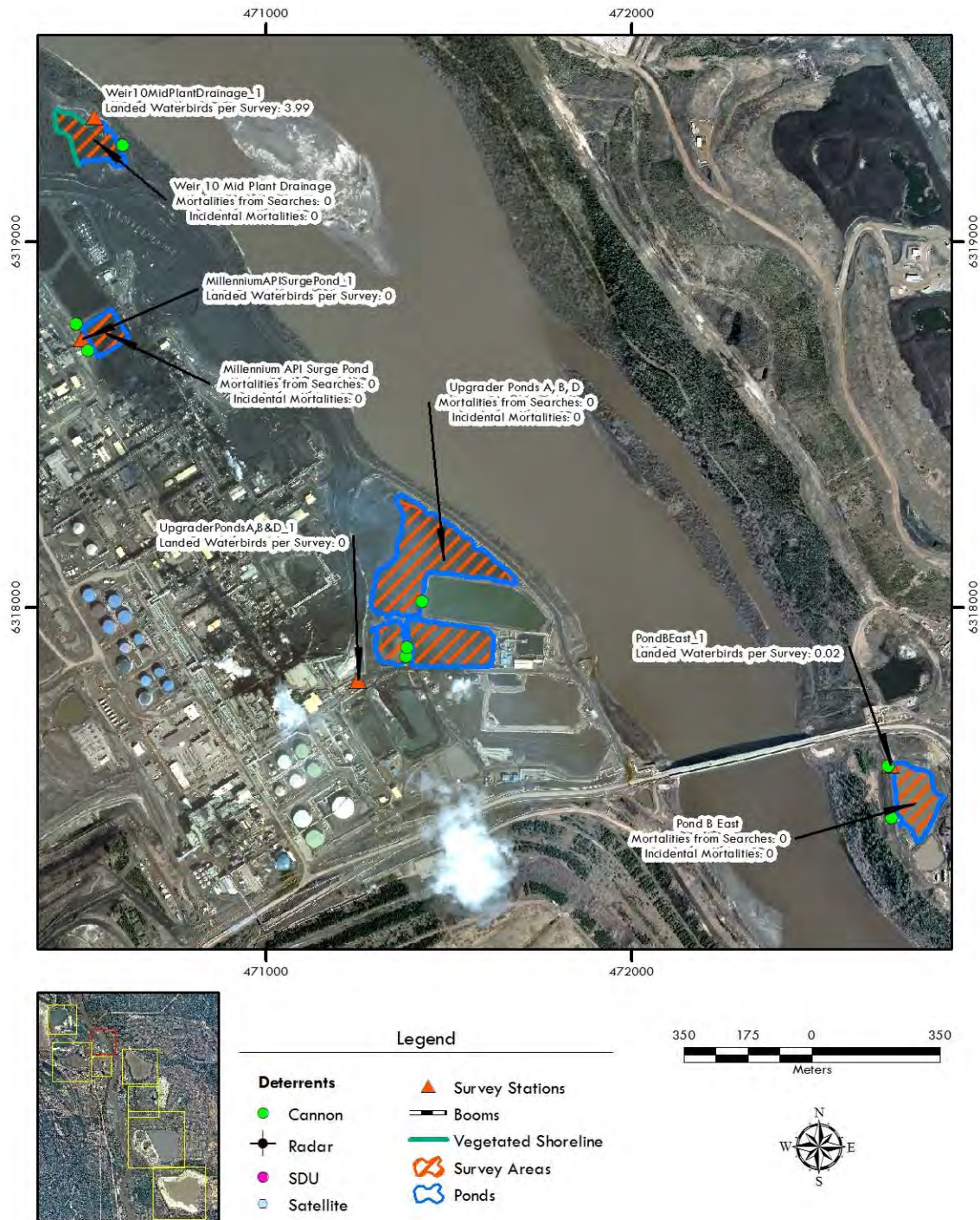
## Appendix 5.A Location of Deterrents, Containment Booms, and Survey Stations at Suncor Base Mine Ponds in 2014

\* indicates ponds not included in the OSBCMP

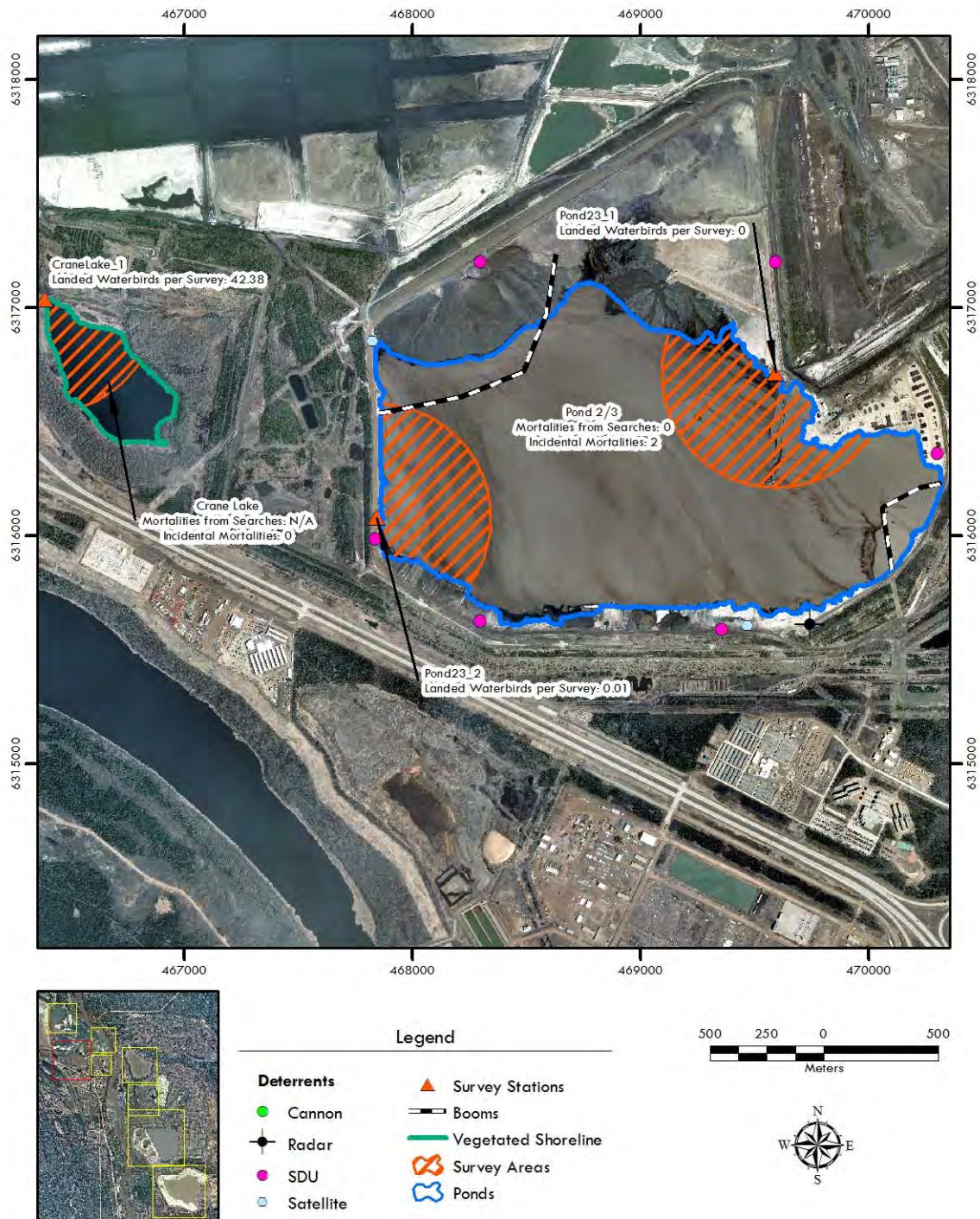
**Figure 5A.1 Location of Deterrents, Containment Booms, and Survey Stations at Suncor Mine North Gate Sump and Pond 6 in 2014**



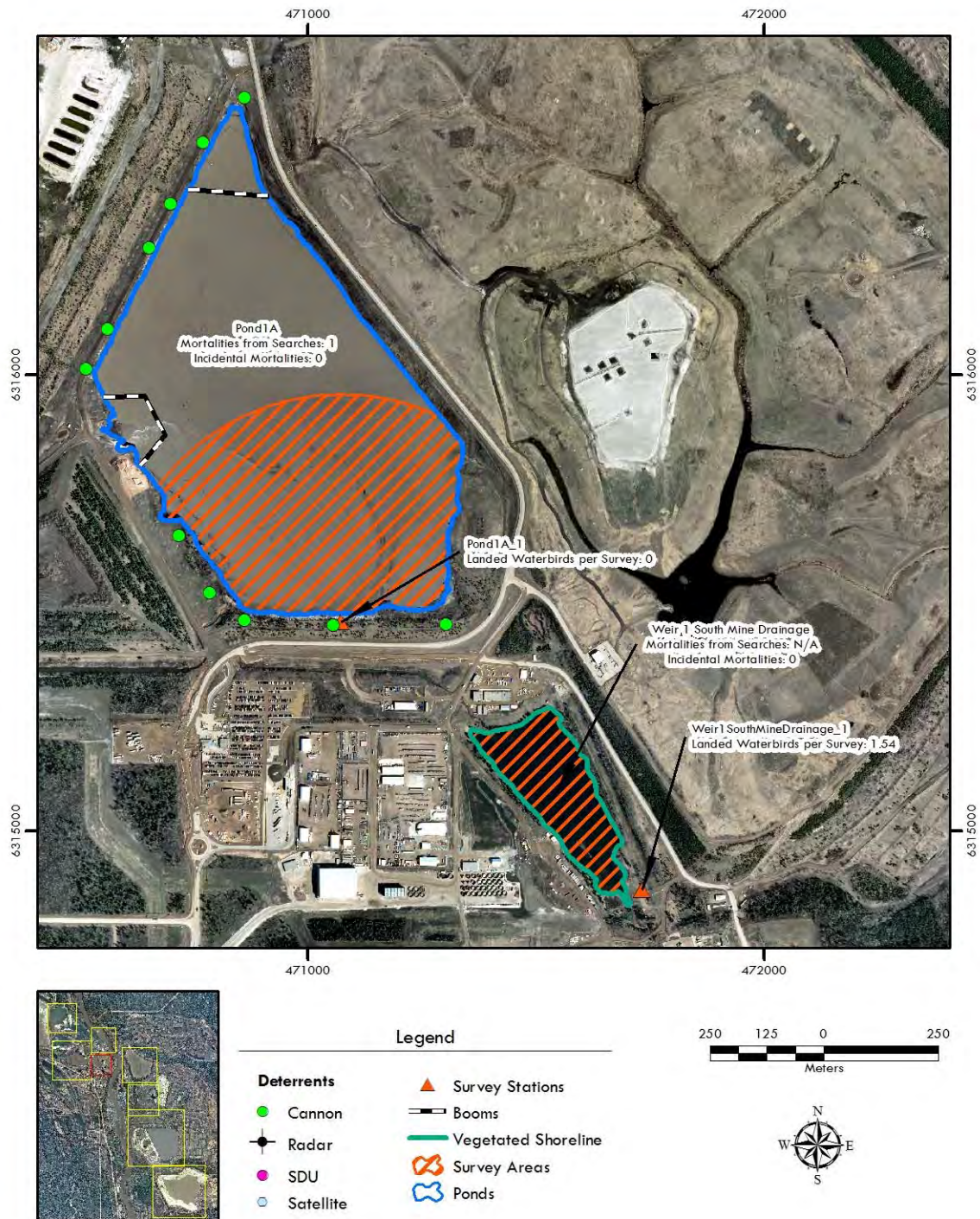
**Figure 5A.2 Location of Deterrents, Containment Booms, and Survey Stations at Millennium API Surge Pond B East, Upgrader Ponds A, B, D and Weir 10 Mid Plant Drainage in 2014**



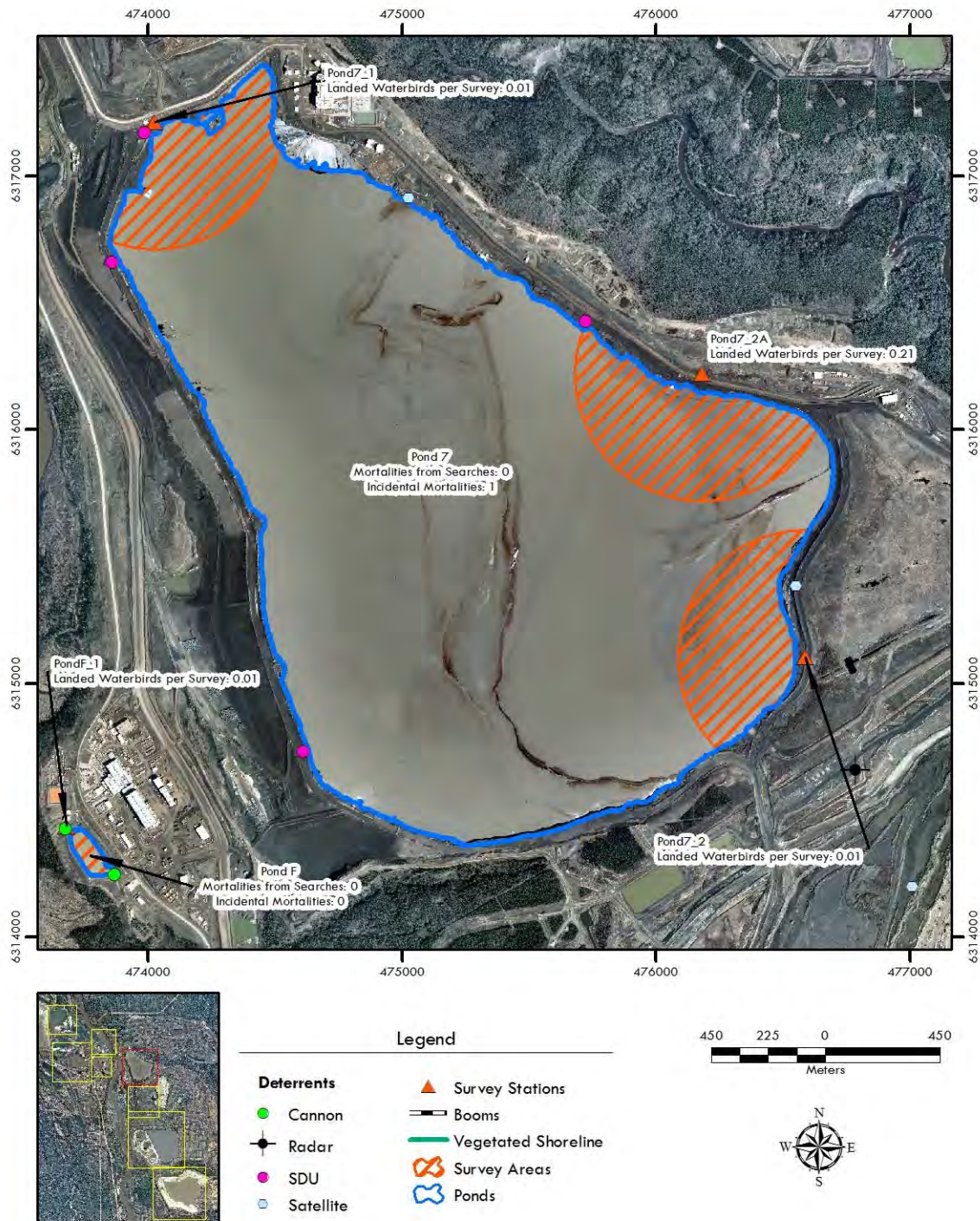
**Figure 5A.3 Location of Deterrents, Containment Booms, and Survey Stations at Pond 2/3 and Crane Lake (Freshwater) in 2014**



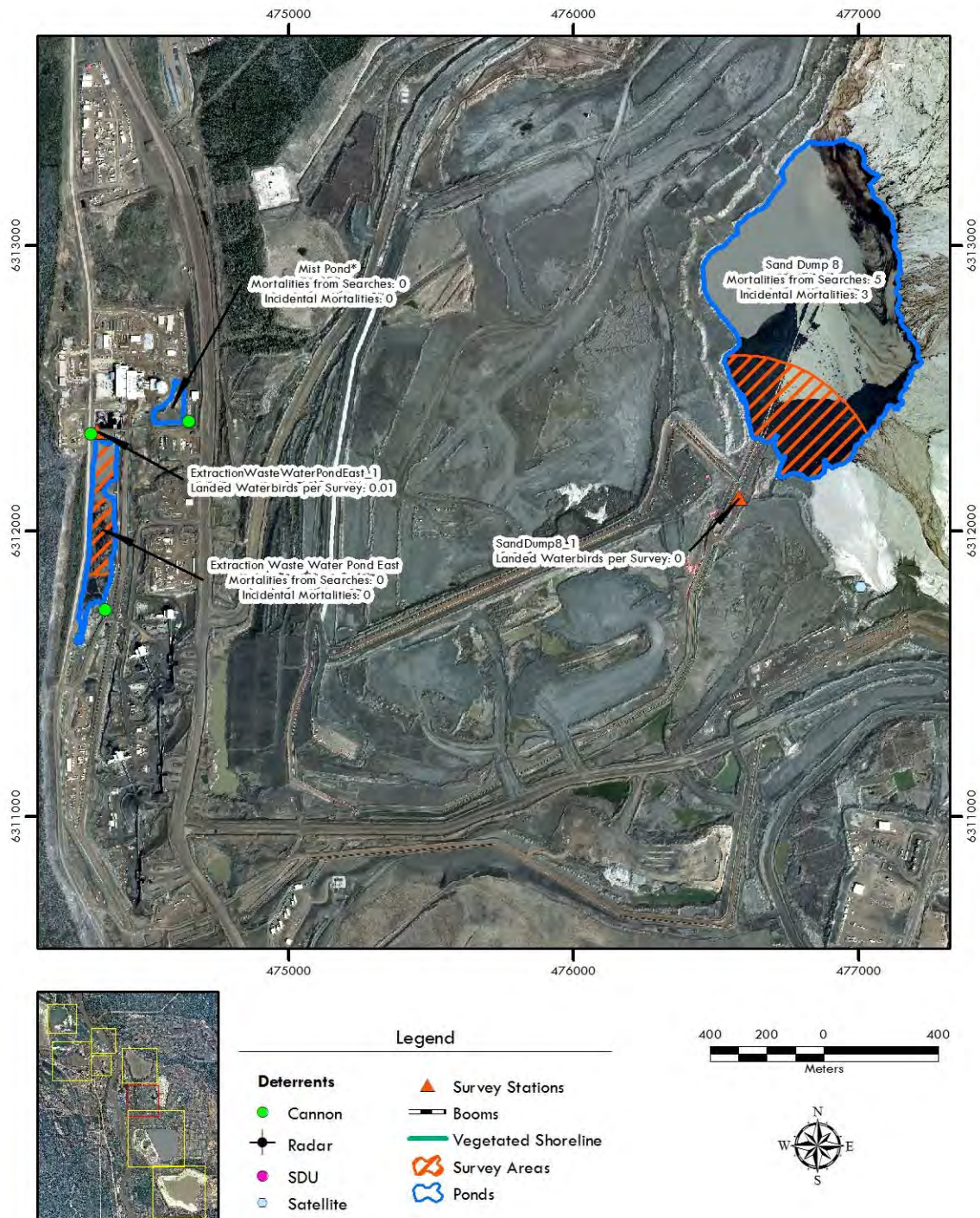
**Figure 5A.4 Location of Deterrents, Containment Booms, and Survey Stations at Pond 1A and Weir 1 South Mine Drainage (Freshwater) in 2014**



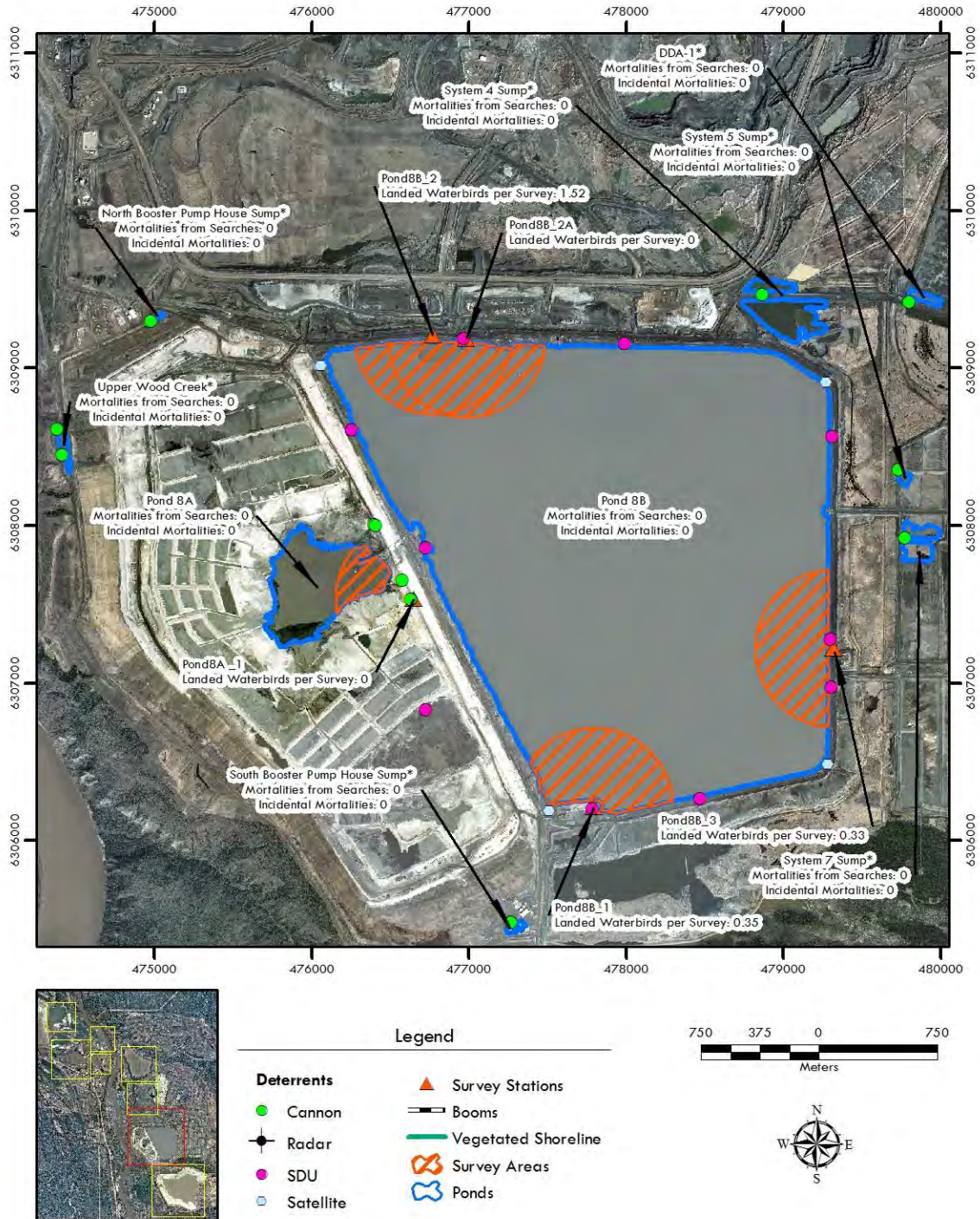
**Figure 5A.5 Location of Deterrents, Containment Booms, and Survey Stations at Pond 7 and Pond F in 2014**



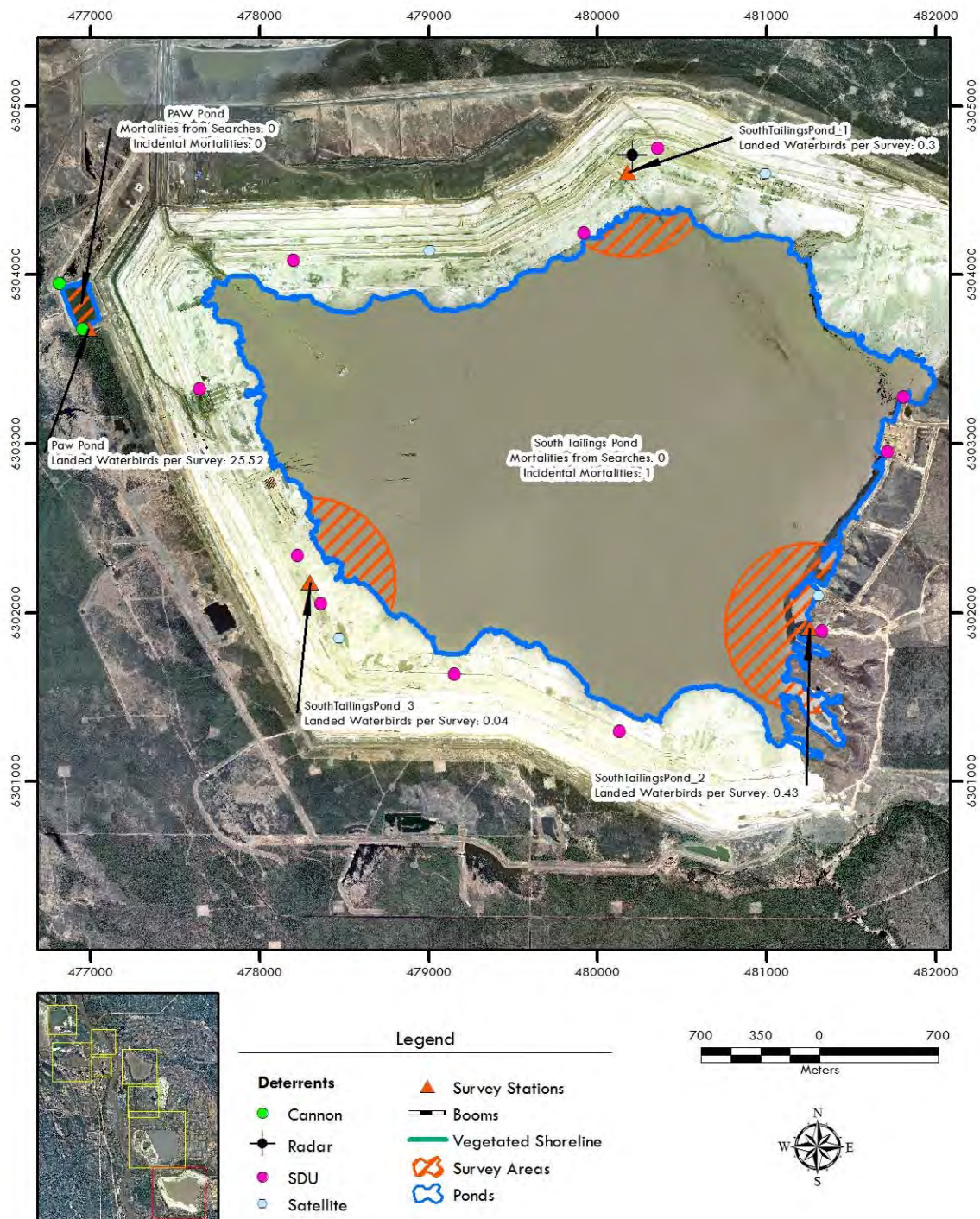
**Figure 5A.6 Location of Deterrents, Containment Booms, and Survey Stations at Extraction Waste Water Pond East, Sand Dump 8 and Mist Pond\* in 2014**



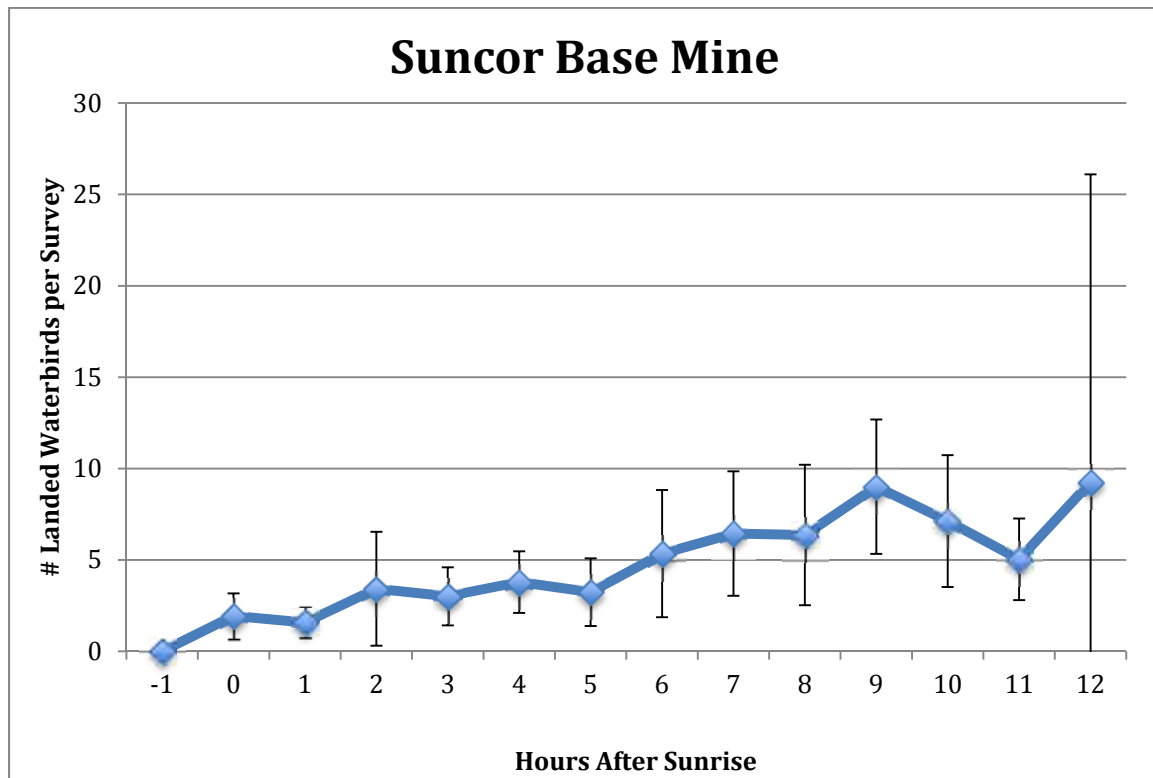
**Figure 5A.7 Location of Deterrents, Containment Booms, and Survey Stations at Pond 8A, Pond 8B, DDA-1\*, North Booster Pump House Sump\*, South Booster Pump House Sump\*, System 4 Sump\*, System 5 Sump\*, System 7 Sump, and Upper Wood Creek\* in 2014**



**Figure 5A.8 Location of Deterrents, Containment Booms, and Survey Stations at PAW Pond and South Tailings Pond in 2014**



### Appendix 5.B: Relationship Between the Mean Number of Landed Waterbirds per Survey and Hour after Sunrise at Suncor Base Mine in 2014



### Appendix 5.C: Number of Bird Observations by Species at Suncor Base Mine Process-affected ponds in 2014

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>                  |                     |                         |                        |                                |            |                  |            |
| American Wigeon                    | 915                 |                         |                        |                                |            |                  |            |
| Bufflehead                         | 881                 |                         | 6                      |                                |            |                  | 1          |
| Mallard                            | 615                 |                         | 15                     |                                |            |                  |            |
| Ring-necked Duck                   | 420                 |                         |                        |                                |            |                  | 2          |
| Lesser Scaup                       | 415                 | 111                     | 10                     |                                |            |                  |            |
| Green-winged Teal                  | 384                 |                         |                        |                                |            |                  | 1          |
| Common Goldeneye                   | 359                 |                         | 3                      |                                |            |                  |            |
| Ruddy Duck                         | 297                 |                         |                        |                                |            |                  |            |
| Redhead                            | 189                 |                         | 3                      |                                |            |                  |            |
| Lesser Yellowlegs                  | 158                 |                         |                        |                                |            |                  |            |
| Canada Goose                       | 120                 |                         | 467                    |                                |            |                  |            |
| Blue-winged Teal                   | 101                 |                         |                        |                                |            |                  |            |
| Canvasback                         | 91                  |                         |                        |                                |            |                  | 1          |
| Northern Shoveler                  | 83                  |                         |                        |                                |            |                  |            |
| American White Pelican             | 48                  |                         |                        |                                |            |                  |            |
| Killdeer                           | 37                  |                         | 12                     |                                |            |                  |            |
| Semipalmated Sandpiper             | 34                  |                         |                        |                                |            |                  |            |
| Unknown Dabbling Duck              | 28                  |                         |                        |                                |            |                  |            |
| Spotted Sandpiper                  | 24                  |                         |                        |                                |            |                  |            |
| Solitary Sandpiper                 | 17                  |                         | 1                      |                                |            |                  |            |
| Bonaparte's Gull                   | 15                  |                         | 2                      |                                |            |                  |            |
| American Coot                      | 14                  |                         |                        |                                |            |                  | 2          |
| Unknown Sandpiper                  | 13                  |                         |                        |                                |            |                  |            |
| Greater Yellowlegs                 | 8                   |                         |                        |                                |            |                  |            |
| Unknown Duck                       | 7                   |                         | 95                     |                                |            | 1                | 2          |
| Black Tern                         | 5                   |                         | 9                      |                                |            |                  |            |
| Greater Scaup                      | 5                   |                         |                        |                                |            |                  |            |
| Least Sandpiper                    | 4                   |                         | 16                     |                                |            |                  |            |
| Pectoral Sandpiper                 | 4                   |                         |                        |                                |            |                  |            |
| Unknown Diving Duck                | 2                   |                         |                        |                                |            |                  | 1          |
| Ring-billed Gull                   | 2                   |                         | 185                    |                                |            |                  |            |
| Semipalmated Plover                | 2                   |                         |                        |                                |            |                  |            |
| Surf Scoter                        | 2                   |                         |                        |                                |            |                  |            |
| Pied-billed Grebe                  | 1                   |                         |                        | 1                              |            |                  | 1          |
| Common Tern                        | 1                   |                         | 6                      |                                |            |                  |            |
| Baird's Sandpiper                  | 1                   |                         |                        |                                |            |                  |            |
| Black-bellied Plover               | 1                   |                         |                        |                                |            |                  |            |
| Red-necked Grebe                   | 1                   |                         |                        |                                |            |                  |            |
| Wilson's Phalarope                 | 1                   |                         |                        |                                |            |                  |            |
| Unknown Gull                       |                     |                         | 3                      |                                |            | 2                |            |

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| Unknown Waterfowl                  |                     |                         |                        |                                |            | 2                |            |
| Unknown Shorebird                  |                     |                         | 4                      |                                |            |                  | 1          |
| Unknown Diver                      |                     |                         |                        |                                |            |                  | 1          |
| California Gull                    |                     |                         | 52                     |                                |            |                  |            |
| Double-crested Cormorant           |                     |                         | 2                      |                                |            |                  |            |
| Northern Pintail                   |                     | 10                      |                        |                                |            |                  |            |
| Sandhill Crane                     |                     | 2                       |                        |                                |            |                  |            |
| <b>Non-target Guilds</b>           |                     |                         |                        |                                |            |                  |            |
| Barn Swallow                       | 34                  |                         | 320                    |                                |            |                  |            |
| Red-winged Blackbird               | 30                  |                         | 78                     |                                |            |                  |            |
| Common Grackle                     | 26                  |                         | 60                     |                                |            |                  |            |
| Snow Bunting                       | 16                  |                         | 5                      |                                |            |                  |            |
| Common Raven                       | 9                   |                         | 225                    |                                |            |                  |            |
| Rusty Blackbird                    | 8                   |                         | 11                     |                                |            |                  |            |
| Black-billed Magpie                | 3                   |                         | 44                     |                                |            |                  |            |
| Chipping Sparrow                   | 2                   |                         |                        |                                |            |                  |            |
| Dark-eyed Junco                    | 2                   |                         |                        |                                |            |                  |            |
| American Kestrel                   | 1                   |                         | 1                      |                                |            |                  |            |
| Brown-headed Cowbird               | 1                   |                         |                        |                                |            |                  |            |
| Eastern Kingbird                   | 1                   |                         |                        |                                |            |                  |            |
| Yellow Warbler                     | 1                   |                         |                        |                                |            |                  |            |
| Savannah Sparrow                   |                     |                         | 4                      |                                |            | 1                |            |
| Bank Swallow                       |                     |                         | 166                    |                                |            |                  |            |
| Tree Swallow                       |                     |                         | 57                     |                                |            |                  |            |
| Cliff Swallow                      |                     |                         | 47                     |                                |            |                  |            |
| Unknown Pecking Bird               |                     |                         | 39                     |                                |            |                  |            |
| Unknown Swallow                    |                     |                         | 34                     |                                |            |                  |            |
| Unknown Bird                       |                     |                         | 25                     |                                |            |                  |            |
| American Robin                     |                     |                         | 6                      |                                |            |                  |            |
| American Crow                      |                     |                         | 5                      |                                |            |                  |            |
| Unknown Blackbird                  |                     |                         | 4                      |                                |            |                  |            |
| Golden Eagle                       |                     |                         | 1                      |                                |            |                  |            |
| Northern Harrier                   |                     |                         | 1                      |                                |            |                  |            |
| Red-tailed Hawk                    |                     |                         | 1                      |                                |            |                  |            |
| Unknown Raptor                     |                     |                         | 1                      |                                |            |                  |            |

**Notes:**

<sup>1</sup> Pink shading: Species of Conservation Concern.

<sup>2</sup> Individual birds may be observed on multiple days and thus be counted multiple times (e.g., Pied-billed Grebe found in the bird survey is the same bird found in the incidental mortality).

<sup>3</sup> Only for Species of Conservation Concern.

### Appendix 5.D: Bird Oiling and Mortality Events at Suncor Base Mine in April–October 2014

| Date              | Species/Species Group | Pond Name (Survey Station ID) | Location Description        | % Oiled | Outcome                     | Context of Detection | Method of Detection         | Potential Reason for Mortality/Oiling |
|-------------------|-----------------------|-------------------------------|-----------------------------|---------|-----------------------------|----------------------|-----------------------------|---------------------------------------|
| June 4, 2014      | Canvasback            | Sand Dump 8                   | Stuck in the middle of cell | >50     | Not recovered, Assumed dead | Incidental           | On foot                     | Weather event                         |
| June 20, 2014     | Unknown Waterfowl     | Sand Dump 8                   |                             | >50     | Found dead                  | Mortality search     | On foot                     | Weather event                         |
| June 20, 2014     | Unknown Waterfowl     | Sand Dump 8                   |                             | >50     | Found dead                  | Mortality search     | On foot                     | Weather event                         |
| May 1, 2014       | Bufflehead            | South Tailings Pond           | Near the barge              | >0      | Not recovered, Assumed dead | Incidental           | On foot                     | Unknown                               |
| May 25, 2014      | Unknown Diver         | Pond 6                        |                             | >50     | Captured and euthanized     | Incidental           | Vehicle                     | Unknown                               |
| August 4, 2014    | Unknown Shorebird     | Pond 7                        | On shore                    | 25      | Found dead                  | Incidental           | Vehicle                     | Unknown                               |
| August 5, 2014    | Unknown Gull          | Pond 1A                       |                             | 70      | Found dead                  | Mortality search     | On foot                     | Visibility reduced, smoke             |
| August 15, 2014   | Unknown Gull          | Sand Dump 8                   | On backside of the barge    | 60      | Found dead                  | Mortality search     | On foot                     | Unknown                               |
| August 28, 2014   | Unknown Duck          | Sand Dump 8                   |                             | >50     | Found dead                  | Mortality search     | On foot                     | Unknown                               |
| August 28, 2014   | Savannah Sparrow      | Sand Dump 8                   |                             | >50     | Captured and euthanized     | Mortality search     | On foot                     | Unknown                               |
| September 2, 2014 | Green- winged Teal    | Pond 6                        | In emergent vegetation      | >50     | Captured and euthanized     | Incidental           | Vehicle                     | Unknown                               |
| September 3, 2014 | Pied- billed Grebe    | Pond 2/3                      | On shore                    | >50     | Captured and euthanized     | Incidental           | Detected during Bird Survey | Unknown                               |
| September 3, 2014 | Ring- necked Duck     | Pond 6                        | On shore                    | >50     | Captured and euthanized     | Incidental           | On foot                     | Unknown                               |
| September 4, 2014 | Ring- necked Duck     | Pond 6                        | On shore                    | >50     | Captured and euthanized     | Incidental           | On foot                     | Unknown                               |
| September 9, 2014 | Unknown Duck          | Sand Dump 8                   |                             | >50     | Captured and euthanized     | Incidental           | On foot                     | Unknown                               |
| October 2, 2014   | Unknown Duck          | Pond 2/3                      | On shore                    | >50     | Found dead                  | Incidental           | On foot                     | Unknown                               |
| October 5, 2014   | American Coot         | Pond 6                        |                             | 40      | Captured and euthanized     | Incidental           | Vehicle                     | Unknown                               |
| October 8, 2014   | Unknown Diving Duck   | Sand Dump 8                   |                             | >50     | Found dead                  | Incidental           | On foot                     | Unknown                               |
| October 8, 2014   | American Coot         | Pond 6                        |                             | >50     | Captured and euthanized     | Incidental           | On foot                     | Unknown                               |

**Note:**

<sup>1</sup> Pink shading: Species of Conservation Concern.

**Appendix 5.E: Incidental Bird Oiling and Mortality Events at Suncor Base Mine Post-monitoring Program  
(after October 31, 2014)**

| <b>Date</b>      | <b>Species/Species Group</b> | <b>Pond Name (Survey Station ID)</b> | <b>Location Description</b> | <b>% Oiled</b> | <b>Outcome</b>          | <b>Context of Detection</b> | <b>Method of Detection</b> | <b>Potential Reason for Mortality/Oiling</b> |
|------------------|------------------------------|--------------------------------------|-----------------------------|----------------|-------------------------|-----------------------------|----------------------------|----------------------------------------------|
| November 4, 2014 | Ring-necked Duck             | Pond 2/3                             | Floating on open water      | >50            | Captured and euthanized | Incidental                  | On foot                    | Weather event                                |
| November 4, 2014 | Ring-necked Duck             | Pond 2/3                             | Floating on open water      | >50            | Captured and euthanized | Incidental                  | On foot                    | Weather event                                |
| November 4, 2014 | Ring-necked Duck             | Pond 2/3                             | Floating on open water      | >50            | Captured and euthanized | Incidental                  | On foot                    | Weather event                                |
| November 4, 2014 | Unknown Diving Duck          | Pond 2/3                             | On shore                    | >50            | Found Dead              | Incidental                  | On foot                    | Weather event                                |
| November 4, 2014 | Unknown Diving Duck          | Pond 2/3                             | On shore                    | >0             | Found Dead              | Incidental                  | On foot                    | Weather event                                |
| November 5, 2014 | Ring-necked Duck             | Pond 2/3                             | On shore                    | >0             | Found Dead              | Incidental                  | On foot                    | Weather event                                |

**OIL SANDS BIRD CONTACT MONITORING PROGRAM  
2014 REGIONAL REPORT**

**Syncrude Canada Ltd.**



March 15, 2015

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](mailto:Gorman.Courtney@syncrude.com) if you have any questions or concerns regarding the content of this report.

Sincerely,

*Courtney Gorman*

Courtney Gorman

Syncrude Canada Ltd.

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## GLOSSARY

Note: Terms and definitions were updated for clarity. Further, four terms were modified as follows. The term **species of conservation concern** is used in place of **species at risk** to avoid confusion with the Alberta “At Risk” designation. Gull species are included in the **target guilds (waterbirds)** instead of **non-target guilds** because they are among the birds most likely to come in contact with ponds, as indicated by their natural history and OSBCMP findings from previous years. Finally, for the purposes of this report and for consistency, **incidental observations** are limited to a specific subset of the data collected in the field, in order to focus on information relevant to the program objectives.

|                                          |                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AHD</b>                               | 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).                                                             |
| <b>ATV</b>                               | All-terrain vehicle, including amphibious vehicles (e.g., Argo).                                                                                                                                                                                                                                                           |
| <b>Bird, Contacted Bitumen; or Oiled</b> | Bird with 5-100% of its body surface oiled, usually when some feathers on the underside or breast are matted or speckled with a black sticky substance. 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. |
| <b>Bird, Flew Over (during a survey)</b> | Bird that flew below 100 m of elevation over the <b>survey area</b> , within the survey period. Birds that both flew over and landed were recorded as landed only.                                                                                                                                                         |
| <b>Bird, Landed (during a survey)</b>    | Bird that was in contact with a <b>pond</b> , within 500 m of the <b>survey station</b> , within the survey period.                                                                                                                                                                                                        |
| <b>Bird, Oiled</b>                       | See “ <b>bird, contacted bitumen</b> ”.                                                                                                                                                                                                                                                                                    |
| <b>Bird Survey</b>                       | Conducted by observers from a <b>survey station</b> ; identification and count of birds that <b>landed</b> within the <b>survey area</b> during the <b>survey period</b> , and birds that <b>flew over</b> , along with the collection of other information (e.g., weather conditions, visibility, bird oiling).           |
| <b>Brood</b>                             | One or a group of <b>chicks</b> , with a parent usually nearby.                                                                                                                                                                                                                                                            |
| <b>Chick</b>                             | Young local bird that has not yet developed the ability to fly.                                                                                                                                                                                                                                                            |
| <b>Effluent</b>                          | Water and other substances deposited in a <b>process-affected pond</b> , typically through a pipeline.                                                                                                                                                                                                                     |

|                                    |                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Guild, Non-target</b>           | Species that peck, fly, glean, stoop/depredate, or scavenge (except gulls) as their primary means of foraging (Appendix A). Includes passerines, raptors, grouse, and woodpeckers.                                                                                                                                                                 |
| <b>Guild, Target; or Waterbird</b> | Species that wade, dabble, or dive in water as their primary means of foraging (Appendix A). The program targets these birds because they have a greater likelihood of becoming in contact with ponds. Includes ducks, geese, shorebirds, grebes, loons, cranes, cormorants, swans, pelicans, coots, rails, gulls, terns, herons, and kingfishers. |
| <b>ha</b>                          | Hectare; 1 ha = 2.47 acres, or 100 x 100 m; 100 ha = 1 km <sup>2</sup> .                                                                                                                                                                                                                                                                           |
| <b>Incidental Observation</b>      | Bird detected in April–October outside a <b>bird survey</b> or <b>mortality search</b> that was 1) <b>oiled</b> , dead, or euthanized, or 2) a <b>species of conservation concern</b> in contact with a <b>process-affected pond</b> .                                                                                                             |
| <b>Island</b>                      | Structure on a <b>pond</b> , surrounded by water, where birds may stand; may be permanent or temporary, natural or artificial, floating or fixed. Includes mats of floating logs or muskeg.                                                                                                                                                        |
| <b>Monitoring</b>                  | <b>Bird surveys</b> and <b>mortality searches</b> .                                                                                                                                                                                                                                                                                                |
| <b>Mortality</b>                   | Bird of any species found dead or euthanized in association with <b>process-affected ponds</b> , either during a <b>mortality search</b> or as an <b>incidental observation</b> .                                                                                                                                                                  |
| <b>Mortality Search</b>            | Search at a <b>pond</b> or section of a pond's surface or <b>shoreline</b> for dead or dying birds. Searches were conducted by boat, truck, or walking.                                                                                                                                                                                            |
| <b>OSBCMP</b>                      | Oil Sands Bird Contact Monitoring Program                                                                                                                                                                                                                                                                                                          |
| <b>Pond</b>                        | Open-air body of water or water storage facility, including its contents, <b>shore</b> , and <b>islands</b> ; may be permanent or temporary.                                                                                                                                                                                                       |
| <b>Pond, Freshwater</b>            | <b>Pond</b> (including its contents, <b>shore</b> , and <b>islands</b> ) containing groundwater, rainwater or runoff water unaffected by the mining process or plant operations.                                                                                                                                                                   |
| <b>Pond, Process-affected</b>      | <b>Pond</b> (including its contents, <b>shore</b> , and <b>islands</b> ) containing water and substances that have been used in or affected by the mining process or plant operations, including tailings, runoff and recycled water. Bitumen may be present (floating or sinking) or absent.                                                      |
| <b>Shore</b>                       | An area along <b>shorelines</b> that may be reached by changing water levels or effluent.                                                                                                                                                                                                                                                          |
| <b>Shoreline</b>                   | Perimeter, expressed in metres (m) or kilometres (km), along which the pond's water meets land.                                                                                                                                                                                                                                                    |

|                                        |                                                                                                                                                                                                                                               |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Species of Conservation Concern</b> | Species designated as Endangered, Threatened, or Special Concern under the Canadian <i>Species at Risk Act</i> , COSEWIC or the Alberta <i>Wildlife Act</i> , or listed within Alberta as At Risk, May Be at Risk, or Sensitive (Appendix A). |
| <b>Survey Area</b>                     | Area comprising the pond's surface, <b>shores</b> and <b>islands</b> within 500 m of the <b>survey station</b> .                                                                                                                              |
| <b>Survey Period</b>                   | Pre-determined amount of time during which <b>bird surveys</b> were conducted. Surveys were 10 min for stations at ponds smaller than 150 ha and 30 min for stations at ponds of 150 ha or larger.                                            |
| <b>Survey Station</b>                  | A fixed location near the edge of a <b>pond</b> , where <b>bird surveys</b> were conducted at regular intervals.                                                                                                                              |
| <b>Waterbird</b>                       | See “ <b>guild, target</b> ”.                                                                                                                                                                                                                 |

## 6. SYNCRUDE CANADA LIMITED (MILDRED & AURORA)

### 6.1 Summary

#### 6.1.1 Bird landings and mortalities at process-affected ponds

Bird survey and mortality search effort throughout the 2014 season for all process affected ponds are shown in Table 6.1. Twelve process affected ponds were surveyed approximately 3,500 times and searched for mortalities approximately 240 times.

**Table 6.1: Monitoring effort at process-affected ponds at Mildred & Aurora in 2014**

| Bird Surveys                                              |                                             |        |          |          |
|-----------------------------------------------------------|---------------------------------------------|--------|----------|----------|
| # Ponds Surveyed                                          | 12                                          |        |          |          |
| # 10-min Surveys Conducted                                | 936                                         |        |          |          |
| # 30-min Surveys Conducted (range: 10-30 min, mean: 29.9) | 2,561                                       |        |          |          |
| Mortality Searches                                        |                                             |        |          |          |
| # Ponds Searched                                          | 12                                          |        |          |          |
| # Searches                                                | 239 (114 focused and 125 transect searches) |        |          |          |
| Search Method                                             | Boat                                        | Walk   | Truck    | Total    |
| Total Time Searched                                       | 68.8 h                                      | 5.2 h  | 27.9 h   | 101.9 h  |
| Distance/Area Searched <sup>1</sup>                       | 1,573 km                                    | 112 km | 80 km    | 1,654 km |
|                                                           | 1,714 ha                                    | 0 ha   | 1,314 ha | 3,140 ha |

<sup>1</sup>For each search, either distance OR area counted towards effort

Bird observations, numbers of species from bird surveys, and mortality searches are shown in Table 6.2. The majority of species observed were non-target species, such as ravens. Most birds and species observed in mortality searches were found incidentally.

**Table 6.2: Bird observations at process-affected ponds at Mildred & Aurora in 2014**

|                      | Waterbirds |           |                   |            |                  |            | Non-target Guilds |           |                   |            |                  |            |
|----------------------|------------|-----------|-------------------|------------|------------------|------------|-------------------|-----------|-------------------|------------|------------------|------------|
|                      | Landed     | Flew Over | Contacted Bitumen |            | Mortality        |            | Landed            | Flew over | Contacted Bitumen |            | Mortality        |            |
|                      |            |           | Bird Survey       | Incidental | Mortality Search | Incidental |                   |           | Bird Survey       | Incidental | Mortality Search | Incidental |
| # Birds <sup>1</sup> | 1,311      | 1,504     | 60                | 0          | 1                | 42         | 741               | 4,537     | 23                | 0          | 0                | 1          |
| # Species            | 31         | 18        | 11                | 0          | 1                | 20         | 23                | 27        | 2                 | 0          | 0                | 1          |

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times

### 6.1.2 Bird landings at a freshwater pond

One freshwater pond was monitored in the 2014 season as in prior years of the program; the Mildred Lake Reservoir. Table 6.3 shows the pond was monitored approximately 50 times throughout the season. As per the OSBCMP protocol, freshwater ponds are only monitored twice weekly.

**Table 6.3: Monitoring effort at a Mildred Lake Reservoir in 2014**

| Bird Surveys               |    |
|----------------------------|----|
| # Ponds Surveyed           | 1  |
| # 10-min Surveys Conducted | 0  |
| # 30-min Surveys Conducted | 51 |

A summary of birds observed and species detected at the freshwater pond are in Table 6.4.

**Table 6.4: Bird observations at Mildred Lake Reservoir in 2014**

|                      | Waterbirds |           |                   |            |                        | Non-target Guilds |           |                   |            |                        |
|----------------------|------------|-----------|-------------------|------------|------------------------|-------------------|-----------|-------------------|------------|------------------------|
|                      | Landed     | Flew Over | Contacted Bitumen |            | Mortality (Incidental) | Landed            | Flew over | Contacted Bitumen |            | Mortality (Incidental) |
|                      |            |           | Bird Survey       | Incidental |                        |                   |           | Bird Survey       | Incidental |                        |
| # Birds <sup>1</sup> | 30         | 106       | 0                 | 0          | 0                      | 147               | 764       | 0                 | 0          | 0                      |
| # Species            | 19         | 7         | 0                 | 0          | 0                      | 20                | 18        | 0                 | 0          | 0                      |

<sup>1</sup> Individual live birds may be observed on multiple days and thus be counted multiple times

### 6.1.3 Standardized Monitoring

Bird contact monitoring field work of the Oil Sands Bird Contact Monitoring Plan was completed under contract with by Terracon Geotechnique. A team of six people monitored all ponds every morning as required in the OSBCMP, three monitoring at Mildred Lake site and one at Aurora North site. Daily monitoring began at 6 AM, or later if sunrise occurred after 6 AM. Monitoring continued throughout the day until all ponds were recorded (typically the monitoring was completed in the morning). Saturdays were used as Syncrude's Comparison days. These days were used for additional training, making up missed stations of the week prior, and/or Inter-Observer Variation (IOV's) monitoring, as per the OSBCMP.

Mortality searches were conducted by Syncrude employees with some contractor additions. As per the OSBCMP, both transect and focused searches were completed on each pond bi-weekly. Mortality searches were conducted primarily by boat. In instances where no boat access was available or other operational constraints to boat work arose, a combination of truck and walking searches were completed. A new pond began in spring 2014, North Mine South Pit- West (NMSPW) with low initial pond area. BET staff attended to the pond on 34 visits during the year from April 22 to October 31.

Mortalities from these searches would be recorded in the incidental mortality data if found. The method used to document route-based coverage was by following a pre-planned documented route covering large areas of the pond with some limitations on boat access.

#### 6.1.4 Species of Conservation Concern

A summary of species listed as conservation concern by either federal or provincial government species of concern lists are shown in Table 6.5. In total there were 797 observations and 6 mortalities of species of conservation concern throughout the 2014 monitoring season.

**Table 6.5: Number of observations of birds of conservation concern at process-affected ponds at Mildred & Aurora in 2014**

| Species                  | Landed <sup>1</sup> |            | Flew Over <sup>1</sup> | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|--------------------------|---------------------|------------|------------------------|--------------------------------|------------|------------------|------------|
|                          | Bird Survey         | Incidental | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>        |                     |            |                        |                                |            |                  |            |
| Lesser Scaup             | 14                  |            | 2                      | 8                              |            | 1                |            |
| Horned Grebe             | 8                   |            |                        |                                |            |                  |            |
| Northern Pintail         | 3                   |            |                        | 2                              |            |                  | 1          |
| Green-winged Teal        | 2                   |            |                        |                                |            |                  |            |
| Sandhill Crane           | 1                   |            | 38                     |                                |            |                  | 1          |
| Piping Plover            | 1                   |            | 2                      |                                |            |                  |            |
| American White Pelican   |                     |            |                        |                                |            |                  | 1          |
| Pied-billed Grebe        |                     |            |                        |                                |            |                  | 1          |
| White-winged Scoter      |                     |            |                        |                                |            |                  | 1          |
| Great Blue Heron         |                     |            | 68                     | 1 <sup>2</sup>                 |            |                  |            |
| American Bittern         |                     |            | 2                      |                                |            |                  |            |
| <b>Non-target Guilds</b> |                     |            |                        |                                |            |                  |            |
| Barn Swallow             | 74                  |            | 184                    |                                |            |                  |            |
| Sharp-tailed Grouse      | 7                   |            | 7                      |                                |            |                  |            |
| American Kestrel         | 4                   |            | 56                     |                                |            |                  |            |
| Northern Harrier         | 3                   |            | 36                     |                                |            |                  |            |
| Bank Swallow             | 1                   |            | 282                    |                                |            |                  |            |
| Canada Warbler           | 1                   |            |                        |                                |            |                  |            |
| Golden Eagle             |                     |            | 1                      |                                |            |                  |            |

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times

<sup>2</sup> In interview in January 2015, observer states this was a data entry error as the bird did not land in survey area. The observation is unchanged in the data so as to provide a more conservative approach.

### **6.1.5 Adaptive Management**

Throughout the 2014 bird season Syncrude implemented many adaptive management practices. Compared to 2013, more water deployed, radar-linked on-demand deterrents were used in favor of land based, random-interval firing deterrents, where applicable. Long-range acoustic Hyperspikes linked to the radar units were also in wider use this year across both Mildred Lake and Aurora North process ponds. Syncrude continued to limit amount of vegetation attractants around pond edges at the south side of the SWSS pond.

A distinct hazing technique was proposed (in the latest draft submission of Syncrude's Waterfowl Protection Plan) when hazing diving ducks off process affected ponds. When diving ducks were observed on the water surface, hazing is immediately initiated. If the initial short duration hazing attempt is unsuccessful, hazing is suspended. The hazing team leaves the area and checks back in 30 to 60 minutes. If the diving duck is still in the area, another hazing attempt is initiated. If the second attempt is not successful, the hazing team leaves again and check back in another 30 to 60 minutes. Usually the duck will fly away as soon as there is no pressure from hazing attempts. The hazing-suspension cycle is repeated until the duck is successfully hazed off the pond.

## **6.2 Introduction**

### **6.2.1 Site**

Syncrude Canada Ltd. has two lease sites that are currently in operation, Mildred Lake lease and Aurora North lease. Mildred Lake is located approximately 30 km north of Fort McMurray, and Aurora North is located approximately 100 km north of Fort McMurray. There are 12 process affected water storage ponds in total, 9 ponds at Mildred Lake lease with a total area of 3300 ha, and 4 at Aurora North with a total area of 923 ha. There is one freshwater pond monitored at Mildred Lake lease, Mildred Lake Reservoir, which is used to store water imported from the Athabasca River. This pond has a total area of 7.5 ha.



Figure 6.1: Process-affected and freshwater ponds at Mildred & Aurora in 2014.

### **6.2.2 Personnel**

Personnel responsible for monitoring the ponds are trained before the season begins, using a training package from the University of Alberta. When new personnel are hired midway through the season, they undergo the specified training. New hires spend 3-5 days learning site rules and regulations, driving in the mine, and protocols for the OSBCMP Plan. They work with an experienced monitor for approximately three days training at specified monitoring locations before they are work on their own. Further on-the-job training and experienced is gained when the observers work together on comparison days, and routinely two observers participated in the observations at the Freshwater pond observations.

Syncrude's Mortality searches were conducted by a team of approximately 40 people along with their other duties as operators and maintainers of the bird deterrent systems. Qualified operators with previous experience of the program train new operators. New to site workers train for 3-5 days on learning site rules, and regulations and driving in the mine. Once this is completed, the new workers then receive approximately 12-18 days of training on specific BET duties that includes mortality searches. This training includes proper boat techniques, how to conduct mortality searches and bird identification using the training package from the University of Alberta. These new workers are then paired up with previously qualified operators for mortality searches practice.

### **6.2.3 Management of avian attractants and control of hazards**

Syncrude actively manages and controls avian attractants and hazards. Syncrude uses booms in an attempt to contain the bitumen slicks on the pond to fewer locations, although there are some limitations to their full effectiveness due to wind and wave action. Booms are deployed as soon as ponds are ice free, and are removed prior to ice coverage. They are moved as per operational requirements.

### **6.2.4 Deterrents**

Syncrude uses multiple methods of bird deterrents on process affected ponds. Accipiter™ radar and controller systems are linked to falcon effigies and long-range acoustic devices. When a target is sensed within zones established on each pond, the long range acoustic devices and the falcon modules are activated. The long range acoustic devices project a predator noise, while the falcon effigies flap their wings, strobe lights flash and a high volume predator noise or other sound track deterrent noise is emitted. In addition to radar linked deterrents, conventional Zon™ cannons are placed around process affected ponds. These cannons fire off at timed intervals. There are also human effigies (scarecrows) placed around process affected ponds which remain there all year.

As per Syncrude's Waterfowl Protection Plan (WPP), at least half of water deployed cannons will be placed within 15 days of the ice-free date and full deployment will be reached within 25 days of the ice free date for each process water pond. Stating around mid-October the primary deterrents that are water deployed will be gradually reduced with freezing ambient temperatures and the start of ice cover on ponds. Reduction of shore-deployed deterrents will follow. During the winter when most process

water pond areas are ice covered, a deterrent is placed on the shoreline at the locations of sustained open water.

Sometimes a deterrent will have to be moved due to operations. The coverage density of deterrents on a pond will remain the same. Refer to Appendix 6.A for an inventory and locations of deterrents for a typical day in 2014.

**Table 6.6: Avian deterrents deployed at Mildred & Aurora (as of Fall 2014)**

| <b>Deterrent Name</b> | <b>Description</b>                                                                                      | <b>Stimuli</b>   | <b>Sound Intensity at 1 m (dB)</b> | <b>Activation Control</b> | <b>Placement</b>     | <b>Number and Location</b>                                                                                                  |
|-----------------------|---------------------------------------------------------------------------------------------------------|------------------|------------------------------------|---------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Falcon Rafts          | Predator-like bird model on a raft. When activated, wings flap and predator call is played over speaker | Audio and Visual | >100                               | Radar                     | Floating and on land | ASB -29<br>AIP-15<br>AIPN-3<br>ANRCW-0<br>MLSB-24<br>EIP-8<br>WIP-34<br>SWIP-10<br>SWSS-42<br>NMSPW-21<br>RCW-0<br>EFF-2    |
| Zon Cannons           | Conventional propane fired cannon. Produced loud blast automatically and fired on a timed interval      | Audio            | >100                               | Timer                     | Floating and on land | ASB-49<br>AIP-22<br>AIPN-12<br>ANRCW-6<br>MLSB-100<br>EIP-13<br>WIP-61<br>SWIP-34<br>SWSS-106<br>NMSPW-12<br>RCW-4<br>EFF-2 |

| <b>Deterrent Name</b> | <b>Description</b>                                                                          | <b>Stimuli</b> | <b>Sound Intensity at 1 m (dB)</b> | <b>Activation Control</b> | <b>Placement</b> | <b>Number and Location</b>                                                                                                   |
|-----------------------|---------------------------------------------------------------------------------------------|----------------|------------------------------------|---------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------|
| Hyperspikes           | Long- Range acoustic device play a loud noise (usually a predator call) over a spear system | Audio          | >100                               | Radar                     | on land          | ASB-11<br>AIP-5<br>AIPN-1<br>ANRCW-0<br>MLSB-20<br>EIP-7<br>WIP-8<br>SWIP-6<br>SWSS-14<br>NMSPW-0<br>RCW-0<br>EFF-0          |
| Effigies              | Human-like scarecrows                                                                       | Visual         | N/A                                | N/A                       | on land          | ASB-121<br>AIP-119<br>AIPN-0<br>ANRCW-13<br>MLSB-129<br>EIP-119<br>WIP-77<br>SWIP-73<br>SWSS-56<br>NMSPW-0<br>RCW-6<br>EFF-4 |

*Deterrent count date was July19, 2014*

**Table 6.7 Number of Avian Radars and Deterrents at Syncrude's Process Affected Ponds**

| Pond Name    | Pond Area (over water; ha) | Number of Radar(s) | Combined Audio & Visual Deterrents <sup>1</sup> |          |            |          | Audio-only Deterrents |           |            |            | Visual-only Deterrents |          |            |            | Total       |                    |
|--------------|----------------------------|--------------------|-------------------------------------------------|----------|------------|----------|-----------------------|-----------|------------|------------|------------------------|----------|------------|------------|-------------|--------------------|
|              |                            |                    | Linked to Radar                                 |          | Not Linked |          | Linked to Radar       |           | Not Linked |            | Linked to Radar        |          | Not Linked |            | Units       | Density (units/ha) |
|              |                            |                    | Floating                                        | On Land  | Floating   | On Land  | Floating              | On Land   | Floating   | On Land    | Floating               | On Land  | Floating   | On Land    |             |                    |
| ASB          | 543.25                     | 3                  | 29                                              | 3        | 0          | 0        | 0                     | 11        | 0          | 46         | 0                      | 0        | 0          | 121        | 213         | 0.39               |
| AIP          | 262.86                     | 0                  | 15                                              | 0        | 0          | 0        | 0                     | 5         | 0          | 22         | 0                      | 0        | 0          | 119        | 161         | 0.61               |
| AIPN         | 87.97                      | 0                  | 0                                               | 3        | 0          | 0        | 0                     | 1         | 0          | 12         | 0                      | 0        | 0          | 0          | 16          | 0.18               |
| ANRCW        | 7.50                       | 0                  | 0                                               | 0        | 0          | 0        | 0                     | 0         | 0          | 6          | 0                      | 0        | 0          | 13         | 19          | 2.50               |
| MLSB         | 721.15                     | 3                  | 24                                              | 0        | 0          | 0        | 0                     | 20        | 25         | 86         | 0                      | 0        | 0          | 129        | 287         | 0.40               |
| EIP          | 111.69                     | 2                  | 8                                               | 0        | 0          | 0        | 0                     | 7         | 0          | 13         | 0                      | 0        | 0          | 119        | 149         | 1.33               |
| WIP          | 739.40                     | 1                  | 34                                              | 0        | 0          | 0        | 0                     | 8         | 0          | 61         | 0                      | 0        | 0          | 77         | 181         | 0.25               |
| SWIP         | 266.66                     | 0                  | 10                                              | 0        | 0          | 0        | 0                     | 6         | 9          | 25         | 0                      | 0        | 0          | 73         | 123         | 0.46               |
| SWSS         | 993.97                     | 2                  | 42                                              | 0        | 0          | 0        | 0                     | 14        | 30         | 76         | 0                      | 0        | 0          | 56         | 220         | 0.22               |
| NMSPW        | 241.45                     | 0                  | 21                                              | 0        | 0          | 0        | 0                     | 0         | 0          | 12         | 0                      | 0        | 0          | 0          | 33          | 0.14               |
| RCW          | 14.82                      | 0                  | 0                                               | 0        | 0          | 0        | 0                     | 0         | 0          | 4          | 0                      | 0        | 0          | 6          | 10          | 0.71               |
| EFF          | 5.80                       | 0                  | 0                                               | 2        | 0          | 0        | 0                     | 0         | 0          | 2          | 0                      | 0        | 0          | 4          | 8           | 1.40               |
| <b>Total</b> | <b>3996.52</b>             | <b>11</b>          | <b>183</b>                                      | <b>8</b> | <b>0</b>   | <b>0</b> | <b>0</b>              | <b>72</b> | <b>64</b>  | <b>365</b> | <b>0</b>               | <b>0</b> | <b>0</b>   | <b>717</b> | <b>1420</b> | <b>0.36</b>        |

<sup>1</sup> Combined deterrents count as one unit; individual components are described in Table 6.7

### **6.2.5 Hazing procedures**

Synchrude's BET team was responsible for any and all hazing activities on process water ponds. If any birds are observed on ponds, including during structured monitoring times, then the observer calls into the BET (Bird and Environment Team) Radar Monitor. The Radar Monitor dispatches the nearest BET hazing crew immediately. The crew will then arrive on scene and assess the next course of action. Usually a boat is deployed and investigates the bird, and if applicable, initiates hazing procedures. Hazing procedures consist of firing off small pyrotechnic projectiles like screamers and bangers, discharge of air horn, or pursuit using a boat.

If the bird is a diving duck, a specified hazing procedure is initiated, which consists of immediately initiated hazing with boats and pyrotechniques. If the initial hazing attempt is unsuccessful, hazing is suspended. The hazing team leaves the area and checks back in 30-60 minutes. If the diving duck is still in the area, another hazing attempt is initiated. If the second attempt is not successful, the hazing team leaves again and check back in another 30-60 minutes. Usually the duck will fly away as soon as there is no pressure from hazing attempts. The hazing-suspension cycle is repeated until the duck is successfully hazed off the pond.

## **6.3 Methods**

The OSBCMP protocol for 2014 was followed throughout the 2014 season. Any deviations in methods are described below.

### **6.3.1 Pond Characteristics**

Pond characteristics were derived from a satellite image measured in a Geographical Information System. The satellite images for Mildred Lake and Aurora used for the 2014 program were taken on September 3, 2013. Characteristics were derived from GIS and are shown in Tables 6.8 and 6.9.

### **6.3.2 Bird Surveys**

Bird monitoring surveys were completed every day as per OSBCMP protocol. Each monitoring station was monitored usually by one observer. Each ponds' monitoring stations were rotated on a schedule to prevent a station being monitored at the same time for every day of the program.

To complete daily monitoring, the monitors used Zeiss Conquest 10 x 42 binoculars and Bushnell/Bushmaster 20 x 60 x 60 Spotting Scopes, Tripod, 3G network capable tablets, and the Sibley Field Guide to Birds of North America.

Please refer to Appendix 6.A for pond maps showing survey stations at Mildred Lake and Aurora North leases.

The methodology described in the OSBCMP protocol 2014 expects timers of some type to be used when a significant break in monitoring occurred to ensure monitoring time was kept to the specified 10 or 30 minutes duration. The use of a timer to allot for missed time due to interruptions in the observation period was at the discretion of the monitor.

### 6.3.3 Inter-observer Variability (IOV)

The IOV comparison surveys are duplicate observations of the number of birds and the number of species recorded independently by two observers at the same location and at the same time. These duplicate observations provide a measure of repeatability and consistency of the observation data. The relative percent difference (RPD) in the duplicate observations is calculated according to the following formula:

$$RPD_{\#birds} = \frac{|x_1 - x_2|}{\bar{x}} * 100$$

Where  $x_1$  is the number of birds from Observer 1,  $x_2$  is the number of birds from Observer 2, and  $\bar{x}$  is the mean of the number of birds from both observers. The mean number of birds provides the reference value against which the two individual observations are compared by assuming that the correct answer is likely between Observer 1 and Observer 2.

For example, Observer 1 counted 12 birds and Observer 2 counted 13 birds. Therefore the  $RPD_{\#birds}$  is:

$$RPD_{\#birds} = \frac{|12 - 13|}{12.5} * 100 = 8\%$$

The same calculation should be completed for the number of species counted by each observer.

An  $RPD_{\#birds}$  and an  $RPD_{\#species}$  of less than 10% is considered optimum, up to 25% may be acceptable, but greater than 25% would suggest that additional training to improve consistency might be required. These cutoff values are generally based on a subjective evaluation that considers the type of data being analyzed and the amount of variability that would be expected or acceptable to the program. As such, there is no standard means by which a definitive percent cutoff can be determined. The results of the IOV analyses will be reviewed to evaluate consistency, determine what cutoff values may be more appropriate, and to also help identify what other factors might be responsible for observer variability.

IOV's were conducted on Syncrude's Comparison days. They are duplicate observations of the number of birds and the number of species recorded independently by two observers at the same location and at the same time. These duplicate observations provide a measure of repeatability and consistency of the observation data.

#### **6.3.4 Mortality Searches**

Mortality searches were completed regularly as described in the OSBCMP protocol. Route transects included a perimeter route with transects being searched within the perimeter area. This covered most areas of pond that is able to be reached by boat. Any areas that were not able to be reached by boat were accessed as close as possible and searched with binoculars. Focused search areas were determined based off of areas where previous activity was observed, either birds observed landed in the pond, or oiled birds were retrieved previously. All searches were performed by at least two people. Route and focused based searches were completed consecutively and all ponds were completed once every two weeks.

To perform searches operators used boats, trucks, binoculars, data sheets, GPS, nets, bags, and labels.

#### **6.3.5 Incidental Observations and Reporting**

Incidental observations consisted of any species of concern that was observed in contact with process-affected ponds. These observations were recorded within and outside the 500m barrier, and anytime within or outside the 30 minute or 10 minute observation session.

### **6.4 Results**

#### **6.4.1 Pond Characteristics**

In the 2014 season, 13 ponds were monitored for bird activity. Of the 13 ponds, 12 contained process affected water, and 1 pond contained freshwater from the Athabasca River. The freshwater pond, Mildred Lake Reservoir, was located at the Mildred Lake lease site. Ponds characteristics can be seen in Table 6.9.

Over the 2014 summer, the newly developed NMSPW pond grew in surface area considerably, while most other ponds had relatively constant surface area.

Syncrude stores coke on a beach on the west side of MLSB. This area is not a water area and is not recorded in the surface area of water. It is beach made of coke with a typical grain size like sand, although in some satellite images and air photos it can appear to be bitumen or water.

**Table 6.8: Characteristics of survey stations monitored at Mildred & Aurora in 2014**

| Pond Name <sup>1</sup>      | Survey Station ID  | Survey Area (over water; ha) | Island (ha) | Emergent Veg. (ha) | Shoreline (m) |          |
|-----------------------------|--------------------|------------------------------|-------------|--------------------|---------------|----------|
|                             |                    |                              |             |                    | Vegetated     | Non-veg. |
| Aurora In-pit               | AIP_1              | 28.49                        | 0           | 0                  | 0             | 1478.70  |
|                             | AIP_2              | 27.92                        | 0           | 0                  | 0             | 1765.50  |
|                             | Total (2 Stations) | 56.41                        | 0           | 0                  | 0             | 891.20   |
| Aurora In-pit North         | AIPN               | 26.80                        | 0           | 0                  | 0             | 4135.40  |
| Aurora North Recycle Water  | ANRCW              | 7.50                         | 0           | 0                  | 0             | 1500.95  |
| Aurora Settling Basin       | ASB_1              | 31.24                        | 0           | 0                  | 1144.48       | 0        |
|                             | ASB_2              | 28.82                        | 0           | 0                  | 838.30        | 0        |
|                             | ASB_3              | 37.08                        | 0           | 0                  | 1003.15       | 278.43   |
|                             | Total (3 Stations) | 97.14                        | 0           | 0                  | 0             | 1084.00  |
| Effluent                    | EFF                | 5.80                         | 0           | 0                  | 2985.93       | 278.43   |
| East In-pit                 | EIP                | 23.66                        | 0           | 0                  | 0             | 11.29    |
| Mildred Lake Settling Basin | MLSB_1             | 36.70                        | 0           | 0                  | 0             | 11.69    |
|                             | MLSB_2             | 15.17                        | 0           | 0                  | 0             | 22.98    |
|                             | MLSB_3             | 3.50                         | 0           | 0                  | 0             | 818.60   |
|                             | Total (3 Stations) | 55.37                        | 0           | 0                  | 0             | 585.64   |
| NMSPW                       | NMSPW              | 13.80                        | 0           | 0                  | 0             | 1561.41  |
| Recycle Water               | RCW                | 10.55                        | 0           | 0                  | 0             | 2965.65  |
| Southwest In-pit            | SWIP_1             | 14.48                        | 0           | 0                  | 0             | 849.12   |
|                             | SWIP_2             | 29.78                        | 0           | 0                  | 1083.62       | 423.36   |
|                             | Total (2 Stations) | 44.26                        | 0           | 0                  | 353.42        | 947.20   |
| Southwest Sands Storage     | SWSS_1             | 2.84                         | 0           | 0                  | 0             | 1092.13  |
|                             | SWSS_2             | 4.02                         | 0           | 0                  | 0             | 1155.31  |
|                             | SWSS_3             | 37.22                        | 0           | 0                  | 0             | 999.21   |
|                             | Total (3 Stations) | 44.08                        | 0           | 0                  | 0             | 3246.65  |
| West In-pit                 | WIP_1              | 11.76                        | 0           | 0                  | 0             | 1037.26  |
|                             | WIP_2              | 13.10                        | 0           | 0                  | 0             | 977.77   |
|                             | WIP_3              | 25.89                        | 0           | 0                  | 0             | 2015.03  |
|                             | WIP_4*             | 14.35                        | 0           | 0                  | 0             | 1437.57  |
|                             | Total (3 Stations) | 36.40                        | 0           | 0                  | 0             | 1237.70  |
| Mildred Lake Reservoir      | MLR                | 27.37                        | 0           | 0                  | 1383.90       | 0        |

<sup>1</sup> Blue shading: freshwater pond. \* Alternative Survey Station (not included in total).

**Table 6.9: Characteristics of ponds monitored at Mildred & Aurora in 2014**

| Pond Name <sup>1</sup><br>(Year of Origin) | Pond<br>Content      | Bitumen Cover                    |                                            | Pond Area<br>(over water;<br>ha) | Island<br>(ha) | Emergent<br>Veg. (ha) | Shoreline (m) |          |
|--------------------------------------------|----------------------|----------------------------------|--------------------------------------------|----------------------------------|----------------|-----------------------|---------------|----------|
|                                            |                      | % <sup>2</sup> : Mode<br>(Range) | Area <sup>3</sup> (ha): Mean<br>(Min-Max)* |                                  |                |                       | Vegetated     | Non-veg. |
| Aurora In-pit<br>2010                      | process-<br>affected | 6-15<br>(1-5 to 51-75)           | 2.64<br>(2.64-2.64)                        | 721.15                           | 0              | 0                     | 0             | 16106.36 |
| Aurora In-pit North<br>2012                | process-<br>affected | 6-15<br>(0 to 76-100)            | 32.13<br>(32.13-32.13)                     | 111.69                           | 0              | 0                     | 0             | 5978.7   |
| Aurora North Recycle Water<br>2001         | process-<br>affected | 1-5<br>(0 to 1-25)               | 0<br>(0-0)                                 | 739.4                            | 0              | 0                     | 12459.12      | 2356.06  |
| Aurora Settling Basin<br>2001              | process-<br>affected | 1-5<br>(0 to 26-50)              | 6.67<br>(6.67-6.67)                        | 266.66                           | 0              | 0                     | 0             | 8033.02  |
| Effluent<br>1977                           | process-<br>affected | 26-50<br>(1-5 to 76-<br>100)     | 4.31<br>(4.31-4.31)                        | 993.97                           | 0              | 0                     | 4736.32       | 10706.5  |
| East In-pit<br>1999                        | process-<br>affected | 1-5<br>(0 to 26-50)              | 0<br>(0-0)                                 | 14.82                            | 0              | 0                     | 776.85        | 1554.98  |
| Mildred Lake Settling Basin<br>1977        | process-<br>affected | 1-5<br>(1-5 to 76-<br>100)       | 33.78<br>(33.78-33.78)                     | 5.8                              | 0              | 0                     | 353.42        | 947.2    |
| NMSPW<br>2013                              | process-<br>affected | 51-75<br>(0 to 76-100)           | **                                         | 241.45                           | 0              | 0                     | 0             | 7614.06  |
| Recycle Water<br>1977                      | process-<br>affected | 1-5<br>(1-5 to 51-75)            | 6.56<br>(6.56-6.56)                        | 543.25                           | 0              | 0                     | 0             | 10398.89 |
| Southwest In-pit<br>2002                   | process-<br>affected | 6-15<br>(0 to 26-50)             | 21.79<br>(21.79-21.79)                     | 262.86                           | 0              | 0                     | 0             | 7888     |
| Southwest Sands Storage<br>1995            | process-<br>affected | 1-5<br>(0 to 26-50)              | 24.43<br>(24.43-24.43)                     | 87.97                            | 0              | 0                     | 0             | 4481.1   |
| West In-pit<br>2001                        | process-<br>affected | 1-5<br>(0 to 1-25)               | 0.5<br>(0.5-0.5)                           | 7.5                              | 0              | 0                     | 0             | 1237.7   |
| Mildred Lake Reservoir                     | freshwater           | 0                                | 0                                          | 156.43                           | 0              | 0.76                  | 8181.09       | 0        |

<sup>1</sup> Blue shading: freshwater pond. <sup>2</sup> Estimated during bird surveys. <sup>3</sup> Estimated from satellite imagery.

\* Syncrude used 1 satellite map for 2014 \*\* In 2014 satellite map, there is no water for NMSPW pond on the day of the satellite image

#### 6.4.2 Bird Observations

Bird observations began April 16<sup>th</sup> and continued until July 6<sup>th</sup> for the spring migration season. The fall migration season was observed from July 25<sup>th</sup> to October 31<sup>st</sup>. Approximately 3500 bird surveys were conducted throughout the season, surveying a total 1275 ha daily. Mildred Lake Reservoir, the freshwater pond, had 29 ha surveyed 51 times throughout the season. This is less frequent than daily monitoring sessions as the OSBCMP protocol requires freshwater ponds to be monitored twice weekly. All ponds were monitored with a high frequency throughout the season (see Table 6.10 and Table 6.11), with almost all ponds having all required stations monitored every day.

**Table 6.10: Bird survey effort by station at Mildred & Aurora in 2014**

| Pond Name <sup>1</sup>      | Survey Duration (min) | Survey Station ID | Survey Area (over water; ha) | # Surveys Conducted in 2014 |
|-----------------------------|-----------------------|-------------------|------------------------------|-----------------------------|
| Aurora In-pit               | 30                    | AIP_1             | 28.49                        | 154                         |
|                             |                       | AIP_2             | 27.92                        | 153                         |
| Aurora In-pit North         | 10                    | AIPN              | 26.8                         | 155                         |
| Aurora North Recycle Water  | 10                    | ANRCW             | 7.5                          | 155                         |
| Aurora Settling Basin       | 30                    | ASB_1             | 31.24                        | 154                         |
|                             |                       | ASB_2             | 28.82                        | 155                         |
|                             |                       | ASB_3             | 37.08                        | 154                         |
| Effluent                    | 10                    | EFF               | 5.8                          | 154                         |
| East In-pit                 | 10                    | EIP               | 23.66                        | 156                         |
| Mildred Lake Settling Basin | 30                    | MLSB_1            | 36.7                         | 153                         |
|                             |                       | MLSB_2            | 15017                        | 159                         |
|                             |                       | MLSB_3            | 3.5                          | 156                         |
| NMSPW                       | 10                    | NMSPW             | 13.8                         | 159                         |
| Recycle Water               | 10                    | RCW               | 10.55                        | 157                         |
| Southwest In-pit            | 30                    | SWIP_1            | 14.48                        | 163                         |
|                             |                       | SWIP_2            | 29.78                        | 158                         |
| Southwest Sands Storage     | 30*                   | SWSS_1            | 2.84                         | 153                         |
|                             |                       | SWSS_2            | 4.02                         | 155                         |
|                             |                       | SWSS_3            | 37.22                        | 160                         |
| West In-pit                 | 30**                  | WIP_1             | 11.76                        | 163                         |
|                             |                       | WIP_2             | 13.1                         | 159                         |
|                             |                       | WIP_3             | 25.89                        | 160                         |
|                             |                       | WIP_4             | 14.35                        | 1                           |
| Mildred Lake Reservoir      | 30                    | MLR               | 27.37                        | 51                          |

<sup>1</sup> Blue shading: freshwater pond

\* Mean: 29.98 min

\*\* Mean: 29.64 min

**Table 6.11: Bird survey effort by pond at Mildred & Aurora in 2014**

| Pond Name <sup>1</sup>      | # Survey Stations | Survey Area (over water; ha) | Survey Area as % of Pond Area (over water; ha) | Duration of Surveys (min) | Scheduled Monitoring Frequency (days/week) | # Surveys Conducted in 2014 | % Days with all scheduled surveys conducted |
|-----------------------------|-------------------|------------------------------|------------------------------------------------|---------------------------|--------------------------------------------|-----------------------------|---------------------------------------------|
| Aurora In-pit               | 2                 | 56.41                        | 21.46                                          | 30                        | 6                                          | 307                         | 99                                          |
| Aurora In-pit North         | 1                 | 26.80                        | 30.46                                          | 10                        | 6                                          | 155                         | 100                                         |
| Aurora North Recycle Water  | 1                 | 7.50                         | 100.00                                         | 10                        | 6                                          | 155                         | 100                                         |
| Aurora Settling Basin       | 3                 | 97.14                        | 17.88                                          | 30                        | 6                                          | 463                         | 100                                         |
| Effluent                    | 1                 | 5.80                         | 100.00                                         | 10                        | 6                                          | 154                         | 99                                          |
| East In-pit                 | 1                 | 23.66                        | 21.18                                          | 10                        | 6                                          | 156                         | 101                                         |
| Mildred Lake Settling Basin | 3                 | 55.37                        | 7.68                                           | 30                        | 6                                          | 468                         | 101                                         |
| NMSPW                       | 1                 | 13.80                        | 5.72                                           | 10                        | 6                                          | 159                         | 103                                         |
| Recycle Water               | 1                 | 10.55                        | 71.19                                          | 10                        | 6                                          | 157                         | 101                                         |
| Southwest In-pit            | 2                 | 44.26                        | 16.60                                          | 30                        | 6                                          | 321                         | 104                                         |
| Southwest Sands Storage     | 3                 | 44.08                        | 4.43                                           | 30*                       | 6                                          | 468                         | 101                                         |
| West In-pit                 | 3                 | 36.40                        | 4.92                                           | 30**                      | 6                                          | 483                         | 104                                         |
| Mildred Lake Reservoir      | 1                 | 27.37                        | 17.50                                          | 30                        | 2                                          | 51                          | 98                                          |

<sup>1</sup> Blue shading: freshwater pond

\* Range: 20-30 min, Mean: 29.98 min

\*\* Range: 10-30 min, Mean: 29.64 min

The monitoring results from the 2014 season varied among Process-Affected ponds and also varied within guild observed. Observations of the PA ponds show the majority of 'target' species that were observed were dabbling ducks. The highest occurrences of dabbling ducks were observed landing at the West In-Pit pond, and flying over at the Southwest Sands Storage pond, more than any other target species. There was also a noted increase in landed Gulls and Waders at MLSB 3, over all other monitoring stations and PA ponds. Non target species were most commonly observed in almost all PA monitoring sessions. Please refer to Table 6.12, Table 6.13 and Table 6.14 for numbers of landed birds observed throughout the season.

The most commonly landed bird species observed and recorded was Unknown Duck. Unknown Ducks were observed landed on process affected ponds 245 times. The average distance for landed Unknown Ducks approached the observation limit as outlined in the Plan. Most Unknown Duck observers report of no colour ID, far away, and poor light. The next most common landed bird was Unknown White Headed Gull at 129 times. Northern Shoveler was the identifiable species that accounted for 102 landings in process affected water. Unknown ducks were observed to be contacted bitumen 16 times, while Northern Shovelers were observed to be contacted bitumen 8 times. Please see Appendix 6.C for number of bird observations by species at Syncrude process affected ponds

**Table 6.12: Number of bird observations by pond and guild at Mildred & Aurora in 2014<sup>1</sup>**

| Pond Name <sup>2</sup>                | Dabblers   |            | Divers     |           | Waders     |            | Gulls      |            | Non-target |              | Total <sup>3</sup> |              |
|---------------------------------------|------------|------------|------------|-----------|------------|------------|------------|------------|------------|--------------|--------------------|--------------|
|                                       | Landed     | Flew Over  | Landed     | Flew Over | Landed     | Flew Over  | Landed     | Flew Over  | Landed     | Flew Over    | Landed             | Flew Over    |
| Aurora In-pit                         | 24         | 80         | 31         | 1         | 0          | 14         | 0          | 3          | 96         | 323          | 208                | 425          |
| Aurora In-pit North                   | 1          | 0          | 4          | 0         | 0          | 2          | 0          | 0          | 6          | 73           | 12                 | 76           |
| Aurora North Recycle Water            | 0          | 1          | 0          | 0         | 0          | 0          | 0          | 0          | 11         | 99           | 11                 | 100          |
| Aurora Settling Basin                 | 35         | 140        | 191        | 2         | 16         | 2          | 12         | 8          | 77         | 549          | 475                | 712          |
| Effluent                              | 0          | 0          | 0          | 0         | 0          | 2          | 0          | 0          | 2          | 40           | 2                  | 42           |
| East In-pit                           | 0          | 2          | 0          | 0         | 0          | 1          | 0          | 0          | 33         | 109          | 33                 | 112          |
| Mildred Lake Settling Basin           | 0          | 134        | 0          | 3         | 139        | 34         | 177        | 44         | 160        | 402          | 485                | 664          |
| NMSPW                                 | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 0          | 0          | 17           | 0                  | 17           |
| Recycle Water                         | 0          | 0          | 0          | 0         | 0          | 1          | 0          | 0          | 8          | 100          | 9                  | 101          |
| Southwest In-pit                      | 1          | 25         | 1          | 0         | 1          | 47         | 7          | 27         | 42         | 723          | 52                 | 842          |
| Southwest Sands Storage               | 25         | 311        | 34         | 25        | 36         | 42         | 7          | 22         | 89         | 622          | 208                | 1,046        |
| West In-pit                           | 263        | 143        | 54         | 20        | 6          | 77         | 1          | 100        | 217        | 1,480        | 557                | 1,904        |
| <b>Total (Process-affected Ponds)</b> | <b>349</b> | <b>836</b> | <b>315</b> | <b>51</b> | <b>198</b> | <b>222</b> | <b>204</b> | <b>204</b> | <b>741</b> | <b>4,537</b> | <b>2,052</b>       | <b>6,041</b> |
| Mildred Lake Reservoir                | 74         | 19         | 86         | 10        | 12         | 3          | 70         | 30         | 147        | 764          | 447                | 870          |

<sup>1</sup> Individual birds may be observed on multiple days and thus be counted multiple times

<sup>2</sup> Blue shading: freshwater pond

<sup>3</sup> Includes unknown duck species (which may be dabblers or divers)

**Table 6.13: Mean number of landed birds per survey at Mildred & Aurora in 2014**

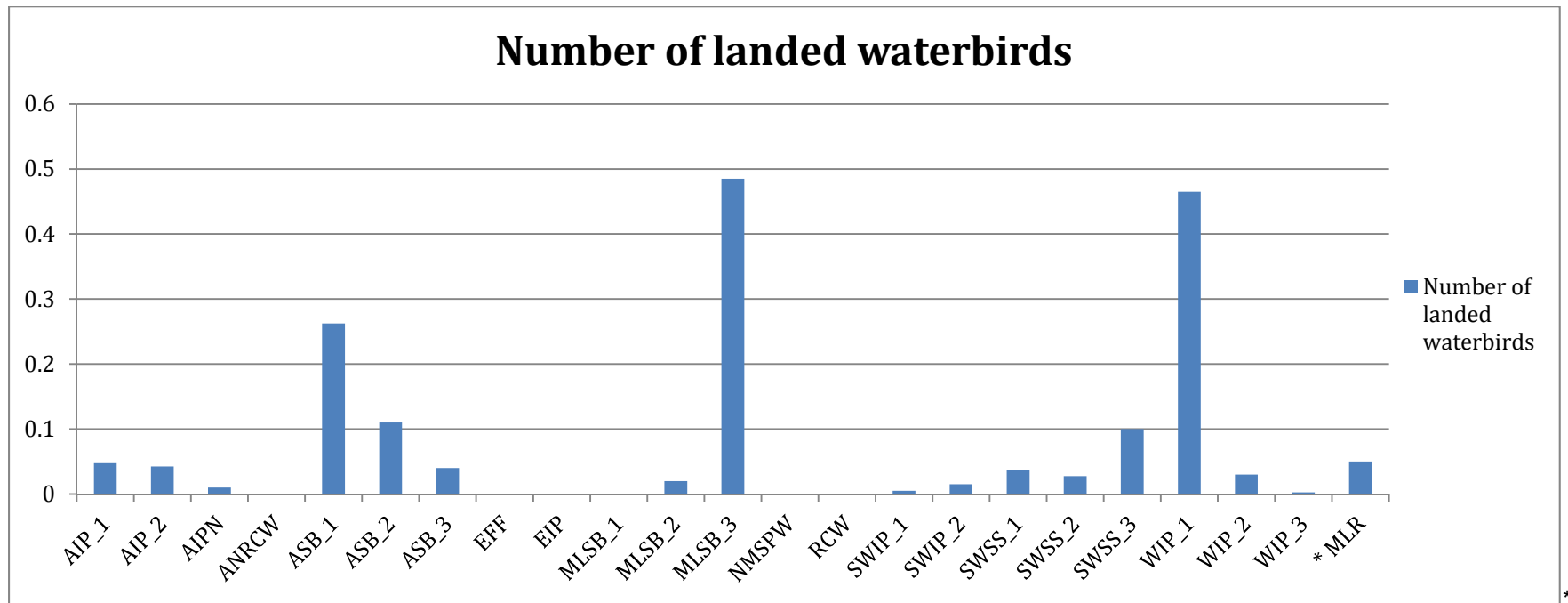
| Pond Name <sup>1</sup>            | Survey Station ID        | Dabblers | Divers | Waders | Gulls | Non-target Guilds | All Guilds <sup>2</sup> |
|-----------------------------------|--------------------------|----------|--------|--------|-------|-------------------|-------------------------|
| Aurora In-pit                     | AIP_1                    | 0.04     | 0.15   | 0      | 0     | 0.62              | 1.11                    |
|                                   | AIP_2                    | 0.12     | 0.05   | 0      | 0     | 0                 | 0.24                    |
|                                   | Mean across surveys      | 0.08     | 0.10   | 0      | 0     | 0.31              | 0.68                    |
| Aurora In-pit North               | AIPN                     | 0.01     | 0.03   | 0      | 0     | 0.04              | 0.08                    |
| Aurora North Recycle Water        | ANRCW                    | 0        | 0      | 0      | 0     | 0.07              | 0.07                    |
| Aurora Settling Basin             | ASB_1                    | 0.10     | 0.84   | 0.03   | 0.08  | 0.07              | 1.13                    |
|                                   | ASB_2                    | 0.10     | 0.26   | 0.08   | 0     | 0.14              | 1.36                    |
|                                   | ASB_3                    | 0.03     | 0.13   | 0      | 0     | 0.29              | 0.58                    |
|                                   | Mean across surveys      | 0.08     | 0.41   | 0.03   | 0.03  | 0.17              | 1.03                    |
| Effluent                          | EFF                      | 0        | 0      | 0      | 0     | 0.01              | 0.01                    |
| East In-pit                       | EIP                      | 0        | 0      | 0      | 0     | 0.21              | 0.21                    |
| Mildred Lake Settling Basin       | MLSB_1                   | 0        | 0      | 0      | 0     | 0.33              | 0.33                    |
|                                   | MLSB_2                   | 0        | 0      | 0.07   | 0.01  | 0.58              | 0.66                    |
|                                   | MLSB_3                   | 0        | 0      | 0.82   | 1.12  | 0.12              | 2.12                    |
|                                   | Mean across surveys      | 0        | 0      | 0.30   | 0.38  | 0.34              | 1.04                    |
| NMSPW                             | NMSPW                    | 0        | 0      | 0      | 0     | 0                 | 0                       |
| Recycle Water                     | RCW                      | 0        | 0      | 0      | 0     | 0.05              | 0.06                    |
| Southwest In-pit                  | SWIP_1                   | 0.01     | 0      | 0      | 0.01  | 0.13              | 0.15                    |
|                                   | SWIP_2                   | 0        | 0.01   | 0.01   | 0.04  | 0.13              | 0.18                    |
|                                   | Mean across surveys      | <0.01    | <0.01  | <0.01  | 0.02  | 0.13              | 0.16                    |
| Southwest Sands Storage           | SWSS_1                   | 0.08     | 0.01   | 0.06   | 0     | 0.36              | 0.60                    |
|                                   | SWSS_2                   | 0.01     | 0      | 0.07   | 0.03  | 0.05              | 0.17                    |
|                                   | SWSS_3                   | 0.07     | 0.21   | 0.10   | 0.02  | 0.16              | 0.56                    |
|                                   | Mean across surveys      | 0.05     | 0.07   | 0.08   | 0.01  | 0.19              | 0.44                    |
| West In-pit                       | WIP_1                    | 1.58     | 0.24   | 0.03   | 0.01  | 0.90              | 2.82                    |
|                                   | WIP_2                    | 0.03     | 0.09   | 0      | 0     | 0.33              | 0.49                    |
|                                   | WIP_3                    | 0        | 0      | 0.01   | 0     | 0.12              | 0.13                    |
|                                   | WIP_4*                   | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | Mean across surveys      | 0.54     | 0.11   | 0.01   | <0.01 | 0.45              | 1.15                    |
| <b>All Process-affected Ponds</b> | <b>Mean across ponds</b> | 0.06     | 0.06   | 0.04   | 0.04  | 0.16              | 0.41                    |
| Mildred Lake Reservoir            | MLR                      | 1.45     | 1.69   | 0.24   | 1.37  | 2.88              | 8.76                    |

<sup>1</sup> Blue shading: freshwater pond. <sup>2</sup> Includes unknown duck species (which may be dabblers or divers).

**Table 6.14: Mean number of oiled birds per survey at Mildred & Aurora in 2014**

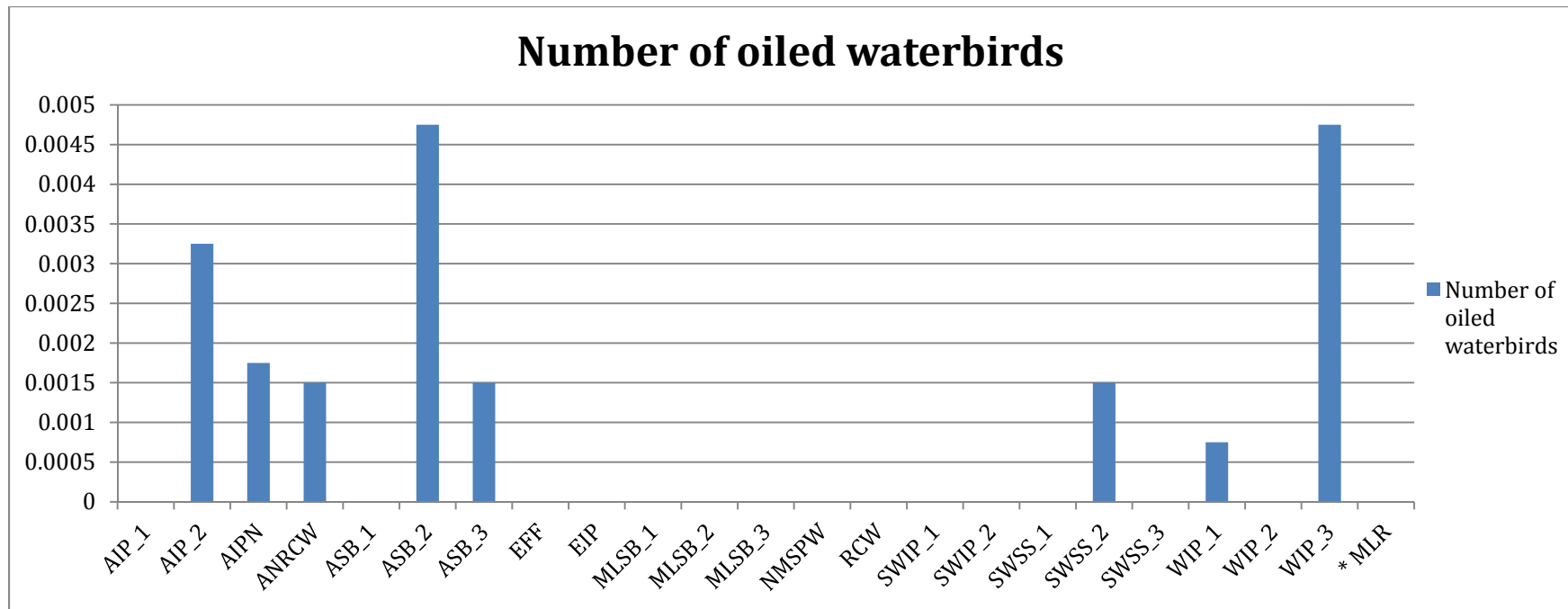
| Pond Name <sup>1</sup>            | Survey Station ID        | Dabblers | Divers | Waders | Gulls | Non-target Guilds | All Guilds <sup>2</sup> |
|-----------------------------------|--------------------------|----------|--------|--------|-------|-------------------|-------------------------|
| Aurora In-pit                     | AIP_1                    | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | AIP_2                    | 0.013    | 0      | 0      | 0     | 0                 | 0.013                   |
|                                   | Mean across surveys      | 0.007    | 0      | 0      | 0     | 0                 | 0.007                   |
| Aurora In-pit North               | AIPN                     | 0.006    | 0      | 0      | 0     | 0                 | 0.006                   |
| Aurora North Recycle Water        | ANRCW                    | 0        | 0      | 0      | 0     | 0                 | 0                       |
| Aurora Settling Basin             | ASB_1                    | 0.019    | 0      | 0      | 0     | 0                 | 0.026                   |
|                                   | ASB_2                    | 0        | 0      | 0.006  | 0     | 0                 | 0.013                   |
|                                   | ASB_3                    | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | Mean across surveys      | 0.006    | 0      | 0.002  | 0     | 0                 | 0.013                   |
| Effluent                          | EFF                      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| East In-pit                       | EIP                      | 0        | 0      | 0      | 0     | 0                 | 0                       |
| Mildred Lake Settling Basin       | MLSB_1                   | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | MLSB_2                   | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | MLSB_3                   | 0        | 0      | 0      | 0     | 0.045             | 0.090                   |
|                                   | Mean across surveys      | 0        | 0      | 0      | 0     | 0.015             | 0.030                   |
| NMSPW                             | NMSPW                    | 0        | 0      | 0      | 0     | 0                 | 0                       |
| Recycle Water                     | RCW                      | 0        | 0      | 0      | 0     | 0                 | 0.006                   |
| Southwest In-pit                  | SWIP_1                   | 0        | 0      | 0.006  | 0     | 0                 | 0.006                   |
|                                   | SWIP_2                   | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | Mean across surveys      | 0        | 0      | 0.003  | 0     | 0                 | 0                       |
| Southwest Sands Storage           | SWSS_1                   | 0        | 0      | 0      | 0     | 0                 | 0.003                   |
|                                   | SWSS_2                   | 0.013    | 0      | 0      | 0.006 | 0                 | 0.039                   |
|                                   | SWSS_3                   | 0        | 0      | 0      | 0     | 0.100             | 0.100                   |
|                                   | Mean across surveys      | 0.004    | 0      | 0      | 0.002 | 0.034             | 0.053                   |
| West In-pit                       | WIP_1                    | 0.129    | 0.074  | 0      | 0     | 0                 | 0.202                   |
|                                   | WIP_2                    | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | WIP_3                    | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | WIP_4*                   | 0        | 0      | 0      | 0     | 0                 | 0                       |
|                                   | Mean across surveys      | 0.043    | 0.025  | 0      | 0     | 0                 | 0.068                   |
| <b>All Process-affected Ponds</b> | <b>Mean across ponds</b> | 0.006    | 0.002  | 0      | 0     | 0.004             | 0.016                   |
| Mildred Lake Reservoir            | MLR                      | 0        | 0      | 0      | 0     | 0                 | 0                       |

<sup>1</sup> Blue shading: freshwater pond. <sup>2</sup> Includes unknown duck species (which may be dabblers or divers)



Freshwater Pond.

**Figure 6.2: Mean number of landed waterbirds per survey at Mildred & Aurora in 2014.**



\* Freshwater Pond.

**Figure 6.3: Mean number of oiled waterbirds per survey at Mildred & Aurora in 2014.**

As Per Table 6.15 below, there were reports of 3 brood observations. Two of these observations at West In-Pit were possibly a repeat sighting of the same brood as they occurred within 2 days and at the same location. The West In-Pit pond is in a process of reclamation and has potential nesting habitat in the vicinity, more so than the other process water ponds. Tall grasses and small freshwater ponds in the immediate area allow for suitable nesting habitat. The other brood was observed at Aurora East-Pit Northeast (AIP), which would have far less suitable habitat for nesting.

**Table 6.15: Brood observations by species at process-affected ponds at Mildred & Aurora in 2014**

| Species/Species Group | # Brood Observations <sup>1</sup> |
|-----------------------|-----------------------------------|
| UNK Dabbler Duck      | 3                                 |

<sup>1</sup> Each brood may contain one to multiple chicks; broods may be observed repeatedly and thus be counted multiple times

### 6.4.3 Inter-observer Variability

There were a total of 57 IOVs completed throughout the season. IOV's that included all monitors at some point during the season. 48 of these IOVs had accurate numbers of species count, and the observers had the same data. There were 35 instances during the 57 IOVs where a bird was spotted by one observer and not the other, and 2 instances during the 57 IOVs where a bird was spotted by both observers but the number of species was counted incorrectly. For a significant number of the IOV's, neither observer observed any birds.

**Table 6.16: Inter-observer variability in terms of relative percent difference (RPD) at Mildred & Aurora in 2014**

| Comparison Survey | Survey Station ID | Landed                          |                              | Flew Over                       |                              |
|-------------------|-------------------|---------------------------------|------------------------------|---------------------------------|------------------------------|
|                   |                   | RPD: Number of Individual Birds | RPD: Number of Avian Species | RPD: Number of Individual Birds | RPD: Number of Avian Species |
| 1                 | AIP1              | -                               | -                            | 0%                              | 0%                           |
| 2                 | EFF               | -                               | -                            | 200%                            | 200%                         |
| 3                 | EIP               | -                               | -                            | 0%                              | 0%                           |
| 4                 | EIP               | -                               | -                            | 200%                            | 200%                         |
| 5                 | MLSB2             | -                               | -                            | 0%                              | 0%                           |
| 6                 | MLSB2             | -                               | -                            | 200%                            | 200%                         |
| 7                 | SWIP1             | -                               | -                            | 0%                              | 0%                           |
| 8                 | SWIP1             | -                               | -                            | 200%                            | 200%                         |
| 9                 | SWIP2             | -                               | -                            | 200%                            | 200%                         |
| 10                | SWSS3             | -                               | -                            | 0%                              | 0%                           |
| 11                | WIP1              | 0%                              | 0%                           | -                               | -                            |
| 12                | WIP1              | -                               | -                            | 0%                              | 0%                           |
| 13                | WIP1              | -                               | -                            | 0%                              | 0%                           |
| 14                | WIP1              | -                               | -                            | 200%                            | 200%                         |
| 15                | WIP1              | -                               | -                            | 200%                            | 200%                         |
| 16                | WIP2              | -                               | -                            | 0%                              | 0%                           |
| 17                | WIP2              | -                               | -                            | 200%                            | 200%                         |
| 18                | WIP2              | -                               | -                            | 200%                            | 200%                         |
| 19                | WIP3              | -                               | -                            | 200%                            | 200%                         |
| 20                | WIP3              | -                               | -                            | 0%                              | 0%                           |
| 21                | WIP3              | -                               | -                            | 200%                            | 200%                         |
| 22                | WIP3              | -                               | -                            | 200%                            | 200%                         |
| 23                | WIP3              | -                               | -                            | 200%                            | 200%                         |
| Mean              |                   | 0%                              | 0%                           | 100%                            | 100%                         |

#### 6.4.4 Mortalities

A total of 3140 hours over 139 days were spent performing mortality searches on 12 different process-affected ponds on both Mildred Lake and Aurora lease sites. Most effort was on boat searches, completing both route based and focused based transects of the ponds. Please refer to Table 6.17.

Formal mortality searches accounted for only 1 oiled duck mortality out of 47 oiled mortalities on ponds. The mortality was observed during a focused search of MLSB it was a live Lesser Scaup that was more than 50% oiled. Almost all mortalities were incidental observations reported by our BET mortality team, or operators working in the area, or other Syncrude workers and contractors. Oiled ducks occurred throughout the year, starting in April. Most of the oiled ducks were found alive and had to be euthanized by site staff, under the direction of the Alberta Government. Most oiled ducks found were >50% oiled.

MLSB was the process affected water pond that accounted for the most oiled ducks, followed by Southwest Sands Storage and Aurora East-Pit Northeast. Half of the oilings in MLSB occurred on the north end of the pond, and was an area of focused searches. Some oilings for 2014 occurred in sumps around the lease, including the 690 Pumphouse Sump and East 45 Dump Sump. Consideration is to be made on closing the 690 Pumphouse Sump and the East 45 Dump Sump, adding bitumen elimination controls, or adding them to the to the monitoring prior to the 2015 program..

Please see Appendix 6 D for mortality event detail.

**Table 6.17: Mortality search effort at Mildred & Aurora in 2014<sup>1</sup>**

| Pond Name                   | # Days Searched | Boat         |            |          | Walk       |             |           | Truck        |              |              | Total        |              |            |
|-----------------------------|-----------------|--------------|------------|----------|------------|-------------|-----------|--------------|--------------|--------------|--------------|--------------|------------|
|                             |                 | h            | km         | ha       | h          | km          | ha        | h            | km           | ha           | h            | km           | ha         |
| Aurora In-pit               | 17              | 7.8          | 136        | 102      | 0.6        | 0           | 30        | 1.0          | 11           | 55           | 9.4          | 147          | 187        |
| Aurora In-pit North         | 12              | 1.2          | 0          | 99       | 1.3        | 0           | 41        | 4.0          | 0            | 840          | 6.5          | 0            | 980        |
| Aurora North Recycle Water  | 12              | 0            | 0          | 0        | 1.0        | 0           | 5         | 3.6          | 0            | 76           | 4.6          | 0            | 80         |
| Aurora Settling Basin       | 14              | 14.0         | 299        | 407      | 0.5        | 0           | 21        | 0.3          | 0            | 4            | 14.7         | 299          | 432        |
| Effluent                    | 13              | 0.0          | 0          | 0        | 0.8        | 0           | 5         | 5.4          | 0            | 77           | 6.1          | 0            | 83         |
| East In-pit                 | 11              | 5.1          | 31         | 51       | 0.2        | 0           | 2         | 1.5          | 3            | 0            | 6.8          | 34           | 54         |
| Mildred Lake Settling Basin | 10              | 12.0         | 228        | 279      | 0          | 0           | 0         | 0            | 0            | 0            | 12.0         | 228          | 279        |
| NMSPW                       | 1               | 0.2          | 0          | 240      | 0          | 0           | 3         | 0            | 0            | 0            | 0.2          | 0            | 243        |
| Recycle Water               | 13              | 0            | 0          | 0        | 0.8        | 0           | 5         | 7.3          | 0            | 184          | 8.1          | 0            | 189        |
| Southwest In-pit            | 11              | 5.8          | 123        | 103      | 0          | 0           | 0         | 0.0          | 0            | 0            | 5.8          | 123          | 103        |
| Southwest Sands Storage     | 13              | 11.9         | 360        | 315      | 0          | 0           | 0         | 3.4          | 66           | 51           | 15.3         | 426          | 366        |
| West In-pit                 | 12              | 10.8         | 397        | 118      | 0          | 0           | 0         | 1.5          | 0            | 27           | 12.3         | 397          | 145        |
| <b>Total</b>                |                 | <b>1,714</b> | <b>5.2</b> | <b>0</b> | <b>112</b> | <b>27.9</b> | <b>80</b> | <b>1,314</b> | <b>101.9</b> | <b>1,654</b> | <b>3,140</b> | <b>1,714</b> | <b>5.2</b> |

<sup>1</sup> Includes route-based and focused transects; for each search, either distance OR area counted towards effort

**Table 6.18: Number of mortalities by pond at Mildred & Aurora in 2014**

| <b>Pond Name<sup>1</sup></b>           | <b>Mortality Search</b> | <b>Incidental</b> | <b>Total</b> |
|----------------------------------------|-------------------------|-------------------|--------------|
| Aurora In-pit                          | 0                       | 6                 | 6            |
| Aurora In-pit North                    | 0                       | 0                 | 0            |
| Aurora North Recycle Water             | 0                       | 0                 | 0            |
| Aurora Settling Basin                  | 0                       | 4                 | 4            |
| Effluent                               | 0                       | 3                 | 3            |
| East In-pit                            | 0                       | 0                 | 0            |
| Mildred Lake Settling Basin            | 1                       | 7                 | 8            |
| NMSPW                                  | 0                       | 0                 | 0            |
| Recycle Water                          | 0                       | 1                 | 1            |
| Southwest In-pit                       | 0                       | 0                 | 0            |
| Southwest Sands Storage                | 0                       | 6                 | 6            |
| West In-Pit                            | 0                       | 6                 | 6            |
| 690 Pumphouse Sump*                    | N/A                     | 3                 | 3            |
| East 45 Dump Sump*                     | N/A                     | 10                | 10           |
| <b>Total (Process- affected Ponds)</b> | <b>1</b>                | <b>46</b>         | <b>47</b>    |
| Mildred Lake Reservoir                 | N/A                     | 0                 | 0            |

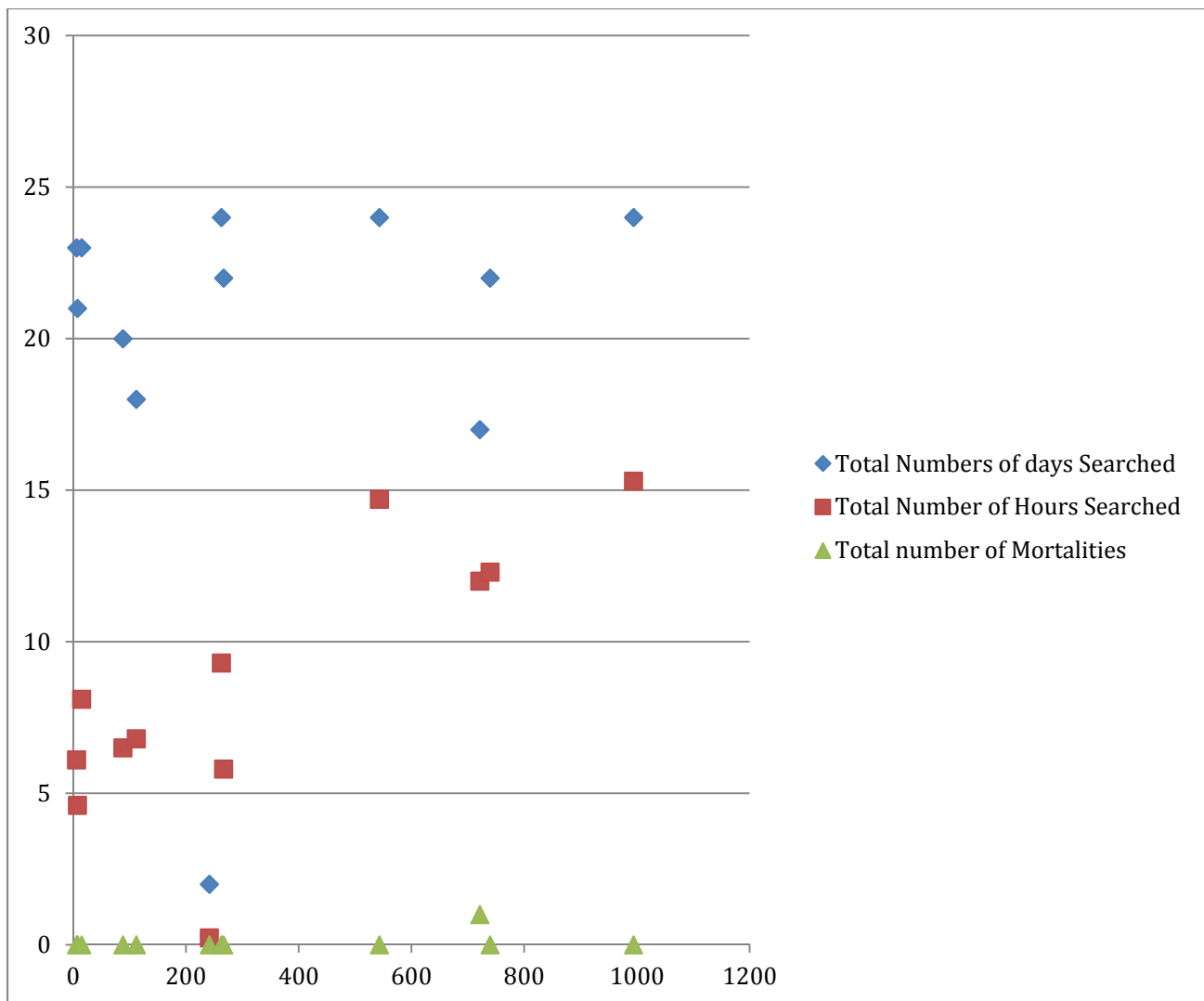
<sup>1</sup> Blue shading: freshwater ponds

\* Ponds not included in the OSBCMP

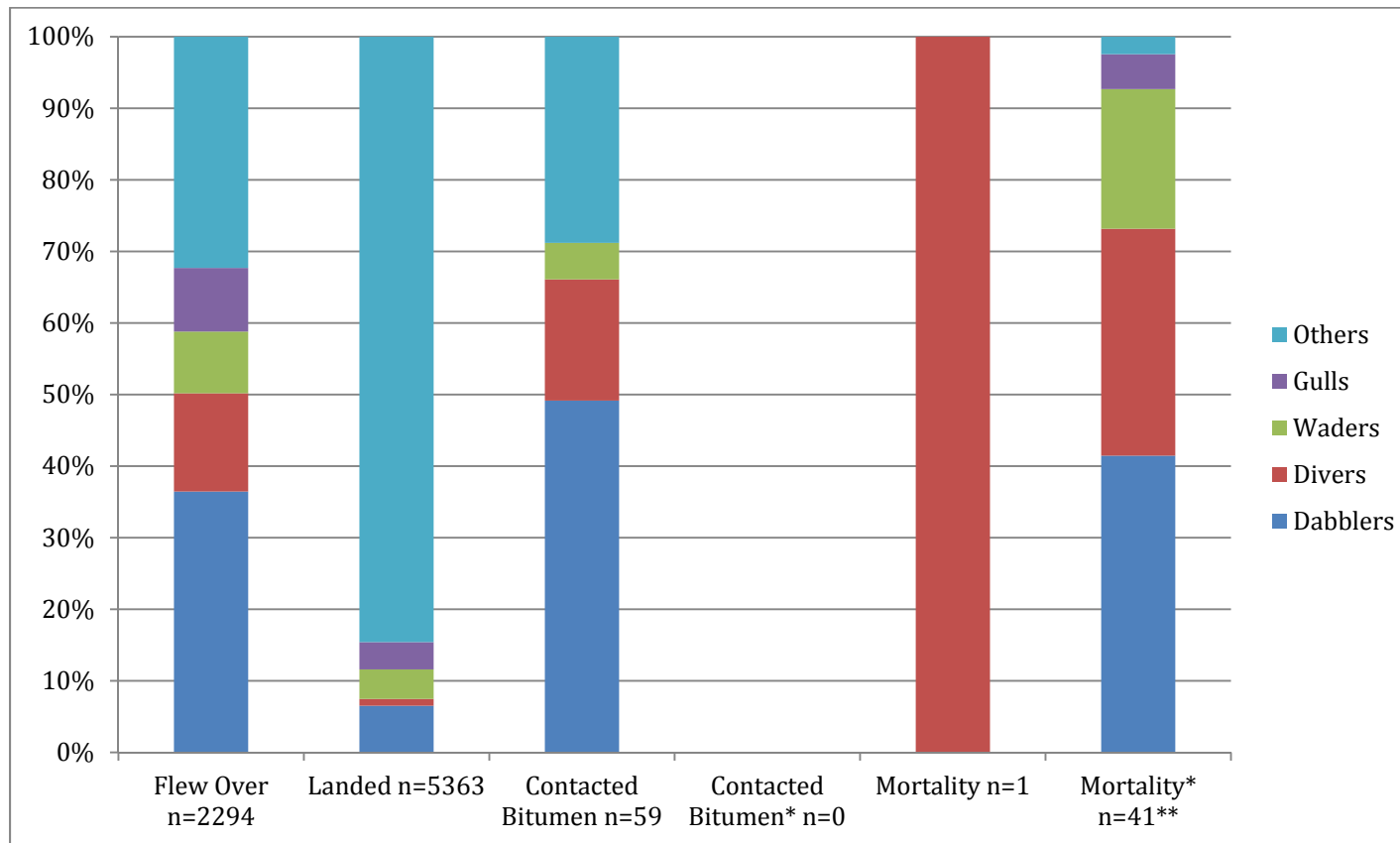
**Table 6.19: Number of observations of oiling and mortalities, by species, at Mildred & Aurora in 2014**

| Species/Species Group       | Contacted Bitumen <sup>1</sup> |            | Mortality        |            |
|-----------------------------|--------------------------------|------------|------------------|------------|
|                             | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>           |                                |            |                  |            |
| Lesser Scaup                | 8                              |            | 1                |            |
| Northern Shoveler           | 8                              |            |                  |            |
| American Wigeon             | 6                              |            |                  | 1          |
| Mallard                     | 5                              |            |                  | 7          |
| Blue-winged Teal            | 5                              |            |                  | 1          |
| American Coot               | 2                              |            |                  | 5          |
| Northern Pintail            | 2                              |            |                  | 1          |
| Gadwall                     | 2                              |            |                  |            |
| Ring-necked Duck            | 2                              |            |                  |            |
| Snow Goose                  | 1                              |            |                  | 2          |
| Great Blue Heron            | 1                              |            |                  |            |
| Unknown Duck                |                                |            |                  | 5          |
| Common Goldeneye            |                                |            |                  | 4          |
| Canada Goose                |                                |            |                  | 3          |
| Long-tailed Duck            |                                |            |                  | 2          |
| Unknown Gull                |                                |            |                  | 2          |
| American White Pelican      |                                |            |                  | 1          |
| Canvasback                  |                                |            |                  | 1          |
| Common Merganser            |                                |            |                  | 1          |
| Eared Grebe                 |                                |            |                  | 1          |
| Greater White-fronted Goose |                                |            |                  | 1          |
| Pied-billed Grebe           |                                |            |                  | 1          |
| Green Winged Teal           |                                |            |                  | 1          |
| Ruddy Duck                  |                                |            |                  | 1          |
| Sandhill Crane              |                                |            |                  | 1          |
| Unknown Shorebird           |                                |            |                  | 1          |
| White-winged Scoter         |                                |            |                  | 1          |
| White- rumped Sandpiper     |                                |            |                  | 1          |
| <b>Non-target Guilds</b>    |                                |            |                  |            |
| Snow Bunting                | 15                             |            |                  |            |
| Common Raven                | 2                              |            |                  | 1          |
| <b>Total</b>                | <b>59</b>                      | <b>0</b>   | <b>1</b>         | <b>46</b>  |

<sup>1</sup> Individual birds may be observed on multiple days or also observed as mortalities, and thus be counted multiple times



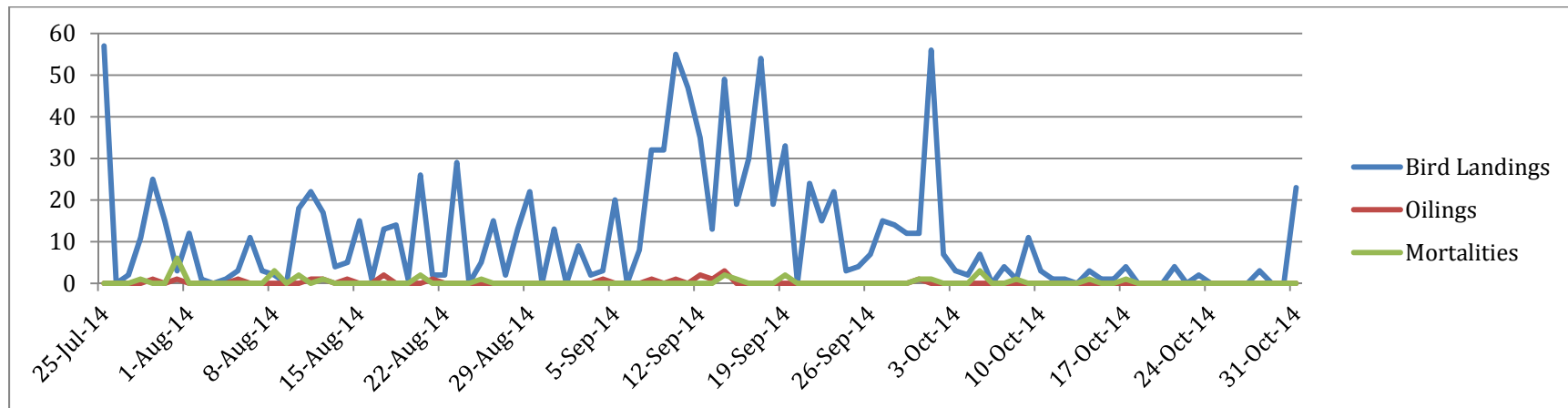
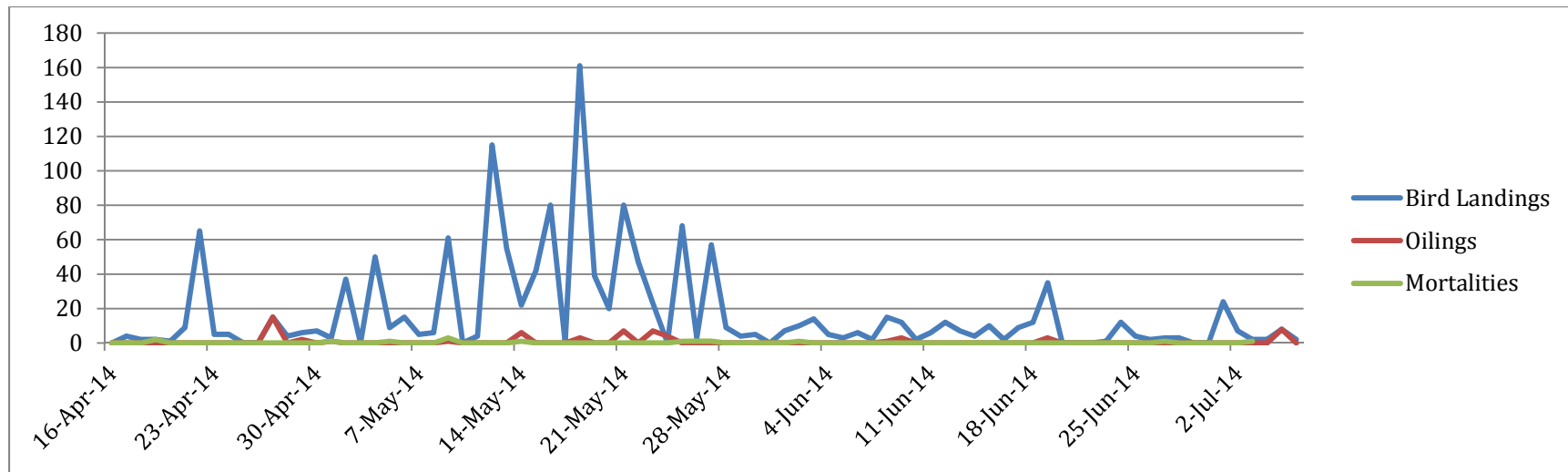
**Figure 6.4: Relationship between pond area (over water in ha), mortality search effort, and mortality search results**



\* Incidental observations

\*\* Excludes 5 unknown ducks

**Figure 6.5: Proportion of each guild for birds that flew over or landed at process-affected ponds, contacted bitumen, or died at Mildred & Aurora in 2014.**



\*Individual birds may be observed repeatedly during consecutive days

**Figure 6.6: Timing of bird landings, oiling, and mortalities in spring (top) and fall (bottom) 2014 at Mildred & Aurora, including freshwater ponds.**

**Table 6.20 Summary of bird survey, mortality and incidental results by pond at Mildred & Aurora in 2014**

| Pond Name <sup>1</sup>            | Pond Area<br>(over water;<br>ha) | Potential Attractants       | % Days with<br>Floating Bitumen Present | Mean # Landed Waterbirds per Survey |             |             |             | # Species Landed   |                                   | # Observations of Oiled Birds |            | # Mortalities    |            |
|-----------------------------------|----------------------------------|-----------------------------|-----------------------------------------|-------------------------------------|-------------|-------------|-------------|--------------------|-----------------------------------|-------------------------------|------------|------------------|------------|
|                                   |                                  |                             |                                         | Dabblers                            | Divers      | Waders      | Gulls       | Total <sup>2</sup> | Conservation Concern <sup>3</sup> | Per Survey                    | Incidental | Mortality Search | Incidental |
| Aurora In-pit                     | 262.86                           | Shore                       | 100                                     | 0.08                                | 0.10        | 0           | 0           | 13                 | 1                                 | 0.007                         | 0          | 0                | 6          |
| Aurora In-pit North               | 87.97                            | Shore                       | 99                                      | 0.01                                | 0.03        | 0           | 0           | 4                  | 0                                 | 0.006                         | 0          | 0                | 0          |
| Aurora North Recycle Water        | 7.50                             | None                        | 68                                      | 0                                   | 0           | 0           | 0           | 4                  | 2                                 | 0                             | 0          | 0                | 0          |
| Aurora Settling Basin             | 543.25                           | Shore                       | 98                                      | 0.08                                | 0.41        | 0.04        | 0.03        | 25                 | 5                                 | 0.013                         | 0          | 0                | 4          |
| Effluent                          | 5.80                             | Shore, perimeter vegetation | 100                                     | 0                                   | 0           | 0           | 0           | 1                  | 0                                 | 0                             | 0          | 0                | 3          |
| East In-pit                       | 111.69                           | Shore                       | 96                                      | 0                                   | 0           | 0           | 0           | 5                  | 1                                 | 0                             | 0          | 0                | 0          |
| Mildred Lake Settling Basin       | 721.15                           | Shore, coke beach           | 100                                     | 0                                   | 0           | 0.30        | 0.38        | 6                  | 1                                 | 0.030                         | 0          | 1                | 7          |
| NMSPW                             | 241.45                           | None                        | 99                                      | 0                                   | 0           | 0           | 0           | 0                  | 0                                 | 0                             | 0          | 0                | 0          |
| Recycle Water                     | 14.82                            | Shore, perimeter vegetation | 100                                     | 0                                   | 0           | 0           | 0           | 5                  | 0                                 | 0.006                         | 0          | 0                | 1          |
| Southwest In-pit                  | 266.66                           | shore                       | 99                                      | <0.01                               | <0.01       | <0.01       | 0.02        | 6                  | 0                                 | 0.003                         | 0          | 0                | 0          |
| Southwest Sands Storage           | 993.97                           | Shore, perimeter vegetation | 99                                      | 0.05                                | 0.07        | 0.08        | 0.02        | 15                 | 3                                 | 0.053                         | 0          | 0                | 6          |
| West In-pit                       | 739.4                            | Perimeter vegetation, cove  | 96                                      | 0.55                                | 0.11        | 0.01        | <0.01       | 30                 | 6                                 | 0.068                         | 0          | 0                | 6          |
| 690 Pumphouse Sump*               | N/A                              | Perimeter vegetation        | N/A                                     | N/A                                 | N/A         | N/A         | N/A         | N/A                | N/A                               | N/A                           | 0          | N/A              | 3          |
| East 45 Sump Sump*                | N/A                              | Perimeter vegetation        | N/A                                     | N/A                                 | N/A         | N/A         | N/A         | N/A                | N/A                               | N/A                           | 0          | N/A              | 10         |
| <b>All Process-affected Ponds</b> | <b>3996.52</b>                   |                             |                                         | <b>0.06</b>                         | <b>0.06</b> | <b>0.04</b> | <b>0.04</b> | <b>54</b>          | <b>12</b>                         | <b>0.016</b>                  | <b>0</b>   | <b>1</b>         | <b>43</b>  |
| Mildred Lake Reservoir            | 156.43                           | Shore, perimeter vegetation | 0                                       | 1.45                                | 1.69        | 0.24        | 1.37        | 39                 | 8                                 | 0                             | 0          | N/A              | 0          |

<sup>1</sup> Blue shading: freshwater pond. <sup>2</sup> During bird surveys. <sup>3</sup> Includes live incidental observations. \* Ponds not included in the OSBCMP.

#### **6.4.5 Species of Conservation Concern**

Throughout the monitoring, 12 species of Conservation Concern were observed landed in process affected water (4) or landed on vegetation on shore/water (8). The 4 species to contact process affected water, Northern Pintail, Green Winged Teal, Horned Grebe and Lesser Scaup, only contacted water a total of 9 times in total over the monitoring season.

6 Species of Special concern were observed as oiled. A Lesser Scaup was found on a focused search mortality search. All others were found incidentally, they include; Sandhill Crane, White winged Scoter, American White Pelican, Pied- Billed Grebe, and a Northern Pintail.

#### **6.5 Discussion**

All process affected ponds had bird deterrents placed on and/or around them at a density specified in the WPP or higher. The freshwater pond, Mildred Lake Reservoir, did not have any bird deterrents placed on or around the pond. Deterrents were moved around the pond areas throughout the season in order to maintain tailings operations.

Throughout the 2014 season, 6,041 birds were observed flying over process affected ponds, while 2,052 birds were observed landing on process water, beaches or vegetation near process water. Of landed birds, dabbling ducks account for 17% of landed species, while diving ducks account for 15%. Gulls and waders are both 10% each of all sightings and non-targets are 36% for the 2014 monitoring season. Unknown ducks make up the remainder. In 2013 monitoring season, dabbling ducks were 11% of all landed observations, diving ducks were 17%, waders were 12% and gulls were grouped in a non-target category at 59%. This data shows similarities from year to year, however some slight variations of data were observed. In 2014, a substantial decrease in non-target species was observed as well as an increase of dabbling ducks. The decrease of non-target bird observations could be due to the inclusion of gull species into the non-target category in 2013 and the removal of gulls from the non-target category to a target species for the 2014 season.

One potential bias for data in the Syncrude program has come to light for one monitoring station located on the coke beach storage area of the MLSB pond. This appears attractive to wader and gull species, and accounts for almost all of MLSB landings (a non-bitumen area). For prior years this station did not contain coke beach within the monitoring radius; the coke beaching encroached over a significant portion of the monitoring radius in 2014. In 2014, there were increased observations of landed waders and gulls on MLSB over the prior year, mostly at Station 3 compared to 2013 observations. In 2013, waders were reported observed landing 19 times at MLSB, compared to 139 waders observed landed in 2014. This could be attributed to the presence of the coke beach storage area that encroached on Station 3 in 2014. The coke beach had a high presence of wader and gull guilds observed landed at this station at 128 observations and 175 observations, respectively. The area surrounding the station it is not a bitumen covered beach, or bitumen mat, it does not pose an immediate threat to oiling. No mortalities were reported from either guild in that location, as can be seen in Appendix 6.D.

Overall monitoring results in 2014 were comparable to 2013 results. Total landed bird observations for 2014 were 2052 on process ponds, and in 2013 there were 1789 observations of birds landed on process affected water. Target species landing on process affected water in 2013 reported 1044 landings, and 1311 in 2014. One significant explanation of this difference in year over year target guild landings comes from observations at the MLSB coke beach storage area. Approximately 300 additional observations of the target guild landings for this monitoring site on MLSB relate to this.

Mortality searches in 2014 were conducted as stated in the OSBCMP plan. Previously in 2013, monitoring was conducted with a much higher frequency. In 2014, with 3140 hours over 139 days of searches, mortality results show 1 bird found using a transect based search method. Almost all oilings reported in this program are found from equipment or tailings operators who are completing work adjacent to a tailings area and happen to observe an oiled bird, not during the structured mortality searches. Incidentally found mortalities accounted for 46 of 47 oiled mortalities reported in the 2014 season and 43 of 47 oiled mortalities in the 2013 season.

Nearly all oiled birds that were recovered from all ponds on both lease sites were found alive and were oiled by more than 50%, with some as much as 90-100% oiled. Most of the oiled birds were reported as incidentals by BET personnel working in the area, or other personnel who work in tailings areas or on the ponds. When reports of birds on process affected ponds are called in to the BET control room, BET personnel are dispatched immediately. They will then assess the bird for guild and oiling level, and then assess the area to determine if it is safe to attempt to haze it by boat (or if it is possible by land). If the bird has no oil, and is a dabbling duck, hazing by boat is preferred, and the BET personnel approach the birds and launch small pyrotechniques. If the ducks do not immediately disperse, then chasing with the boat is initiated, being mindful of bitumen mats and obstructions on ponds, such as booms or deterrents. This continues until the ducks leave the area. If it is a diving duck, hazing is initiated and then stops to allow for the birds to fly away, as opposed to diving, escaping immediate danger. This cycle continues until the bird leaves. If a bird is determined to be oiled, a plan will be formulated to retrieve it.. Some oiled birds are irretrievable when the location is not accessible by boat or by land (e.g. if it is too shallow, or inside a boom).

Oiled bird numbers were similar with prior year's data. For the 2014 monitoring plan period, 47 oiled birds were reported from contact with PA ponds, this is comparable to 44 oiled birds resulting from contact with PA ponds reported in 2013.

The number of oiled bird losses in 2013 at the MLSB pond were 19 in total, the most mortality of the Syncrude process affected ponds for that year. For 2014, the MLSB pond accounted for 8 losses, substantially less than 2013. This appears to be due to shifts in locations of deterrents, and possibly a shift in the beach habitat type causing the area to be less attractive to dabblers and diving ducks.

The pond with the greatest recorded amount of surface bitumen visible was North Mine South-Pit West (NMSPW). This pond was reported by the observers, often to have 50% or more bitumen visible on the surface. The pond is new to the monitoring program this year and is getting a fresh supply of tailings. This pond is expected to be bigger and require more monitoring locations for subsequent monitoring years. There were no recorded landings of any birds on NMSPW for the monitoring season. This could be due to the un-attractiveness of the pond due to deterrents, no vegetation and high levels of activity in the area. No designated mortality searches were completed on the pond. However documented visits

and searches were completed when the pond was serviced for cannons, approximately once every seven days. There were no mortalities reported from NMSPW during the monitoring season.

The numbers of bird contacts with process affected ponds for species of conservation concern were considerably less than observations of their fly overs. For target species, there were 112 observations of flying over process affected ponds, with 29 observations of landed birds in PA ponds. Of non-target species of concern 90 observations were made of landing, with 566 observations of flying over. These species of conservation concern that are on the non-target guild in the program are at a low risk of oiling as they do not frequent water. On the designated focused mortality searches a single bird, a Lesser Scaup, was found (on MLSB).

Some birds that are observed repetitively are thought to be resident species. In particular, ravens, magpies, swallows, sparrows and some gulls are believed to be resident species. Some observations of species were repetitively observed in the same area over a series of days. The same number of birds in the exact same area and in some cases nesting behaviors and actual nests were observed. For example Barn Swallows had built nests on pond barges and dredges which were within the 500m survey radius. These swallows were observed flying around in the beginning of the season with nesting materials, and entering and exiting the same location of the barge. They were continued to be seen most days until presumably the chicks had fledged. These birds were then counted in each observation and counted towards our observed bird results.

Inter-observer variability sessions were completed over the 2014 season. At least two sessions were completed by each observer. For most of the IOVs completed the observers had matching observations; however it should be noted that many of these IOVs were completed without either observer observing any birds. Most differences in species observed were a case of one monitor observing a single bird and the other monitor not observing that same bird. This most commonly occurred with Ravens being observed flying over the survey area and being detected or recorded by one monitor and not by the other.

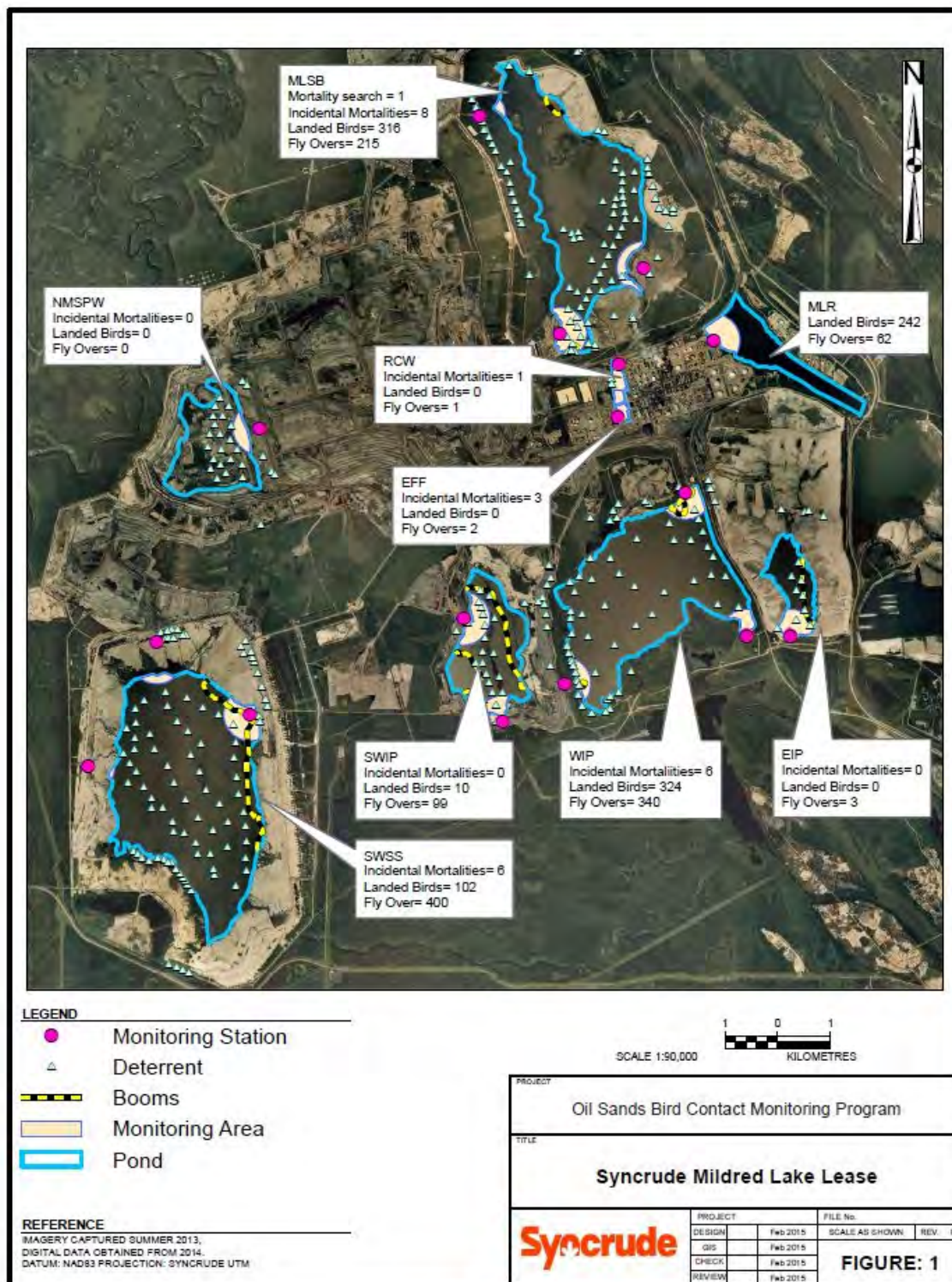
## **6.6 Documents Cited**

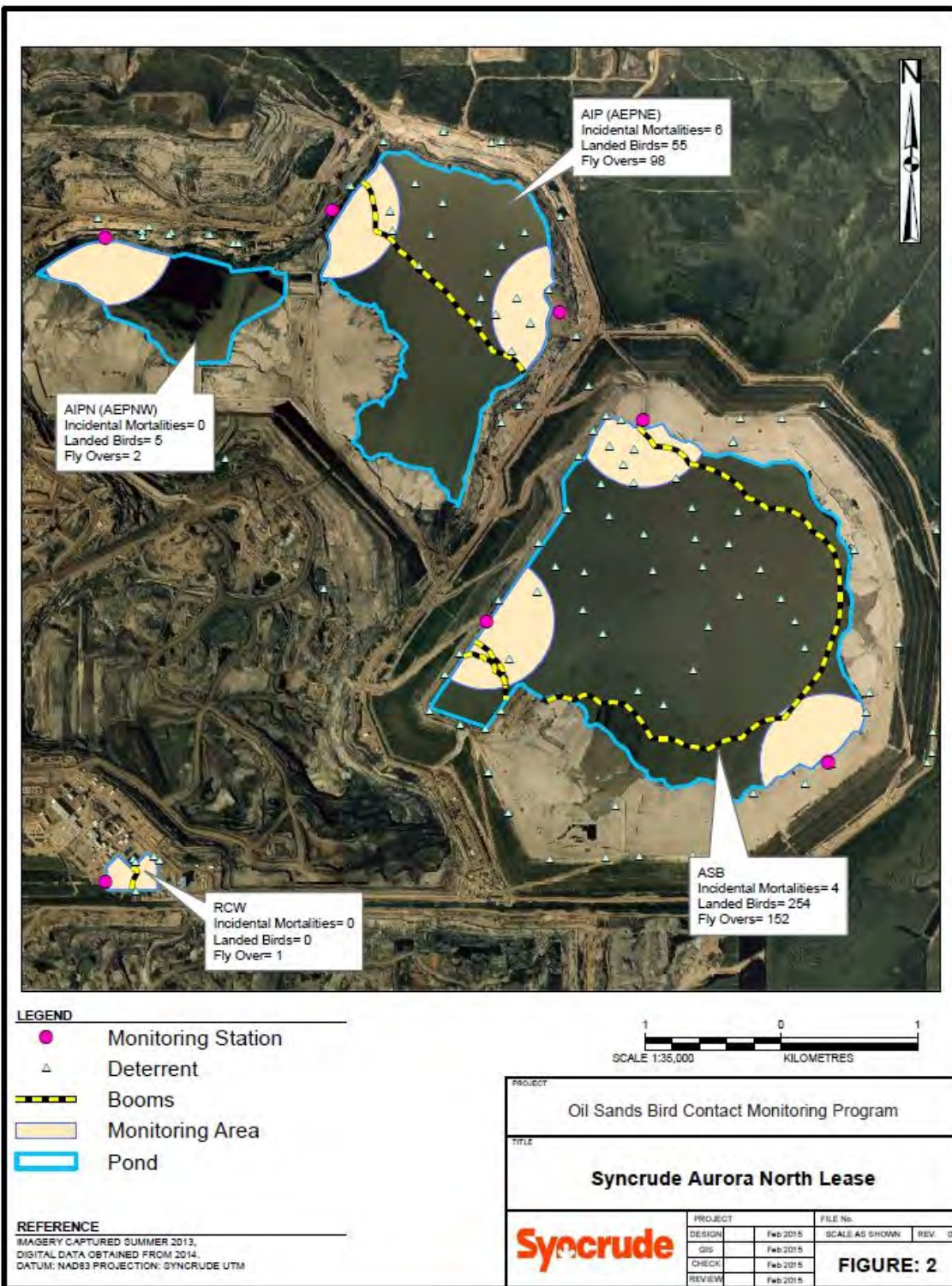
St. Clair CC, Loots S, Ronconi RA (2014)- 2014 Protocol Oil Sands Bird Contact Monitoring Program. Department of Biological Sciences, University of Alberta. Prepared for Oil Sands Operators and Alberta ESRD.

## 6.7 Appendices

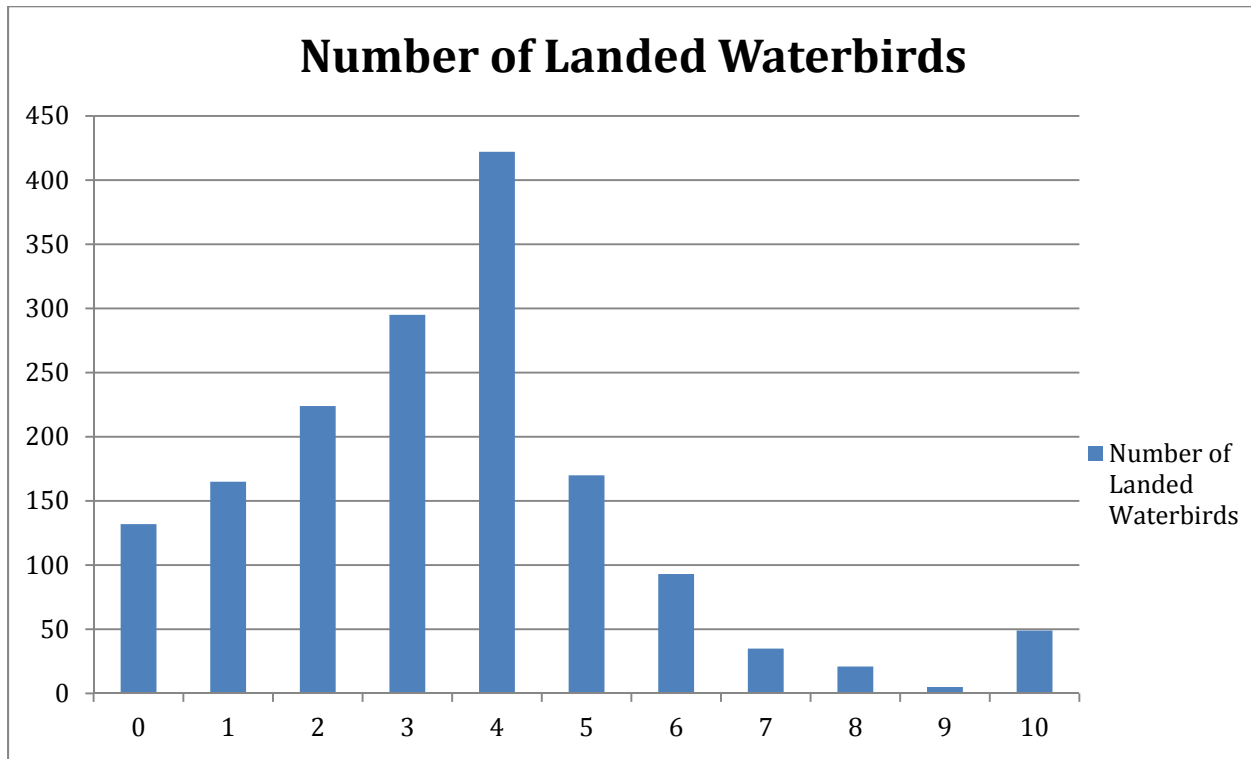
### Appendix 6.A

#### Location of deterrents, containment booms and survey stations at Mildred & Aurora ponds in 2014





**Appendix 6.B: Relationship between the mean number of landed waterbirds per survey and hour after sunrise at Mildred & Aurora in 2014**



**Appendix 6.C: Number of bird observations by species at Mildred & Aurora process-affected ponds in 2014**

| Species/Species Group <sup>1</sup> | Landed <sup>2</sup> |                         | Flew Over <sup>2</sup> | Contacted Bitumen <sup>2</sup> |            | Mortality        |            |
|------------------------------------|---------------------|-------------------------|------------------------|--------------------------------|------------|------------------|------------|
|                                    | Bird Survey         | Incidental <sup>3</sup> | Bird Survey            | Bird Survey                    | Incidental | Mortality Search | Incidental |
| <b>Waterbirds</b>                  |                     |                         |                        |                                |            |                  |            |
| Unknown Duck                       | 245                 |                         | 191                    | 16                             |            |                  | 5          |
| Unknown White-headed Gull          | 129                 |                         | 140                    |                                |            |                  |            |
| Northern Shoveler                  | 102                 |                         | 4                      | 8                              |            |                  |            |
| Unknown Grebe                      | 102                 |                         |                        |                                |            |                  |            |
| Unknown Dabbling Duck              | 82                  |                         | 4                      |                                |            |                  |            |
| Unknown Diving Duck                | 79                  |                         |                        |                                |            |                  |            |
| Mallard                            | 76                  |                         | 38                     | 5                              |            |                  | 7          |
| Unknown Shorebird                  | 75                  |                         | 60                     | 1                              |            |                  | 1          |
| Unknown Plover                     | 70                  |                         | 6                      |                                |            |                  |            |
| Unknown Gull                       | 57                  |                         | 54                     |                                |            |                  | 2          |
| Common Goldeneye                   | 48                  |                         | 34                     |                                |            |                  | 4          |
| Canada Goose                       | 26                  |                         | 658                    |                                |            |                  | 3          |
| Greater White-fronted Goose        | 23                  |                         | 41                     |                                |            |                  | 1          |
| Semipalmated Sandpiper             | 20                  |                         |                        |                                |            |                  |            |
| Unknown Sandpiper                  | 19                  |                         | 39                     |                                |            |                  |            |
| Ring-necked Duck                   | 17                  |                         |                        | 2                              |            |                  |            |
| Bonaparte's Gull                   | 15                  |                         |                        |                                |            |                  |            |
| Lesser Scaup                       | 14                  |                         | 2                      | 8                              |            | 1                |            |
| American Wigeon                    | 14                  |                         |                        | 6                              |            |                  | 1          |
| American Coot                      | 13                  |                         |                        | 2                              |            |                  | 5          |
| Blue-winged Teal                   | 10                  |                         |                        | 5                              |            |                  | 1          |
| Unknown Diver                      | 10                  |                         |                        |                                |            |                  |            |
| Eared Grebe                        | 8                   |                         |                        |                                |            |                  | 1          |
| Cackling Goose                     | 8                   |                         | 8                      |                                |            |                  |            |
| Horned Grebe                       | 8                   |                         |                        |                                |            |                  |            |
| Lesser Yellowlegs                  | 4                   |                         | 4                      |                                |            |                  |            |
| Bufflehead                         | 4                   |                         |                        |                                |            |                  |            |
| Unknown Yellowlegs                 | 4                   |                         |                        |                                |            |                  |            |
| Northern Pintail                   | 3                   |                         |                        | 2                              |            |                  | 1          |
| Barrow's Goldeneye                 | 3                   |                         |                        |                                |            |                  |            |
| Ruddy Duck                         | 3                   |                         |                        |                                |            |                  |            |
| Gadwall                            | 2                   |                         |                        | 2                              |            |                  |            |
| Common Loon                        | 2                   |                         | 6                      |                                |            |                  |            |
| Greater Scaup                      | 2                   |                         |                        |                                |            |                  |            |
| Green-winged Teal                  | 2                   |                         |                        |                                |            |                  |            |
| Herring Gull                       | 2                   |                         |                        |                                |            |                  |            |
| Semipalmated Plover                | 2                   |                         |                        |                                |            |                  |            |
| Unknown Scaup                      | 2                   |                         |                        |                                |            |                  |            |
| Snow Goose                         | 1                   |                         | 11                     | 1                              |            |                  | 2          |
| Unknown Black-headed Gull          | 1                   |                         | 8                      | 1                              |            |                  |            |
| Sandhill Crane                     | 1                   |                         | 38                     |                                |            |                  | 1          |
| Piping Plover                      | 1                   |                         | 2                      |                                |            |                  |            |
| Solitary Sandpiper                 | 1                   |                         |                        |                                |            |                  |            |
| White-rumped Sandpiper             | 1                   |                         |                        |                                |            |                  |            |
| Great Blue Heron                   |                     |                         | 68                     | 1                              |            |                  |            |
| Long-tailed Duck                   |                     |                         |                        |                                |            |                  | 2          |
| American White Pelican             |                     |                         |                        |                                |            |                  | 1          |
| Canvasback                         |                     |                         |                        |                                |            |                  | 1          |

|                            |     |  |      |    |  |  |   |
|----------------------------|-----|--|------|----|--|--|---|
| Common Merganser           |     |  |      |    |  |  | 1 |
| Pied-billed Grebe          |     |  |      |    |  |  | 1 |
| White-winged Scoter        |     |  |      |    |  |  | 1 |
| Unknown Goose              |     |  | 34   |    |  |  |   |
| Unknown Swan               |     |  | 28   |    |  |  |   |
| Unknown Dabbler            |     |  | 10   |    |  |  |   |
| Double-crested Cormorant   |     |  | 6    |    |  |  |   |
| Unknown Tern               |     |  | 3    |    |  |  |   |
| American Bittern           |     |  | 2    |    |  |  |   |
| Franklin's Gull            |     |  | 1    |    |  |  |   |
| Killdeer                   |     |  | 1    |    |  |  |   |
| Ring-billed Gull           |     |  | 1    |    |  |  |   |
| Unknown Calidris Sandpiper |     |  | 1    |    |  |  |   |
| Unknown Wader              |     |  | 1    |    |  |  |   |
| <b>Non-target Guilds</b>   |     |  |      |    |  |  |   |
| Common Raven               | 156 |  | 664  | 2  |  |  | 1 |
| Unknown Swallow            | 94  |  | 1143 | 6  |  |  |   |
| Barn Swallow               | 74  |  | 184  |    |  |  |   |
| American Pipit             | 73  |  | 221  |    |  |  |   |
| Snow Bunting               | 55  |  | 531  | 15 |  |  |   |
| Black-billed Magpie        | 49  |  | 157  |    |  |  |   |
| Red-winged Blackbird       | 35  |  | 128  |    |  |  |   |
| Unknown Sparrow            | 34  |  | 85   |    |  |  |   |
| American Crow              | 31  |  | 163  |    |  |  |   |
| Unknown Passerine          | 20  |  | 478  |    |  |  |   |
| Clay-colored Sparrow       | 16  |  | 11   |    |  |  |   |
| Cliff Swallow              | 15  |  | 119  |    |  |  |   |
| Horned Lark                | 14  |  | 10   |    |  |  |   |
| Song Sparrow               | 14  |  | 2    |    |  |  |   |
| Brewer's Blackbird         | 11  |  | 14   |    |  |  |   |
| American Robin             | 8   |  | 1    |    |  |  |   |
| Ruffed Grouse              | 7   |  | 1    |    |  |  | 1 |
| Sharp-tailed Grouse        | 7   |  | 7    |    |  |  |   |
| Unknown Pecking Bird       | 5   |  | 18   |    |  |  |   |
| American Kestrel           | 4   |  | 56   |    |  |  |   |
| Tree Swallow               | 4   |  | 19   |    |  |  |   |
| Savannah Sparrow           | 4   |  | 3    |    |  |  |   |
| Northern Harrier           | 3   |  | 36   |    |  |  |   |
| White-throated Sparrow     | 3   |  |      |    |  |  |   |
| Unknown Gleaner            | 2   |  | 100  |    |  |  |   |
| Bank Swallow               | 1   |  | 282  |    |  |  |   |
| Merlin                     | 1   |  | 1    |    |  |  |   |
| Canada Warbler             | 1   |  |      |    |  |  |   |
| Unknown Blackbird          |     |  | 78   |    |  |  |   |
| European Starling          |     |  | 9    |    |  |  |   |
| Unknown Raptor             |     |  | 6    |    |  |  |   |
| Northern Flicker           |     |  | 4    |    |  |  |   |
| Black-capped Chickadee     |     |  | 2    |    |  |  |   |
| Blackpoll Warbler          |     |  | 2    |    |  |  |   |
| Golden Eagle               |     |  | 1    |    |  |  |   |
| Snowy Owl                  |     |  | 1    |    |  |  |   |

<sup>1</sup> Pink shading: Species of Conservation Concern

<sup>2</sup> Individual birds may be observed on multiple days and thus be counted multiple times

<sup>3</sup> Only for Species of Conservation Concern

**Appendix 6.D: Bird mortality events at Mildred & Aurora in April–October 2014**

| Date   | Species/Species Group  | Pond Name (Survey Station ID) | Location Description | % Oiled | Outcome                      | Context of Detection        | Method of Detection | Potential Reason for Mortality/Oiling |
|--------|------------------------|-------------------------------|----------------------|---------|------------------------------|-----------------------------|---------------------|---------------------------------------|
| 19-Apr | Common Goldeneye       | Effluent Pond                 | Unknown              | 100     | Found Dead                   | Reported by workers in area | Boat                | Unknown                               |
| 19-Apr | Common Goldeneye       | Effluent Pond                 | Unknown              | 100     | Captured and euthanized      | Reported by workers in area | Boat                | Unknown                               |
| 1-May  | Northern Pintail       | MLSB                          | North end of pond    | 80      | Captured and euthanized      | Reported by workers in area | Boat                | Unknown                               |
| 5-May  | Canvasback             | MLSB                          | North end of pond    | 100     | Captured and euthanized      | Reported by workers in area | Boat                | Unknown                               |
| 9-May  | American Wigeon        | SWSS                          | Near boat dock       | 60      | Captured and euthanized      | Reported by workers in area | Foot                | Unknown                               |
| 9-May  | Long Tailed Duck       | MLSB                          | North end of pond    | 100     | Reported, unable to retrieve | Reported by workers in area | Truck               | Unknown                               |
| 9-May  | Long Tailed Duck       | MLSB                          | North end of pond    | 70      | Captured and euthanized      | Reported by workers in area | Boat                | Unknown                               |
| 14-May | White Rumped Sandpiper | ASB                           | NW corner            | 100     | Found Dead                   | Reported by workers in area | Boat                | Unknown                               |
| 25-May | Common Goldeneye       | AEPNE                         | Floating on surface  | 100     | Captured and euthanized      | Reported by workers in area | boat                | Unknown                               |
| 26-May | American Coot          | AEPNE                         | On Shore             | 80      | Captured and euthanized      | Reported by workers in area | On foot             | Unknown                               |
| 27-May | Green Winged Teal      | MLSB                          | Near Q-Pit           | 10      | Found Dead                   | Reported by workers in area | Truck               | Unknown                               |
| 2-Jun  | Eared Grebe            | AEPNE                         | Unknown              | 90      | Captured and euthanized      | Reported by workers in area | Boat                | Unknown                               |
| 27-Jun | Blue Winged Teal       | ASB                           | SE Corner            | 80      | Captured and euthanized      | Reported by workers in area | On Foot             | Unknown                               |
| 2-Jul  | Sandhill Crane         | SWSS                          | On shore             | 50      | Captured and euthanized      | Reported by workers in area | Truck               | Unknown                               |
| 3-Jul  | Raven                  | SWSS                          | Unknown              | 60      | Captured and euthanized      | Reported by workers in area | On Foot             | Unknown                               |
| 5-Jul  | Unknown duck           | 690 Sump                      | Unknown              | 90      | Captured and euthanized      | Reported by workers in area | Truck               | Unknown                               |

**Appendix 6.D: Bird mortality events at Mildred & Aurora in April–October 2014 (Continued)**

| Date   | Species/Species Group | Pond Name (Survey Station ID) | Location Description | % Oiled | Outcome                 | Context of Detection        | Method of Detection | Potential Reason for Mortality/Oiling |
|--------|-----------------------|-------------------------------|----------------------|---------|-------------------------|-----------------------------|---------------------|---------------------------------------|
| 5-Jul  | Unknown duck          | 690 Sump                      | Unknown              | 90      | Captured and euthanized | Reported by workers in area | Truck               | Unknown                               |
| 5-Jul  | Unknown duck          | 690 Sump                      | Unknown              | 90      | Captured and euthanized | Reported by workers in area | Truck               | Unknown                               |
| 28-Jul | American Pelican      | ASB                           | Unknown              | 98      | Captured and euthanized | Reported by workers in area | Boat                | Unknown                               |
| 31-Jul | Mallard               | 45 Dump Sump                  | Unknown              | 100     | Found Dead              | Reported by workers in area | Truck               | Unknown                               |
| 31-Jul | Mallard               | 45 Dump Sump                  | Unknown              | 100     | Found Dead              | Reported by workers in area | Truck               | Unknown                               |
| 31-Jul | Mallard               | 45 Dump Sump                  | Unknown              | 100     | Found Dead              | Reported by workers in area | Truck               | Unknown                               |
| 31-Jul | Mallard               | 45 Dump Sump                  | Unknown              | 100     | Found Dead              | Reported by workers in area | Truck               | Unknown                               |
| 31-Jul | Mallard               | 45 Dump Sump                  | Unknown              | 100     | Captured and euthanized | Reported by workers in area | Truck               | Unknown                               |
| 31-Jul | Unknown shorebird     | 45 Dump Sump                  | Unknown              | 100     | Captured and euthanized | Reported by workers in area | Truck               | Unknown                               |
| 8-Aug  | Canada Goose          | SWSS                          | Seepage pond         | 70      | Unable to retrieve      | Reported by workers in area | Truck               | Unknown                               |
| 8-Aug  | Canada Goose          | SWSS                          | Seepage pond         | 50      | Unable to retrieve      | Reported by workers in area | Truck               | Unknown                               |
| 8-Aug  | Canada Goose          | SWSS                          | Seepage pond         | 50      | Unable to retrieve      | Reported by workers in area | Truck               | Unknown                               |
| 10-Aug | Mallard               | 45 Dump Sump                  | Unknown              | 100     | Captured and euthanized | Reported by workers in area | Truck               | Unknown                               |
| 10-Aug | Mallard               | 45 Dump Sump                  | Unknown              | 100     | Captured and euthanized | Reported by workers in area | Truck               | Unknown                               |
| 12-Aug | White Winged Scoter   | RCW                           | Shore                | 100     | Captured and euthanized | During bird survey          | Binoculars          | Unknown                               |

**Appendix 6.D: Bird mortality events at Mildred & Aurora in April–October 2014 (Continued)**

| Date   | Species/Species Group       | Pond Name (Survey Station ID) | Location Description    | % Oiled | Outcome                 | Context of Detection        | Method of Detection | Potential Reason for Mortality/Oiling |
|--------|-----------------------------|-------------------------------|-------------------------|---------|-------------------------|-----------------------------|---------------------|---------------------------------------|
| 20-Aug | Unknown duck                | 45 Dump Sump                  | Unknown                 | 97      | Captured and euthanized | Reported by workers in area | Truck               | Unknown                               |
| 20-Aug | Unknown duck                | 45 Dump Sump                  | Unknown                 | 100     | Found dead              | Reported by workers in area | Truck               | Unknown                               |
| 25-Aug | Pied Billed Grebe           | Effluent pond                 | North side              | 100     | Captured and euthanized | Reported by workers in area | On Foot             | Unknown                               |
| 14-Sep | Unknown gull                | AEPNE                         | AIP 2                   | 100     | Captured and euthanized | During Bird Survey          | Binoculars          | Unknown                               |
| 14-Sep | Unknown gull                | AEPNE                         | AIP 2                   | 100     | Captured and euthanized | During Bird Survey          | Binoculars          | Unknown                               |
| 15-Sep | Ruddy Duck                  | WIP                           | In cove                 | 70      | Captured and euthanized | During Bird Survey          | Binoculars          | Unknown                               |
| 19-Sep | Greater White-Fronted Goose | AEPNE                         | On shore                | 90      | Captured and euthanized | Reported by workers in area | On foot             | Unknown                               |
| 19-Sep | Snow Goose                  | MLSB                          | On roadway near pond    | 60      | Captured and euthanized | Reported by workers in area | Truck               | Unknown                               |
| 30-Sep | Snow Goose                  | ASB                           | Floating on surface     | 40      | Captured and euthanized | During Bird Survey          | Binoculars          | Unknown                               |
| 1-Oct  | Lesser Scaup                | MLSB                          | On shore near boat dock | 100     | Captured and euthanized | Reported by workers in area | Boat                | Unknown                               |
| 5-Oct  | American Coot               | WIP                           | On shore                | 100     | Captured and euthanized | Reported by workers in area | On foot             | Unknown                               |
| 5-Oct  | American Coot               | WIP                           | On shore                | 100     | Captured and euthanized | Reported by workers in area | On foot             | Unknown                               |
| 5-Oct  | American Coot               | WIP                           | On shore                | 100     | Captured and euthanized | Reported by workers in area | On foot             | Unknown                               |
| 8-Oct  | Common Goldeneye            | WIP                           | On road near pond       | 30      | Captured and euthanized | Reported by workers in area | On foot             | Unknown                               |
| 14-Oct | Common Merganser            | MLSB                          | East shore              | 70      | Captured and euthanized | Reported by workers in area | On foot             | Unknown                               |
| 17-Oct | American Coot               | WIP                           | North end               | 100     | Captured and euthanized | Reported by workers in area | Boat                | Unknown                               |

### Appendix 6.E: Incidental bird oiling and mortality events at Mildred & Aurora post-monitoring program (after Oct 31, 2014)

Subsequent to the end of the 2014 Monitoring Program, losses were incurred and are documented below. There were 79 total losses from Nov 4 to 7th 2014. Of these losses, 4 were found dead, and 75 were found alive. Permission was sought and received from the Alberta Government to euthanize those 75 oiled birds found alive. Bird losses occurred at 3 ponds; West In-Pit (74 losses), North Mine South Pit- West (1 loss), and Aurora East Pit- Northeast (4 losses). Species that were found oiled stemming from this period were Lesser Scaup (66 mortalities), American Coot (7 mortalities), Gadwall (1 mortality), Mallard (2 mortalities), Red-Necked Grebe (1 mortality) Canvasback (1 mortality) and an Unknown species (1 mortality). Birds were recovered over 4 days, November 4<sup>th</sup> -7<sup>th</sup>. No more birds were recovered after the 7<sup>th</sup>, even with extensive searches of ponds for the next 3 days. The loss breakdown is as follows, on November 4<sup>th</sup> seven birds were recovered, on November 5<sup>th</sup> thirty-one birds recovered, on November 6<sup>th</sup> thirty-three birds recovered, and on November 7<sup>th</sup> eight birds recovered.

| Date Bird Found | Time     | Pond | Species       | Bird State           |
|-----------------|----------|------|---------------|----------------------|
| 4-Nov           | 1720 hrs | WIP  | American Coot | Alive, 90-100% oiled |
| 4-Nov           | 1720 hrs | WIP  | American Coot | Alive, 90-100% oiled |
| 4-Nov           | 1720 hrs | WIP  | Lesser Scaup  | Alive, 90-100% oiled |
| 4-Nov           | 1720 hrs | WIP  | Lesser Scaup  | Alive, 90-100% oiled |
| 4-Nov           | 1720 hrs | WIP  | Lesser Scaup  | Alive, 90-100% oiled |
| 4-Nov           | 1720 hrs | WIP  | Lesser Scaup  | Alive, 90-100% oiled |
| 4-Nov           | 1720 hrs | WIP  | Lesser Scaup  | Alive, 90-100% oiled |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1240 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1320 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1320 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1320 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1320 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1355 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1355 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1355 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1355 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1355 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1355 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1355 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1355 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1520 hrs | WIP  | Lesser Scaup  | Dead 90-100% Oiled   |
| 5-Nov           | 1520 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |
| 5-Nov           | 1520 hrs | WIP  | Lesser Scaup  | Alive 90-100% Oiled  |

**Appendix 6.E: Incidental bird oiling and mortality events at Mildred & Aurora post-monitoring program (after Oct 31, 2014) (Continued)**

| Date Bird Found | Time     | Pond  | Species          | Bird State          |
|-----------------|----------|-------|------------------|---------------------|
| 5-Nov           | 1520 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 5-Nov           | 1520 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 5-Nov           | 1520 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 5-Nov           | 1520 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 5-Nov           | 1650 hrs | WIP   | American Coot    | Alive 90-100% Oiled |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Dead 90-100% Oiled  |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Dead 90-100% Oiled  |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Dead 90-100% Oiled  |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 0955 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1020 hrs | NMSPW | American Coot    | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | American Coot    | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | American Coot    | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | American Coot    | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | American Coot    | Alive 90-100% Oiled |
| 6-Nov           | 1200 hrs | WIP   | Gadwall          | Alive 90-100% Oiled |
| 6-Nov           | 1150 hrs | AEPNE | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1150 hrs | AEPNE | Mallard          | Alive 90-100% Oiled |
| 6-Nov           | 1150 hrs | AEPNE | Mallard          | Alive 90-100% Oiled |
| 6-Nov           | 1150 hrs | AEPNE | Unknown Duck     | Alive 90-100% Oiled |
| 6-Nov           | 1615 hrs | WIP   | Red Necked Grebe | Alive 90-100% Oiled |
| 6-Nov           | 1615 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1615 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1615 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1615 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1640 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 6-Nov           | 1640 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 7-Nov           | 1100 hrs | WIP   | Lesser Scaup     | Dead 90-100% Oiled  |
| 7-Nov           | 1100 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 7-Nov           | 1100 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 7-Nov           | 1100 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 7-Nov           | 1610 hrs | WIP   | Canvasback       | Alive 40% Oiled     |
| 7-Nov           | 1610 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 7-Nov           | 1610 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |
| 7-Nov           | 1610 hrs | WIP   | Lesser Scaup     | Alive 90-100% Oiled |



**OIL SANDS BIRD CONTACT MONITORING PROGRAM  
2014 ANNUAL REPORT**

**7. REGIONAL DISCUSSION**

**Prepared for:**

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

**March 13, 2015**

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## 7.0 REGIONAL RESULTS AND DISCUSSION

### 7.1 Bird Surveys, Oiled Bird Observations, and Avian Mortalities

#### 7.1.1 Bird Surveys

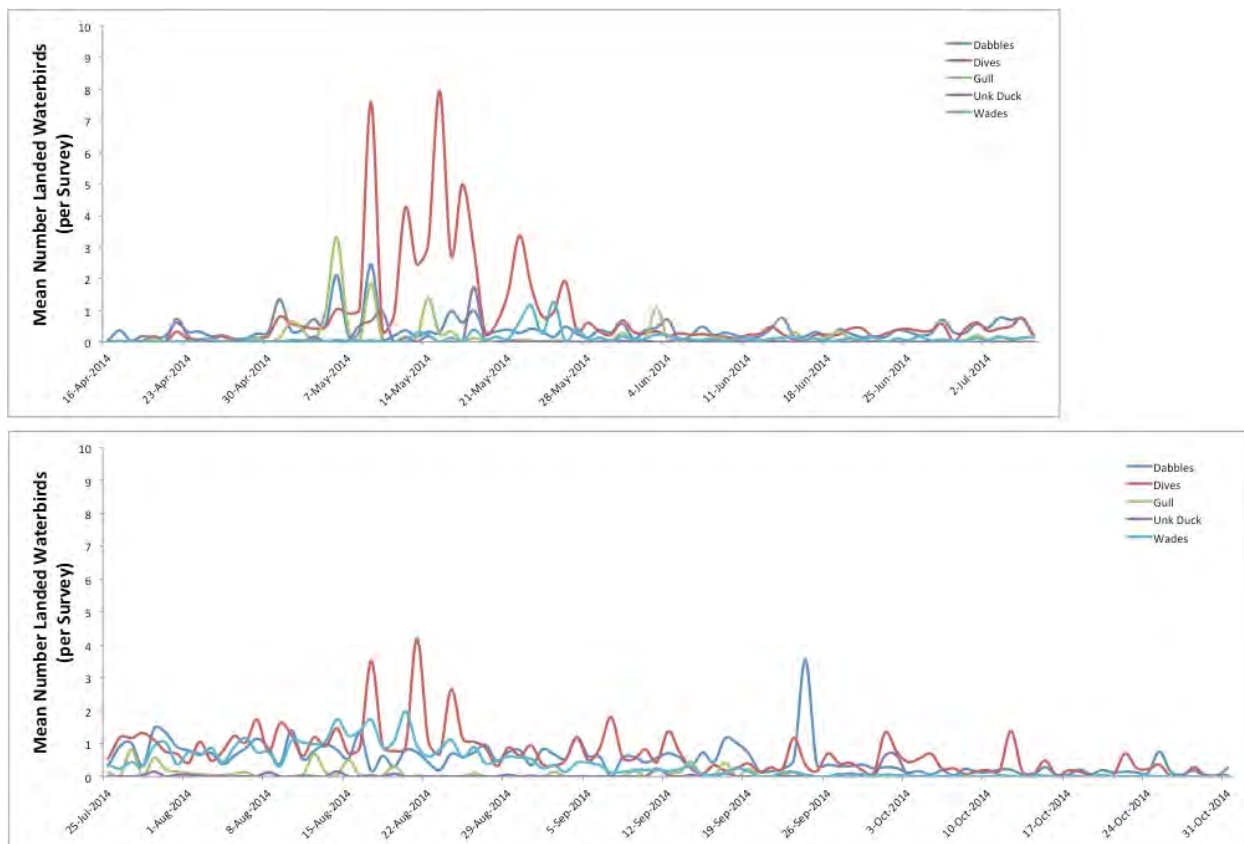
There was a total of 51,049 bird observations in the 2014 OSBCMP, 24,858 of which were landed within, and 26,191 were observed flying over (within 100 m altitude) the survey areas (Table 7.1). Observations of bird contacts were elevated in May, concurrent with the expectation of spring migration activity (Figure 7.1, top panel). However, there is little to no indication of a peak of observations in the fall migration period (Figure 7.1, bottom panel). Comparisons, including those among sites and between process-affected and freshwater ponds, are limited to qualitative commentary, as none of the data in Table 7.1 are normalized for effort.

**Table 7.1: Observations of Landed Birds in, and Birds Flying over, Survey Areas during the 2014 Oil Sands Bird Contact Monitoring Program\***

| Operator                 | Pond Type        | Target Guilds |        |           |       |       |        | Non-target Guilds | Total  | Site Total |
|--------------------------|------------------|---------------|--------|-----------|-------|-------|--------|-------------------|--------|------------|
|                          |                  | Dabbles       | Dives  | Unk. Duck | Wades | Gull  | Total  |                   |        |            |
| Landed Bird Observations |                  |               |        |           |       |       |        |                   |        |            |
| Canadian Natural         | Process-affected | 1,959         | 2,633  | 130       | 1,564 | 125   | 6,411  | 534               | 6,945  | 7,965      |
|                          | Freshwater       | 266           | 575    | 9         | 39    | 98    | 981    | 39                | 1,020  |            |
| Imperial                 | Process-affected | 113           | 509    | 92        | 571   | 196   | 1,481  | 586               | 2,067  | 3,828      |
|                          | Freshwater       | 406           | 421    | 56        | 150   | 190   | 1,223  | 538               | 1,761  |            |
| Shell                    | Process-affected | 202           | 808    | 8         | 659   | 126   | 1,803  | 259               | 2,062  | 2,497      |
|                          | Freshwater       | 232           | 153    | 0         | 3     | 25    | 413    | 22                | 435    |            |
| Suncor                   | Process-affected | 2,246         | 2,731  | 7         | 304   | 17    | 5,305  | 134               | 5,439  | 8,069      |
|                          | Freshwater       | 346           | 1,752  | 0         | 0     | 491   | 2,589  | 41                | 2,630  |            |
| Syncrude                 | Process-affected | 349           | 315    | 245       | 198   | 204   | 1,311  | 741               | 2,052  | 2,499      |
|                          | Freshwater       | 74            | 86     | 58        | 12    | 70    | 300    | 147               | 447    |            |
| Total Landed Birds       | Process-affected | 4,869         | 6,996  | 482       | 3,296 | 668   | 16,311 | 2,254             | 18,565 | 24,858     |
|                          | Freshwater       | 1,324         | 2,987  | 123       | 198   | 874   | 5,506  | 787               | 6,293  |            |
| Flyover Observations     |                  |               |        |           |       |       |        |                   |        |            |
| Canadian Natural         | Process-affected | 961           | 25     | 288       | 635   | 60    | 1,969  | 4,208             | 6,177  | 6,477      |
|                          | Freshwater       | 140           | 9      | 8         | 2     | 16    | 175    | 125               | 300    |            |
| Imperial                 | Process-affected | 2,608         | 61     | 44        | 202   | 229   | 3,144  | 2,380             | 5,524  | 6,716      |
|                          | Freshwater       | 278           | 16     | 53        | 49    | 68    | 464    | 728               | 1,192  |            |
| Shell                    | Process-affected | 1,271         | 92     | 23        | 752   | 172   | 2,310  | 1,256             | 3,566  | 3,759      |
|                          | Freshwater       | 81            | 28     | 1         | 23    | 16    | 149    | 44                | 193    |            |
| Suncor                   | Process-affected | 482           | 39     | 95        | 33    | 242   | 891    | 1,135             | 2,026  | 2,328      |
|                          | Freshwater       | 9             | 129    | 0         | 4     | 60    | 202    | 100               | 302    |            |
| Syncrude                 | Process-affected | 836           | 51     | 191       | 222   | 204   | 1,504  | 4,537             | 6,041  | 6,911      |
|                          | Freshwater       | 19            | 10     | 44        | 3     | 30    | 106    | 764               | 870    |            |
| Total Flyovers           | Process-affected | 6,158         | 268    | 641       | 1,844 | 907   | 9,818  | 13,516            | 23,334 | 26,191     |
|                          | Freshwater       | 527           | 192    | 106       | 81    | 190   | 1,096  | 1,761             | 2,857  |            |
| Totals                   |                  | 12,878        | 10,443 | 1,352     | 5,419 | 2,639 | 32,731 | 15,277            | 51,049 |            |

**Note:**

\* Observations are not corrected for survey effort.



**Figure 7.1: The Timing of Landings of Birds of the Target Guilds in the Spring (Top Panel) and Fall (Bottom Panel) Migration Seasons**

Bird observation numbers are highly variable across the sites, for both landed bird and flyover observations. This variation can be partially removed by normalizing for survey effort. The mean numbers of landed bird observations during bird surveys at each of process-affected and freshwater ponds at each site is presented in Table 7.2.

**Table 7.2: Mean Number of Landed Birds (per Survey) at Process-affected and Freshwater Ponds during the Oil Sands Bird Contact Monitoring Program in 2014**

| Operator         | Mean Number of Landed Birds (per survey) |                  |
|------------------|------------------------------------------|------------------|
|                  | Process-affected Ponds                   | Freshwater Ponds |
| Canadian Natural | 2.26                                     | 19.62            |
| Imperial Oil     | 0.60                                     | 8.72             |
| Shell            | 1.08                                     | 8.37             |
| Suncor           | 1.99                                     | 22.14            |
| Syncrude         | 0.41                                     | 8.76             |
| <b>Average</b>   | <b>1.27</b>                              | <b>13.52</b>     |

Differences in process-affected pond characteristics among sites are also likely responsible for the differences in landed bird numbers per survey, ranging from 0.41 at Syncrude to 2.26 at Canadian Natural. More landed birds per survey were observed at freshwater ponds than at process-affected ponds, an approximate 10-fold difference likely indicative of the greater presence of attractive habitat at freshwater ponds, and possibly, an effect of deterrent systems on process-affected ponds. The magnitude of the difference varied among sites, from an 8-fold difference (Shell) to a 21-fold difference at Syncrude. Such differences are likely attributable to a number of factors related to specific pond characteristics (both process-affected and freshwater) and the locations established for survey stations at the ponds, and deterrent placement relative to survey station location at process-affected ponds, among others.

Dabbling and diving ducks were nearly equally represented in the dataset (25% and 20% of observations, respectively), with 3% of observations being of ducks not identified to guild (Table 7.1). Waders (11%) and gulls (5%) comprise the remainder of the observations associated with target guilds. Non-target guild observations represent 30% of the total number of observations in the 2014 database.

After normalization for survey effort, observations at freshwater ponds (74 landed birds and 33 flyovers per survey, respectively) were higher than observed at process-affected ponds (23 landed birds and 29 flyovers per survey, respectively). It's likely that the magnitude of the difference between pond types would be larger with the removal of small process-affected pond data from the comparison, such that bird observations at freshwater compensation lakes were compared more directly to those obtained at the tailings ponds.

Of the 51,049 bird observations across all sites, 5,728 (11% of observations) were of birds of species of conservation concern (Table 7.3). Of the 2,130 observations of landed species of conservation concern, 1,896 (89.0%) were species in the target guilds. Within the 3,598 observations of flyover species of conservation concern, 350 (9.7%) were species in the target guilds. Bank Swallows (564 observations) and Barn Swallows (2,446 observations) together represented the majority (3,010 flyover observations, 83.7% of the total) of the species of conservation concern flyover observations in 2014. A focus on landed birds appropriately captures observations of species of concern at risk of oiling as a consequence of contact with process-affected ponds. Flyover data contain far fewer observations of species of conservation concern.

**Table 7.3: Species of Conservation Concern Observations during Bird Surveys in 2014**

| Observation Type | Total Observations | Target Guild |             |
|------------------|--------------------|--------------|-------------|
|                  |                    | Total        | %           |
| Landed           | 2,130              | 1,896        | <b>89.0</b> |
| Flyover          | 3,598              | 350          | <b>9.7</b>  |
| Totals           | 5,728              | 2,246        | <b>39.2</b> |

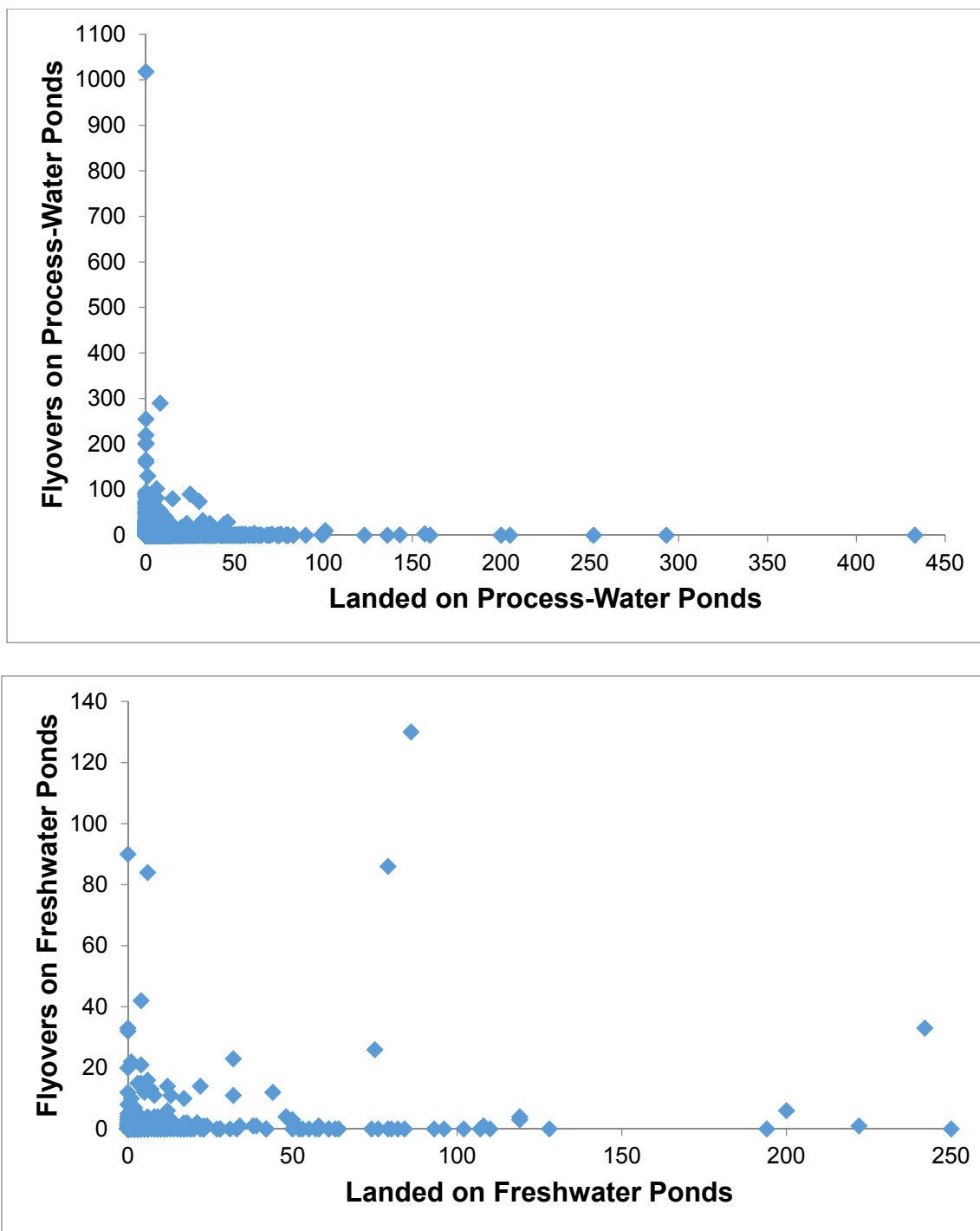
### 7.1.2 Relationship between Landed and Flyover Bird Survey Observations

Flyover data has been collected in the monitoring program assuming a relationship exists between the numbers of birds flying over ponds and the numbers of birds landed, that flyovers are an indicator of the probability of bird contact with process-affected ponds, that flyovers represent an indicator of oiling and/or mortality risk, or both. The 2014 data were examined to determine if such a relationship existed between the two data sets. Non-target birds were excluded from this analysis, and the target bird data were examined in two ways: 1) with all observations where zero birds were present included, and 2) with all observations where zero birds were present excluded. The data in each case were not normally distributed. Log-transformation did not improve the data distributions and a linear relationship could not be found between the datasets due to the presence of outliers. In many cases, birds were recorded as landed but there were no flyovers, or birds were recorded flying over but there were no birds landed.

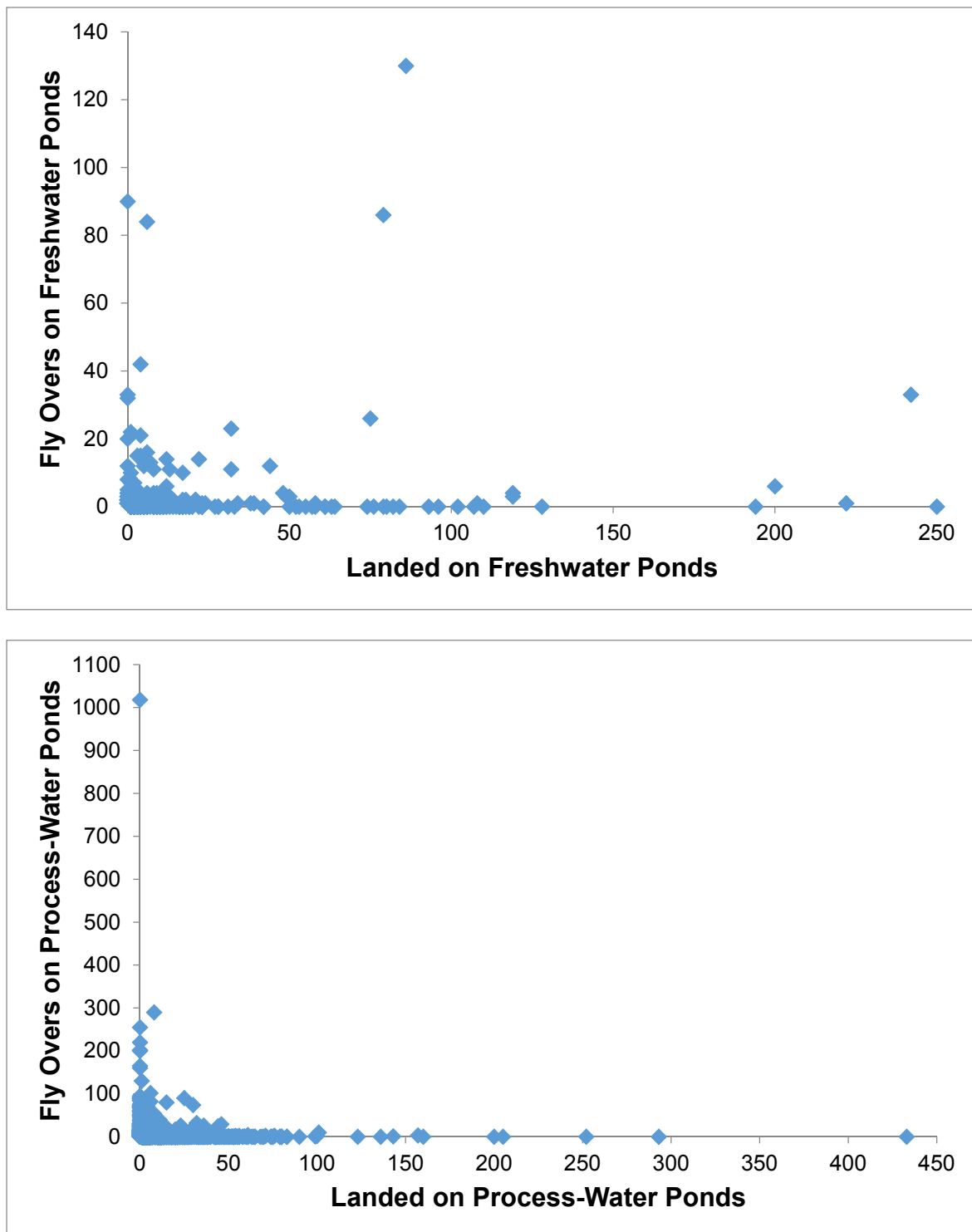
In 2014, 16,311 of the season total of 18,565 (88%) landed bird observations on process-affected ponds were of target guild species, while target guild species comprised less than half of the flyover observations (42%; 9,818 of 23,334 flyover observations) on these same ponds (Table 7.1). Landed bird observations clearly focus on species most at risk of contact with bitumen on process-affected ponds, while flyover observations are dominated by non-target guild species; the relationship between numbers and species of landed and flyover birds is at best very weak. Thus, flyovers are not representative of migratory pressure or deterrent effectiveness. Furthermore, flyover data are typically more variable than landed bird observation data, given that the birds are moving and harder to identify and count, and that conditions and activities beyond the survey area may influence the numbers of observations of birds flying over.

A correlation analysis was not possible on these data due to violations of statistical assumptions for non-parametric analyses. A visual representation of the waterbird data, including zero birds present, on freshwater and process-water ponds is depicted in Figures 7.2 and 7.3, respectively. No relationships between landed and flyover observations are evident. A correlation analysis by guild is not possible, for the same reasons discussed above. Complex regression modelling would potentially determine if a relationship between flyover and landings exist. Other factors to be considered in such analyses should include detectability of birds with increasing distance, constraints of the survey area within which flyovers and landed birds are being recorded, habitats within the survey area, weather, deterrent operation immediately prior to and during the survey, consideration of the presence of summer resident birds, and perhaps others.

Prior to determining if such analyses are worth conducting, the value of the flyover data should be considered in the context of whether the data provides value in answering the question of how many birds are contacting process-water ponds. The assumption that a relationship exists may not be biologically reasonable. For example, geese are commonly recorded as flyovers in the dataset and dabbling ducks are more commonly recorded as landed, therefore an analyses of the number of target guild birds flying over the survey area (geese) is unlikely to be representative of the number of target guild birds landed on the pond (dabbling ducks).



**Figure 7.2: Relationship between Flyover Observations and Landed Bird Observations, with all Zero Observations Included, on Process-affected Ponds (top panel) and Freshwater Ponds (bottom panel) in the 2014 Oil Sands Bird Contact Monitoring Program**



**Figure 7.3: Relationship between Flyover Observations and Landed Bird Observations, with all Zero Observations Excluded, on Process-affected Ponds (top panel) and Freshwater Ponds (bottom panel) in the 2014 Oil Sands Bird Contact Monitoring Program**

A requirement, therefore, would be to conduct analyses of the relationship(s) between landed and flyover observations on a species-by-species basis. Furthermore, most birds migrate at night and the majority of landed birds observed are likely not part of the flocks observed flying over a pond during an observation period. Thus, the two observations may be independent of each other; landed birds are not consistently representative of flyovers and vice versa.

### 7.1.3 Oiled Birds and Bird Mortalities

Reporting the total numbers of oiled birds and bird mortalities requires some method of standardization for search effort, by and across operators. However, a report of an incidental oiled or dead bird observation has no associated search effort, since it is a random event that occurs during other activities on site. Nevertheless, the observations of oiled and dead birds are important, whether detected during the standardized components of the program (bird survey, mortality search) or incidentally. While incidental observations are not pooled within the standardized database, evaluation of incidental bird oiling and mortality observations in the examination of the data OSBCMP contributes to meeting program objectives.

A total of 485 observations of live oiled birds were recorded during 2014 (Table 7.4), the majority of which (94%) were detected during the bird survey component of the program. The remainder (6%) was of oiled birds reported incidentally. These equate to approximately 3.1 observations of oiled birds per day of monitoring, 2.9 oiled bird observations per day arising from the bird survey component of the program (0.2 oiled bird observations per day were reported incidentally). There is no apparent correlation of the numbers of oiled birds reported with the numbers of landed bird observations during bird surveys.

**Table 7.4: Observations of Oiled Birds and Bird Mortalities  
 during the Bird Surveys, Mortality Searches and as Incidental Observations  
 in the 2014 Oil Sands Bird Contact Monitoring Program**

| Operator                | Target Guilds |       |              |       |      |       | Non-target Guilds | Total |
|-------------------------|---------------|-------|--------------|-------|------|-------|-------------------|-------|
|                         | Dabbles       | Dives | Unknown Duck | Wades | Gull | Total |                   |       |
| Oiled Bird Observations |               |       |              |       |      |       |                   |       |
| Canadian Natural        | 11            | 3     | 0            | 90    | 37   | 141   | 0                 | 141   |
| Imperial                | 23            | 10    | 26           | 80    | 10   | 149   | 5                 | 154   |
| Shell                   | 13            | 7     | 2            | 84    | 0    | 106   | 0                 | 106   |
| Suncor                  | 0             | 1     | 0            | 0     | 0    | 1     | 0                 | 1     |
| Syncrude                | 29            | 12    | 16           | 2     | 1    | 60    | 23                | 83    |
| Oiled Bird Totals       | 69            | 29    | 44           | 239   | 47   | 428   | 28                | 485   |
| Bird Mortalities        |               |       |              |       |      |       |                   |       |
| Canadian Natural        | 4             | 20    | 2            | 0     | 5    | 31    | 0                 | 31    |
| Imperial                | 19            | 6     | 3            | 2     | 10   | 40    | 4                 | 44    |
| Shell                   | 12            | 16    | 3            | 0     | 1    | 32    | 1                 | 33    |
| Suncor                  | 1             | 9     | 5            | 1     | 2    | 18    | 1                 | 19    |
| Syncrude                | 16            | 19    | 5            | 2     | 2    | 44    | 1                 | 45    |
| Total                   | 52            | 70    | 18           | 5     | 20   | 165   | 7                 | 172   |

A total of 172 bird mortalities were reported in April to October 2014 (Table 7.4), 13 (8%; 0.08 mortalities/day) from mortality searches and 159 (92%; 1.1 mortalities/day) from incidental observations. There is no apparent correlation of bird mortality numbers with the numbers of landed bird observations during bird surveys.

The very low number of bird mortalities observed during the mortality searches (13, or 8% of the total number of mortalities) relative to the significant level of effort allocated to this component of the program, indicates that the protocol should be revised to allocate appropriate effort to areas and times when mortalities are most likely to occur.

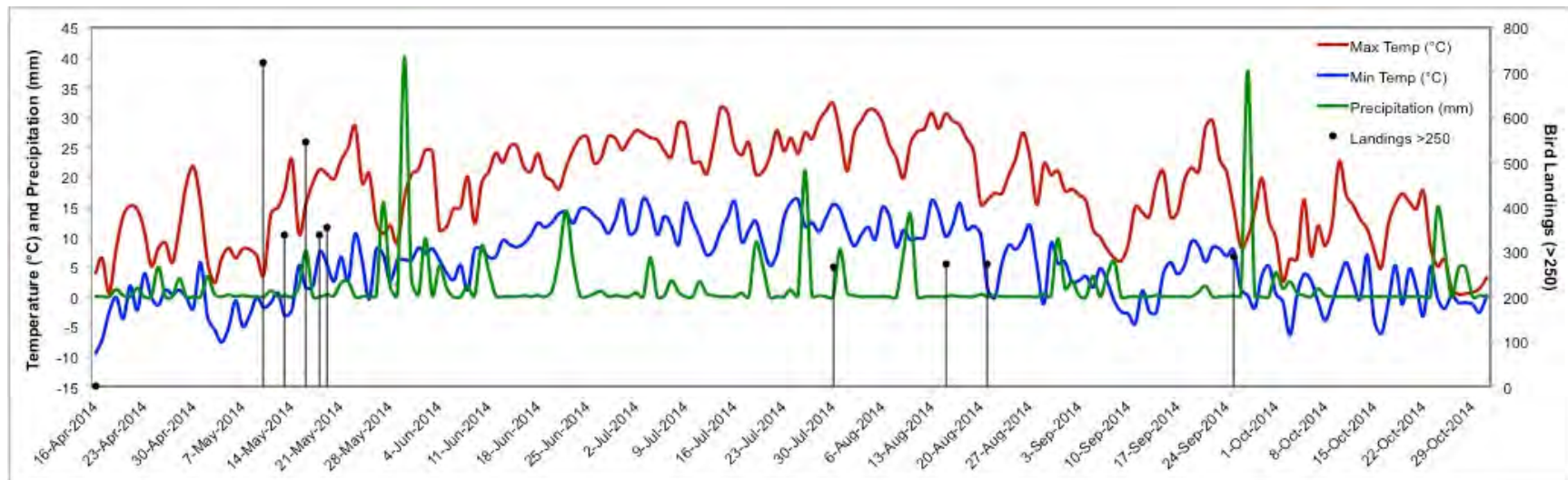
## **7.2 Influence of Weather on Bird Contact, Oiling and Mortality Observations**

The landing and subsequent oiling and mortality of birds in April 2008, October 2010, and most recently, in early November 2014, illustrate the effect that specific adverse weather conditions occurring during bird migration can have on the numbers of birds forced to land, and appearing on ponds in the oil sands region. The weather leading up to and during the mass landings in 2008 and 2010 shared some common attributes – precipitation, strong and variable winds, and dense cloud cover (St. Clair et al. 2011). Rapidly decreasing temperatures are also likely to play a role, as in the snow storm of April 2008, as this could cause freezing of precipitation on flight feathers, forcing the birds to land.

To evaluate the relationship between landed bird observations and weather variables, days during which a total of 250 or more birds of target guilds were observed landed on process-affected ponds were extracted from the database. This number represents target guild bird landings on 5% of the survey days, and 21% of the total number of target guild bird landings observed on process-affected ponds. Thus, a total of 250 observations of target guild bird landings on a single day across all sites is taken as a reasonable indicator of a possible landing event. The total number of landings on process-affected ponds is used instead of a mean number of landed birds per survey, since a large number of birds landing at one site (a possible mass landing at that site) might go unnoticed if few landed birds were observed at the other sites. Variability in the numbers of birds landing at each site during a landing event was apparent in the 2008 and 2010 landing events.

Total landed target guild observations of 250 or more on process-affected ponds on a day occurred nine times during the season (Figure 7.4), five in the spring, and four in the fall monitoring periods. There are no apparent, consistent combinations of maximum temperature, minimum temperature, the rate of increase or decrease in either maximum or minimum temperatures, and precipitation that correlate with total of 250 or more target guild bird landing observations.

In an attempt to determine the relative importance of meteorological factors that contribute to the requirement for birds to land, a preliminary statistical analysis was performed using SAS software 9.3 (SAS 2008. SAS/STAT® 9.3 User's Guide. SAS Institute Inc.). Bird landings were analyzed using generalized linear models (GENMOD procedure in SAS). Generalized linear models handle complex regression analyses and violations of assumptions of normality, independence, and equal variance more easily than general linear models.



**Figure 7.4: Weather (Maximum and Minimum Temperatures, Precipitation) and Possible Bird Landing Events (≥250 Total Landed Bird Observations) on Process-affected Ponds during the 2014 Oil Sands Bird Contact Monitoring Program**

Landing data for each day were log-transformed to achieve a near-normal distribution. The weather model contained daily values for maximum temperature (°C), minimum temperature (°C), change in maximum temperature (°C), change in minimum temperature (°C), total precipitation (mm), and maximum wind gust (km/hr) as fixed effects.

Maximum temperature ( $\chi^2 = 9.70$ ,  $p = 0.0018$ ), minimum temperature ( $\chi^2 = 5.05$ ,  $p = 0.0246$ ), and daily change in maximum temperature ( $\chi^2 = 4.52$ ,  $p = 0.0335$ ) were significant predictors of bird landings. Daily change in minimum temperature, total precipitation and maximum wind gusts were not significant.

Other weather factors, such as atmospheric pressure, the presence of cloud cover, and ground-level fog have been suggested as contributors to landing events. A statistical evaluation of the relative importance of weather components would be appropriate. However, the weather measured at ground level at a regional meteorological station such as that operated by Environment Canada cannot be truly representative of the conditions that migrating birds are encountering at the altitudes at which they fly. Meteorological observations collected during the bird surveys do not explain bird landings. About 67% of bird landings in 2014 were reported under calm or light wind conditions, 88% of bird landings occurred during no precipitation, and 97% were reported when visibility was clear.

### **7.3 Deterrent Systems**

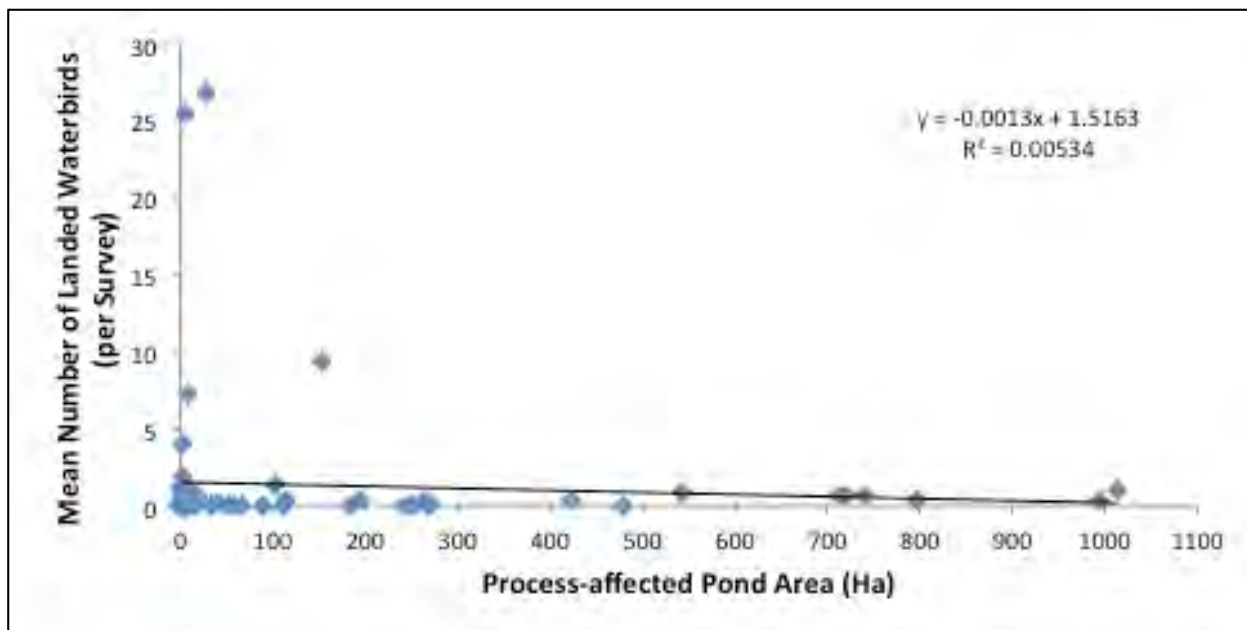
Each operator has implemented a comprehensive deterrent system, including passive (effigy) and numerous active systems. Active systems are operated either independently, such as cannons that fire at intervals, or are activated “on-demand”, such as deterrents that activate upon receipt of a radio signal produced automatically by a computer-driven radar detection system. The specific technologies vary across the sites; details are presented in the individual operator sections.

To date, an examination of the effectiveness of individual deterrents, or the networks of deterrents at the sites, has not been possible. Data from the 2014 program do not address this gap, as none of the monitoring activities were constructed in a manner that would allow linkage of observation data to deterrent operations. A method of developing a linkage between deterrent systems and bird contact observations would advance the program toward meeting the fifth objective of the OSBCMP. This is an area for further discussion.

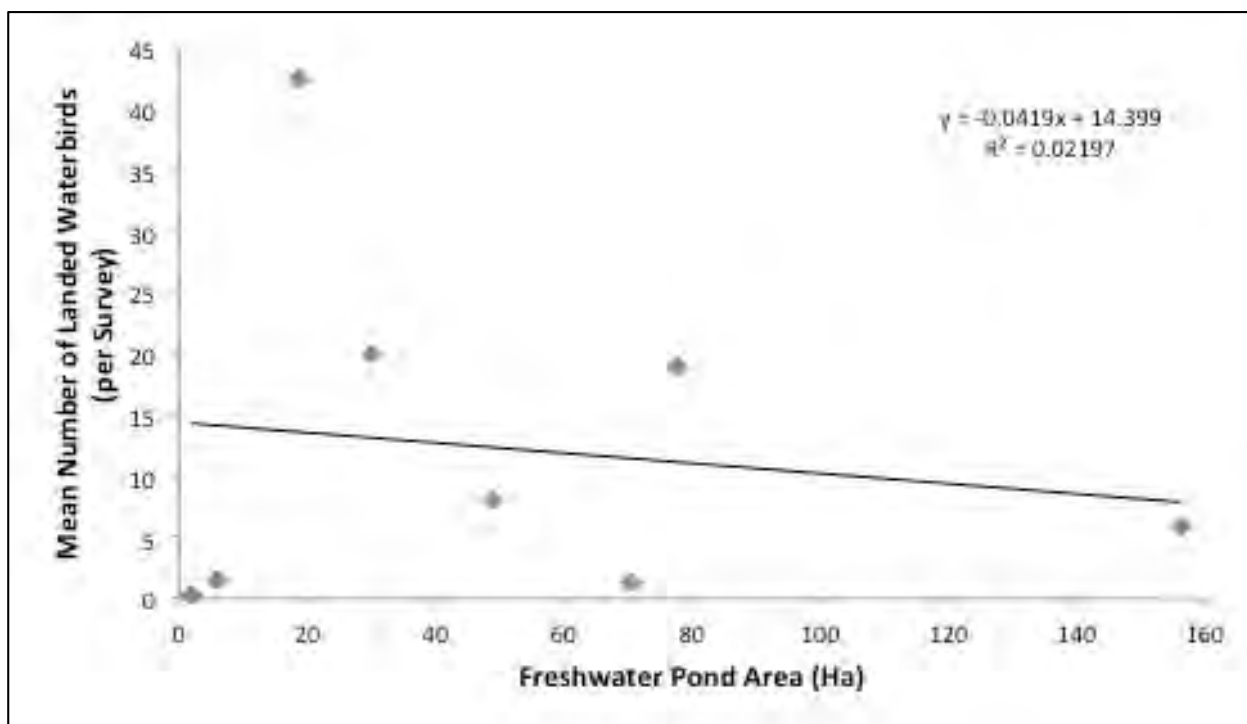
### **7.4 Relationship Between Bird Contact Numbers and Pond Size and Distance to Athabasca River**

#### **7.4.1 Bird Contact Numbers and Pond Size**

There is no apparent relationship between the number of waterbirds landing within survey areas and the surface area of water of the pond, whether the pond contains process-affected water and has deterrents (Figure 7.5) or freshwater and no deterrents (Figure 7.6). This may not be surprising, given that there is no means to appropriately extrapolate observed numbers to estimate landed bird numbers over the entire surfaces of the ponds. In other words, the survey area defines the unit of sampling (not the pond area).



**Figure 7.5: Relationship Between the Number of Landed Waterbirds Observed During Bird Surveys and Process-affected Pond Area Over Water in the 2014 Oil Sands Bird Contact Monitoring Program**



**Figure 7.6: Relationship Between the Number of Landed Waterbirds Observed During Bird Surveys and Freshwater Pond Area Over Water in the 2014 Oil Sands Bird Contact Monitoring Program**

As estimates of bird contacts on ponds as a whole is an objective of the OSBCMP, a realignment of survey locations to ensure random or stratified random sampling of larger ponds is necessary for appropriate extrapolation. Alternatively, surveying the entire pond would be required.

#### **7.4.2 Influence of the Athabasca River**

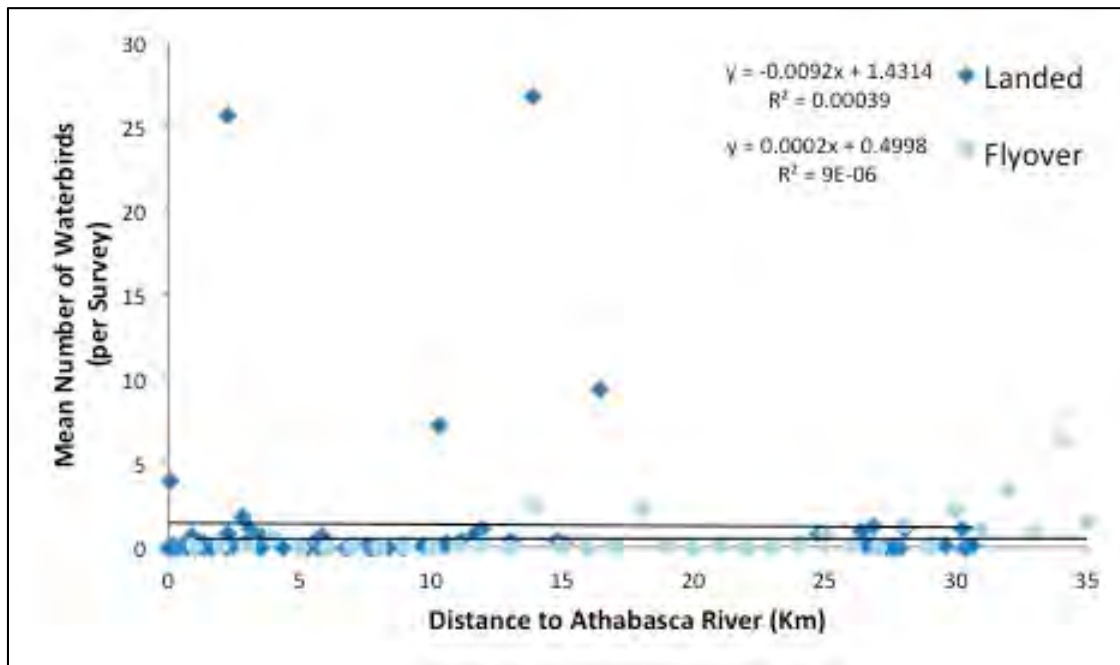
Convergence of four migratory flyways in northeastern Alberta and the proximity of oil sands developments to the Peace-Athabasca Delta has led to the hypothesis that the Athabasca River may define migratory bird movement through the region (St. Clair et al. 2014). In previous OSBCMP reports, an assessment of the role that the river plays in migration pathways has been examined through evaluation of bird contact and flyover observations relative to the distance of the ponds from the river. The hypothesis is that, all else being equal, the Athabasca River defines a flyway or convergence of flyways, and that a greater number of landings and flyovers would be observed at ponds closer to the river than would be observed more distant from the river. No data on bird numbers, whether landed or flying over at varying altitudes, are available from the Athabasca River in the vicinity of the mines that would allow for an examination of the importance of this segment of the river in influencing waterbird numbers at the mine sites.

The numbers of bird observations and flyovers observed at ponds at different distances from the Athabasca River is presented in Figures 7.7 and 7.8 for process-affected and freshwater ponds, respectively. These pond types were separately evaluated, since a relationship might be more apparent on freshwater ponds, where deterrents are not deployed. A relationship between bird contact observations and pond size is not apparent for either pond type.

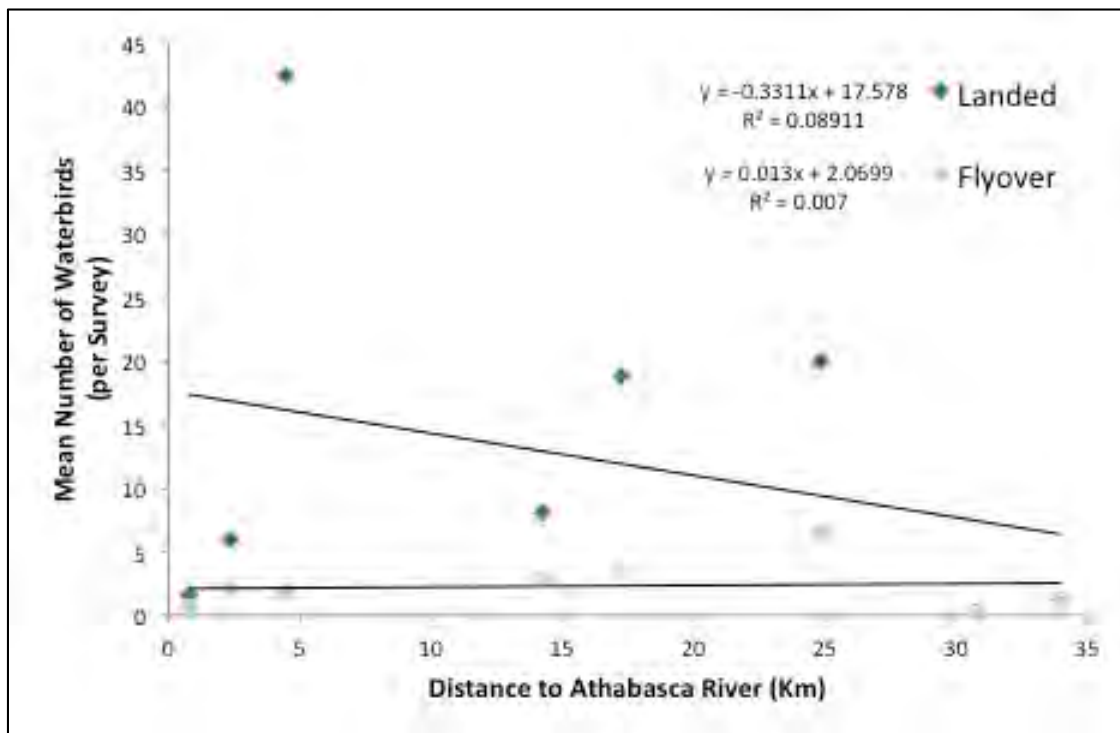
#### **7.4.3 Pond Characteristics**

While the above analyses are intended to provide some insight into bird behaviour, and potentially help guide deterrent deployment strategies (i.e., more deterrents on ponds closer to the river, if warranted), the underlying assumption that all other factors are equal begs discussion. Of the other factors, pond and surrounding habitat features likely dominate the attractiveness of the ponds to birds. It is also worth challenging the assumptions that the migratory flyways in spring and fall are the same, are rigidly defined by the orientation and course of the river, and that the flyways are so narrow that a pond beside the river would be visible to a migrating bird, while ponds just a little farther away would not. In the context of bird flight abilities and the altitude at which birds migrate, it is likely that all ponds in the OSBCMP are visible to most migrating birds. An alternate hypothesis is that habitats on and around a pond will have a greater potential to attract birds than would any influence arising from the distance of that pond from the Athabasca River.

As a preliminary test of this hypothesis, the relationship between pond characteristics and the mean number of landed waterbirds per survey at process-affected ponds was tested using SAS Software 9.3 (SAS 2008. SAS/STAT® 9.3 User's Guide. SAS Institute Inc.), using the generalized linear models (GENMOD) procedure. Generalized linear models handle complex regression analyses and violations of assumptions of normality, independence, and equal variance more easily than general linear models.



**Figure 7.7: Relationship Between Mean Number of Landed Waterbirds on Process-affected Ponds and the Distance of the Process-affected Ponds from the Athabasca River**



**Figure 7.8: Relationship Between Mean Number of Landed Waterbirds on Freshwater Ponds and the Distance of the Freshwater Ponds from the Athabasca River**

GIS analyses were used to define habitat features, and the mean number of observed waterbird landings per survey was extracted for each pond from the 2014 dataset. Because data were not normally distributed, and a log-transformation of bird landing observations could not achieve a normal distribution, the data were examined and the distribution that best fit the data was used in the statistical model (a negative binomial distribution with log-link function). Survey areas on ponds with more than one survey station were considered to be individual samples (i.e., not averaged). The pond characteristics model contained distance to the Athabasca River (km), pond area (ha), pond perimeter (m), length of non-vegetated shoreline (m), length of vegetated shoreline (m), islands (ha), and emergent vegetation (ha) as fixed effects. None of the pond characteristics as measured by GIS were statistically significant. The results suggest that local pond or habitat characteristics that are not currently measured in the monitoring program likely influence bird landings.

The statistical model could not be applied to the freshwater ponds, due to the limited number of freshwater ponds in the program and the absence of a data distribution amenable to statistical analysis.

## **7.5 Inter-Observer Variation**

Inter-observer variation (IOV) was quantitatively assessed at four sites during 2014. As directed for 2014, the observations conducted by the two observers during an IOV were concurrent but independent, with the observers separated from each other by a few metres, and using separate sets of monitoring equipment. Relative percent difference (RPD) values ranged from 0% (no difference between observers) to 200% (Table 7.5). A general trend of greater RPD with fewer bird numbers being present occurred across all sites. This is not unexpected, as a one-bird difference in the counts between observers when few birds were present represents a greater RPD than does a one bird difference between two counts of large bird numbers. Differences between two observers is not unexpected in ecological field programs, as an observer focused on one aspect of monitoring (i.e., identifying a bird using the spotting scope) is likely to not observe something occurring in a different aspect (a bird flying over), while a second observer engaged differently may see the flyover. Observers at the Imperial site used IOV surveys as collaborative training exercises. Quantitative observations between observers were not recorded, with the focus instead resting on identifying and reducing in-field differences through comparison and discussion.

Notwithstanding the constraints associated with the IOV procedure as applied in 2014, some useful observations arise. First, the variations among observers do not appear substantive, and since most of the data acquired during formal surveys is the product of the two observers working as a team, the variances in the data (counts, species identifications) arising from observer variability are acceptable. Second, some differences between two observers likely originated from an element of the IOV procedure or the logistical execution of it. Such differences could arise from separate positioning of the two observers resulting in differences in the field of vision, from use of different types and quality of equipment, or observer abilities. Understanding the reasons for differences in counts during an IOV is a critical component of evaluation observer variation, and addressing it through procedural modifications should be considered in the 2015 protocol.

**Table 7.5: Inter-Observer Variation (Relative Percent Difference) in the Oil Sands Bird Contact Monitoring Program in 2014\***

| Site     | Survey Station | Landed |         | Flyover |         |
|----------|----------------|--------|---------|---------|---------|
|          |                | Birds  | Species | Birds   | Species |
| CNRL     | PMP1           | —      | —       | 0       | 0       |
|          | PMP1           | —      | —       | 67      | 67      |
|          | PMP2           | 0      | 0       | 0       | 0       |
|          | PMP2           | —      | —       | 0       | 0       |
|          | PMP2           | 120    | 0       | 21      | 40      |
|          | PMP2           | —      | —       | 200     | 200     |
|          | PMP3           | 9      | 0       | 0       | 0       |
|          | PMP4           | 111    | 0       | 200     | 200     |
|          | PMP4           | —      | —       | 0       | 0       |
|          | PMP4           | —      | —       | 67      | 0       |
|          | PMP4           | 0      | 0       | 67      | 67      |
|          | PMP4           | 200    | 200     | —       | —       |
|          | PMP5           | 0      | 0       | 0       | 0       |
|          | PMP5           | 40     | 0       | 167     | 120     |
|          | PMP5           | 200    | 200     | 38      | 29      |
|          | TMP1           | 29     | 86      | 200     | 200     |
|          | TMP1           | 11     | 18      | —       | —       |
| Shell    | TT 1           | 0      | 0       | 0       | 0       |
|          | Inpit 2        | 0      | 0       | 0       | 0       |
|          | TT 4           | 0      | 0       | 0       | 0       |
|          | SC2 1          | 25     | 50      | 200     | 200     |
|          | CL 1           | 0      | 0       | 200     | 200     |
|          | CL 1           | 0      | 0       | 0       | 0       |
| Suncor   | MFT 2          | 0      | 0       | 0       | 0       |
|          | Pond23_2       | —      | —       | 0       | 0       |
|          | Pond6_2        | —      | —       | 0       | 0       |
|          | Pond8B_2       | —      | —       | 200     | 200     |
|          | Pond6_1A       | —      | —       | 200     | 200     |
|          | Pond7_1        | —      | —       | 0       | 0       |
|          | Pond8B_1       | 12     | 67      | —       | —       |
|          | Pond23_2       | —      | —       | 0       | 0       |
|          | Pond6_1        | —      | —       | 200     | 200     |
|          | Pond7_1        | 14     | 0       | —       | —       |
|          | Pond6_1        | —      | —       | 67      | 0       |
|          | Pond7_1        | —      | —       | 0       | 0       |
|          | Pond8B_2       | —      | —       | 200     | 200     |
| Syncrude | Pond23_1       | —      | —       | 0       | 0       |
|          | EFF            | 0      | 0       | 200     | 200     |
|          | EIP            | 0      | 0       | 200     | 200     |
|          | MLSB2          | 0      | 0       | 200     | 200     |
|          | SWIP1          | 0      | 0       | 200     | 200     |
|          | SWIP2          | 0      | 0       | 200     | 200     |
|          | WIP1           | 0      | 0       | 200     | 200     |
|          | WIP1           | 0      | 0       | 200     | 200     |
|          | WIP2           | 0      | 0       | 200     | 200     |
|          | WIP2           | 0      | 0       | 200     | 200     |
|          | WIP3           | 0      | 0       | 200     | 200     |
|          | WIP3           | 0      | 0       | 200     | 200     |
|          | WIP3           | 0      | 0       | 200     | 200     |

**Notes:**

\* Relative Percent Differences were derived at four sites, with the fifth using the IOV procedure to reduce variability among monitoring personnel at that site, the intended outcome of the procedure  
 — = No birds were observed by either observer.

## **7.6 Freshwater Ponds**

Freshwater ponds are included in the OSBCMP to provide data against which observations at process-affected ponds can be compared. This comparison is primarily intended to yield information on the effectiveness of deterrents, as ponds with deterrents would be expected to attract fewer birds than ponds without. Freshwater ponds without deterrents, in proximity to process-affected ponds with deterrents, might be expected to have even higher numbers, as birds are pushed from the process ponds to freshwater ponds nearby. Making these comparisons requires that process-affected and freshwater ponds be monitored in the same way, that differential effort be normalized either in the field or mathematically, and that the temporal distribution of effort be similar between the pond types. While the technique of monitoring is the same for both ponds, the effort allocation to freshwater ponds (10-minute surveys, twice per week) is less than that allocated to small process-affected ponds (10-minute surveys, one or six times per week, depending on the pond) and substantially less than to larger process-affected ponds (more than one survey location, 30-minute surveys, six times per week).

## **7.7 Recommendations for Protocol Revision**

The review and data analyses presented above lead to recommendations for improvement of the protocol. Several recommendations were presented in the above sections, following discussion of elements of the program, and these are included in the items below.

### **7.7.1 Bird Survey Sampling Unit**

The selection of survey locations is based strongly on logistical factors – predominantly crew safety and location accessibility. Consequently, survey stations are established where they can be, with lesser consideration of the representativeness of the area surveyed in the context of the larger pond. Survey areas comprise different habitat types and qualities, and this varies substantially among survey areas within and among operator sites. These restrictions raise the fundamental question of statistical representativeness of the survey locations and areas. Without a network of survey stations that are statistically representative of the ponds at which these stations are meant to sample, it is inappropriate to extrapolate the observed landed bird numbers (and bird oilings and mortalities) to the larger pond surface. Establishment of more survey stations at accessible locations on larger ponds will not itself improve representative sampling, unless each station properly and within an acceptable statistical framework contributes to a representation of the larger pond surface. These barriers essentially negate the ability to achieve the first and second objectives of the OSBCMP, and significant amendments to the OSBCMP protocol are required to address this monitoring design deficiency.

### **7.7.2 Habitat Unit Definitions**

There is a very high level of variability among survey stations and in the habitats present within the survey areas. Definitions used to date to define habitat features on which landed birds are observed during surveys have not precisely delineated the habitat to the degree necessary to correlate with observations of landed bird numbers and mortalities. A consideration for improvement of the OSBCMP protocol will be to develop a set of standard habitat definitions

and identify these within each survey area as viewed from each survey station, consistently across all sites. This would allow for a greater ability to correlate observations of bird numbers and species with habitats present in the survey areas.

While this will make the data more consistent within and across sites, it is unlikely to address the issue of non-representative sampling. However, better definition of bird-habitat associations at the mine sites may be beneficial in advising on adjustment of deterrent placements, habitat management, and/or hazing priorities.

### **7.7.3 Mortality Search Procedure**

Mortality searches yielded the recovery of 13 dead or euthanized birds. Search effort was reported in number of hours spent searching, and variously reported in distance searched and/or area searched. Spatial effort cannot be integrated into a single effort metric, however, the effort expended across the five sites on mortality searches was substantial: 1,714 km, 9,688 ha and 114 hours. The few dead birds found during these formal searches may be the result of: 1) few birds dying; 2) the residence time of a dead bird on the pond surface is less than the interval between searches (two weeks); and/or 3) the methods used are not able to identify dead birds.

Landed waterbirds observed at process-affected ponds during the bird surveys totalled 16,311, while there were 165 observations of dead birds on and around these ponds. These data, together with the few birds (13) found dead during the intensive mortality searches, indicate that relatively few birds die upon contact with bitumen on process-affected ponds.

This conclusion is supported by an evaluation of the intensive mortality search program conducted by Syncrude in 2013, which sought to address the questions of detectability, loss of dead birds (e.g., sinking) and total numbers of mortalities at process-affected ponds. The outcome of this intensive effort is presented in Table 7.6. During 373 searches, totalling 305.5 hours of search time, only three oiled or dead birds were observed (all in the spring), two on the AIP pond (one observed by each of the boat and truck methods), and the third by boat on the SWSS pond. In the spring, approximately three searches were conducted per day, an average interval between searches of about two days (all methods, all ponds). In the fall, an average of just over one survey was conducted per day, with an interval (all methods, all ponds) of approaching nine days between surveys. The results of the mortality search protocol applied from 2011 to 2014, as supplemented by Syncrude, has provided an indication that birds are dying on process-affected ponds at very low rates.

The observation of very few oiled/dead birds during formal mortality searches and the higher number of incidental observations of oiled/dead birds relative to the numbers observed during mortality search efforts, strongly indicate that a revision to the mortality search component of the protocol is warranted. This revision would address two aspects of the findings to-date: 1) the reduction of incidental observations of oiled and dead birds; and 2) a redistribution of effort from routine searches to a focus of effort in areas known or expected to cause bird oiling/death. Increasing the ability to associate mortality observations with search effort would allow an estimate of bird mortalities with confidence intervals at each mine site.

**Table 7.6: Effort and Oiled/Dead Bird Observations in Syncrude's 2013  
 Enhanced Mortality Search Program\***

| Syncrude Pond               | Effort | Spring |        |       | Fall  |       | Total  |
|-----------------------------|--------|--------|--------|-------|-------|-------|--------|
|                             |        | Boat   | Truck  | Foot  | Boat  | Truck |        |
| Aurora Settling Basin       | No.    | 7      | 13     | 7     | 12    |       | 39     |
|                             | hh:mm  | 11:50  | 10:35  | 1:40  | 4:54  |       | 28:59  |
| Aurora In-Pit               | No.    | 8      | 9      | 8     | 11    | 2     | 38     |
|                             | hh:mm  | 14:00  | 6:30   | 3:25  | 4:25  | 0:32  | 28:52  |
| Aurora In-Pit North         | No.    | 3      | 15     | 12    | 3     | 8     | 41     |
|                             | hh:mm  | 2:30   | 9:15   | 3:20  | 0:38  | 2:12  | 17:55  |
| Aurora North Recycle Water  | No.    |        | 12     | 8     |       | 11    | 31     |
|                             | hh:mm  |        | 3:05   | 0:55  |       | 2:21  | 6:21   |
| Mildred Lake Effluent       | No.    |        | 9      | 5     |       | 9     | 23     |
|                             | hh:mm  |        | 2:45   | 0:30  | 1:50  |       | 5:05   |
| East In-Pit                 | No.    |        | 9      | 7     | 11    |       | 27     |
|                             | hh:mm  |        | 11:55  | 5:05  | 2:42  |       | 19:42  |
| Mildred Lake Settling Basin | No.    | 6      | 10     | 3     | 12    |       | 31     |
|                             | hh:mm  | 20:00  | 25:30  | 2:30  | 4:13  |       | 52:13  |
| Recycle Water               | No.    |        | 12     | 10    |       | 8     | 30     |
|                             | hh:mm  |        | 4:36   | 2:15  |       | 2:13  | 9:04   |
| South-west In-Pit           | No.    | 4      | 11     | 8     | 12    |       | 35     |
|                             | hh:mm  | 9:30   | 12:05  | 3:40  | 5:16  |       | 30:31  |
| South-west Sands            | No.    | 3      | 10     | 7     | 20    |       | 40     |
|                             | hh:mm  | 6:30   | 25:49  | 7:55  | 12:26 |       | 52:40  |
| West In-Pit                 | No.    | 4      | 12     | 8     | 14    |       | 38     |
|                             | hh:mm  | 10:00  | 30:10  | 4:50  | 9:09  |       | 54:09  |
| Totals                      | No.    | 35     | 122    | 83    | 95    | 38    |        |
|                             | hh:mm  | 74:20  | 142:15 | 36:05 | 43:43 | 9:08  |        |
|                             | No.    | 240    |        |       | 133   |       | 373    |
|                             | hh:mm  | 252:40 |        |       | 52:51 |       | 351:31 |

**Note:**

\* Each highlighted cell (pink shading) indicates that a total of one bird was found during searches on the pond in the indicated season, by the indicated method.

#### **7.7.4 Effort Allocation to Freshwater Pond Observations**

The inclusion of freshwater ponds in the program was intended to provide data on the activity of birds in the area, providing an indication of the numbers of birds available to land on process-affected ponds. Comparisons of landed bird observations between process-affected and freshwater ponds might also provide an indication of the effectiveness of deterrents.

However, comparison of data collected during 30-minute surveys, six times per week, from multiple survey stations on a large process-affected pond to data collected during 10-minute surveys twice per week from a single survey station on a freshwater pond has substantial limitations. Peaks in bird activity (landings, flyovers) occurring between surveys at freshwater pond could elevate the numbers of birds observed at process-affected ponds relative to those at freshwater ponds.

The OSBCMP data analysed to date clearly show that bird landings on the freshwater ponds at each operator site are higher than those observed at process-affected ponds. Landing data from freshwater ponds illustrate the effects of the presence of suitable habitat, the absence of deterrents, and the isolation from industrial and human activity. Continued monitoring of these ponds will not change this understanding. Objective 2 of the OSBCMP has been achieved; therefore, termination of monitoring at freshwater ponds may be appropriate in the revisions in the 2015 Protocol.

#### **7.7.5 Weather Data**

Landing events appear to be driven by a combination of specific weather conditions and bird migration behaviours (e.g., night migration), and factors at the site level may be involved. Understanding the relative importance of individual components of weather (temperature, wind, humidity, precipitation, barometric pressure, etc.) will require at a minimum the collection and analysis of weather data obtained in the vicinity of the site(s) at which landing event(s) occur.

#### **7.7.6 Inter-observer Variability**

In the absence of knowledge, or an ability to acquire the knowledge, of the true number of birds within the survey area (and flying over), calculation of inter-observer variability is compromised. The significant benefit from the procedure used in 2014 is the ability to evaluate the observation data immediately following an IOV observation session. This evaluation can be immediately beneficial, as observers calibrate their monitoring methods among themselves, leading to a more consistent application of the protocol requirements.

For this reason, retention of an IOV procedure is considered appropriate in the 2015 protocol, however, it will be focussed on the identification of factors at a site that contribute to variability among observers and on development of methods to address the effects of these factors. Without an ability to know the true number of birds in a survey area, the calculated values for inter-observer variability do not contribute to addressing the variability, nor can the variability estimate be used to improve the ability to extrapolate observed bird numbers beyond the survey area. Other mechanisms (e.g., training programs) may be more valuable in reducing intra-site and inter-site variability.

### **7.7.7 Data Management**

The OSBCMP is data-intensive, with crews at each of the five sites collecting and transmitting data on a daily basis through the monitoring season. At intervals through the season data are extracted from the database and returned to field personnel for QA/QC, correcting errors and clarifying data entries. A QA/QC process also occurs at the end of the season, in which the entire dataset for a site is checked, again returning it to the field crews to address questions of consistency and potential error. This is an onerous task on all parties, and the time required to complete data verification delays the start of data analyses, compressing the time needed to analyse, interpret and report key data.

Collection, verification and reporting of data on non-target guilds, primarily flyovers of terrestrial species, consumes a significant amount of time, while not contributing to the overall program objectives of defining and reducing waterbird contact with process-affected and the mortalities that occur on these ponds. The reporting of over 3,000 observations on Bank and Barn swallows as flyovers during the bird surveys illustrates this point; these observations do not provide any information or guidance to site operators that would improve deterrent deployment or other site management actions targeting reduced contacts and mortalities.

With four years of OSBCMP operation and experience, it is timely to review the data that are collected at each survey station, and validate their continued collection or remove them from the program. Meteorological observations are easily obtained in the field, however, the processing of these data and the inability to correlate these data with bird landings, represent a significant time investment. Reducing data collection to those items of importance in understanding the reasons for bird contacts, oilings and mortalities would lead to significant efficiencies in the program overall.

Once refined to focus on the data required to support achievement of program objectives, efforts to develop and implement real-time QA/QC procedures would be appropriate. Crews would be able to collect, review and correct their data in a single day, improving both the quality and efficiency of the QA/QC process.

### **7.7.8 Hypothesis-driven Monitoring**

The current protocol states five objectives, and defines a suite of data elements to be collected that are expected to address these objectives. However, the links between the objectives and these data elements are not precisely defined, resulting in attempts each year to analyse the data in various ways to garner kernels of information that hopefully, when all analyses are complete, allow a conclusion to be drawn that addresses one or more of the objectives. This approach is labour-intensive, and to-date, has not provided an understanding of the larger picture as articulated by program objectives. Nevertheless, a substantial amount has been learned about bird numbers interacting with ponds on mine sites, challenges in the execution of a bird contact/mortality monitoring program defined, and findings to-date are critical in setting the stage for improving the program.

A refinement of the OSBCMP protocol to guide monitoring based on an explicit hypothesis-driven approach is recommended. The data collected to-date suggest that less than 1% of birds that land on process-water will die as a consequence of contact with bitumen. However, this number cannot be validated using the current monitoring approach. The following hypotheses (null, alternate) encompassing each of the bird contact and mortality components of the program are proposed as the basis of a revision to the OSBCMP protocol:

- Null Hypothesis ( $H_0$ ): The number of bird mortalities that occur on oil sands process-water ponds is less than 1% of the number of birds that land on these ponds.
- Alternate Hypothesis ( $H_A$ ): More bird mortalities are occurring on oil sands process-water ponds than are currently reported.

From these hypotheses, two questions can be derived, and the data necessary (and only those data) to analyse each question collected. These questions are:

1. What is the number of birds that land on process-water ponds? The current monitoring approach does not include representative sampling of process-water ponds and therefore, extrapolation to a number of birds that land on these ponds is not possible.
2. What is the number of bird mortalities that occur on process-water ponds? The majority of bird mortalities are found incidentally, which does not allow for a calculation of total number of bird mortalities or estimation of mortality numbers based on survey effort.

The ultimate objectives from the OSBCMP are to reduce the number of birds that land on process-water ponds and have zero bird mortalities. The purpose of the waterfowl monitoring program is to inform on-site industry managers to achieve this objective. However, a number of additional questions remain that prevent the program from meeting its objectives, and in particular providing direction on adaptive management for bird deterrent programs.

- Why are birds landing on process-water ponds?
- How do we prevent birds from landing on process-water ponds?
- What is the fate of oiled, live birds?

From these questions, the data requirements can be defined and revisions made to the monitoring protocol. Such revisions would focus on improving the detectability of landed birds, oiled-live birds, and bird mortalities, and improve the statistical means to estimate these numbers across a pond. Companion research studies would determine the effectiveness of deterrents and inform the management of bird attractants.

## 7.8 Conclusions

The number of landed bird observations in 2014 (24,858 in total, 18,565 at process-affected ponds) is similar to the number of observed in 2013 (23,602 in total, 18,161 at process-affected ponds) (St. Clair et al. 2014). The protocol for recording bird contacts was relatively similar in 2013 and 2014, and although there were changes in pond numbers and other measures of

effort between years, in the context of the overall program this consistency in numbers is sufficient to conclude that regionally, bird numbers as expressed in observed contacts remained relatively constant.

The number of observed flyovers in 2014 (26,191 in total, 23,334 at process-affected ponds) was lower than observed in 2013 (32,452 in total, 26,489 at process-affected ponds). However, the composition of landed birds in 2014 (88% from target guilds) substantially differed from that of flyover birds (42% target guilds), suggesting that there is little relationship between birds landed within the survey areas and those flying over.

In 2013, 157 mortalities were reported relative to 18,161 bird contacts on process-affected ponds. In 2014, 172 mortalities were reported relative to 18,565 bird contacts on process-affected ponds. The mortality numbers are low relative to the numbers of birds present, and appear consistent between years.

The relative contribution of attractive habitats on ponds, pond distance from the Athabasca River, and components of weather (temperature, precipitation, wind) were examined statistically, and some elements of weather (temperature) were found to correlate with observed bird contacts. However, limitations in the design of the monitoring program reduced the ability to comprehensively assess the role of habitat, weather, and other factors on bird contacts.

The landing event in November 2014 adds credence to the hypothesis that birds are not landing on process or freshwater ponds at constant, high rates, nor are birds being oiled at high rates. It appears to be a specific combination of migratory behaviour and weather events that result in these landing events.

An hypothesis driven approach is recommended as the basis of a review and revision of the protocol, improving its ability to direct data collection and analysis in a manner that better applies monitoring resources to addressing program objectives and the needs of government and industry participants.

## **7.9 Documents Cited**

- St. Clair C.C., Habib T., Shore B. (2011) Spatial and Temporal Correlates of Mass Bird Mortality in Oil Sands Tailings Ponds. Prepared for Alberta Environment. Department of Biological Sciences, University of Alberta, Edmonton, Canada T6G 2E9. 61 pp.
- St. Clair C.C., Loots S., Ronconi R.A. (2014) Final Report of the Research on Avian Protection Project (2010–2014). Research on Avian Protection Project, Department of Biological Sciences, University of Alberta, Edmonton; Prepared for Alberta Justice; 95 p.