ATTACHMENT C **EVOSTC Annual Project Report Form**

Form Rev. 8.30.18

1. Program Number:

18120114-N

2. Project Title:

Long-term killer whale monitoring in Prince William Sound/ Kenai Fjords

3. Principal Investigator(s) Names:

Craig O. Matkin and Dan Olsen, North Gulf Oceanic Society

4. Time Period Covered by the Report:

February 1, 2018-January 31, 2019

5. Date of Report:

April 1, 2019

6. Project Website (if applicable):

www.gulfwatchalaska.org

7. Summary of Work Performed:

We completed 64 survey days in 2018 with timing and geographic components of effort similar to all other years of the Gulf Watch Alaska program (Fig. 1). We had thirty-seven encounters with resident ecotype killer whales, 4 encounters with transient ecotype killer whales, and 3 encounters with offshore ecotype killer whales (Fig. 2). In 2018, all 7 of the AT1 (Chugach) transients were identified, whose ages are now estimated between 34-53. The youngest female is estimated to be 44 years old, which is likely beyond reproductive age, and no new calves were documented.

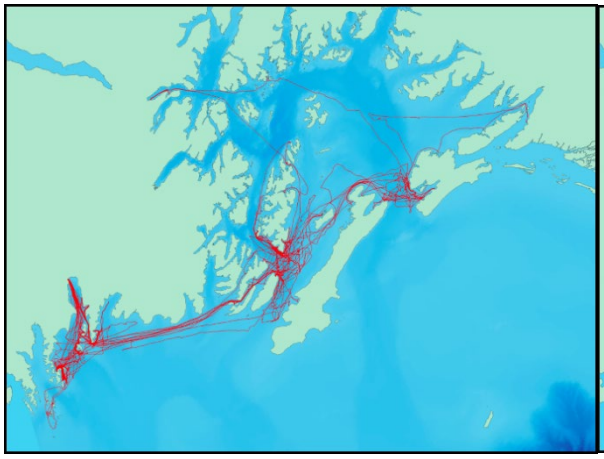

Figure 1. Effort tracks.

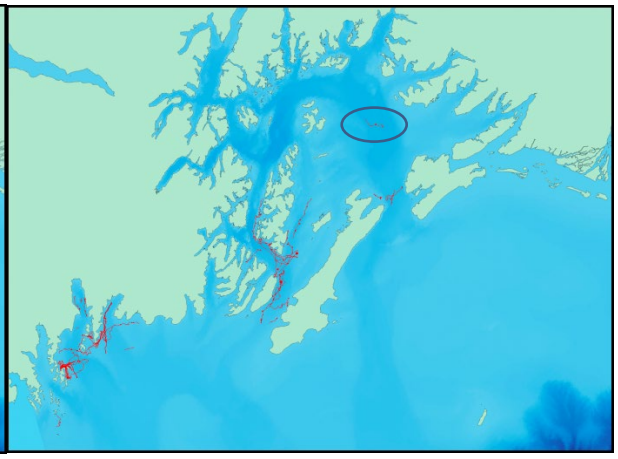

Figure 2. Encounter tracks.

Note: Blue ellipse encircles interaction with sablefish longline fisherman by AB pod.

One encounter was a response to a vessel commercially fishing sablefish (black cod). The group of killer whales involved was found to be matrilines of AB pod depredating on the longlines. This is the same pod that was involved in depredations in the 1980s prior to the *Exxon Valdez* oil spill. Fishermen have reported interactions over the past decade and that it appears to be the same whales involved.

It appears that for AB pod, all of the AB26, AB27, and AB54 matrilines are present and there are no new calves in 2018. However, as in 2017, three matrilines that contain all adult males and their mothers (the AB14, AB17, and AB 22 matrilines) were not encountered for the second year running. We are concerned that these whales have perished since these matrilines contain the oldest individuals in the pod. There is still the possibility that they are feeding separately from other AB matrilines and are using areas outside (offshore) of Prince William Sound and Kenai Fjords. As a result, we are uncertain of the total number of whales in AB pod and this is reflected Fig. 3 where we circle the “optimistic” number for the past several years. Although we have had two births in the past 3 years (none occurred in 2018), we have no way of knowing if there have been mortalities in the missing matrilines although some are likely due to the age of matriarchs and their sons.

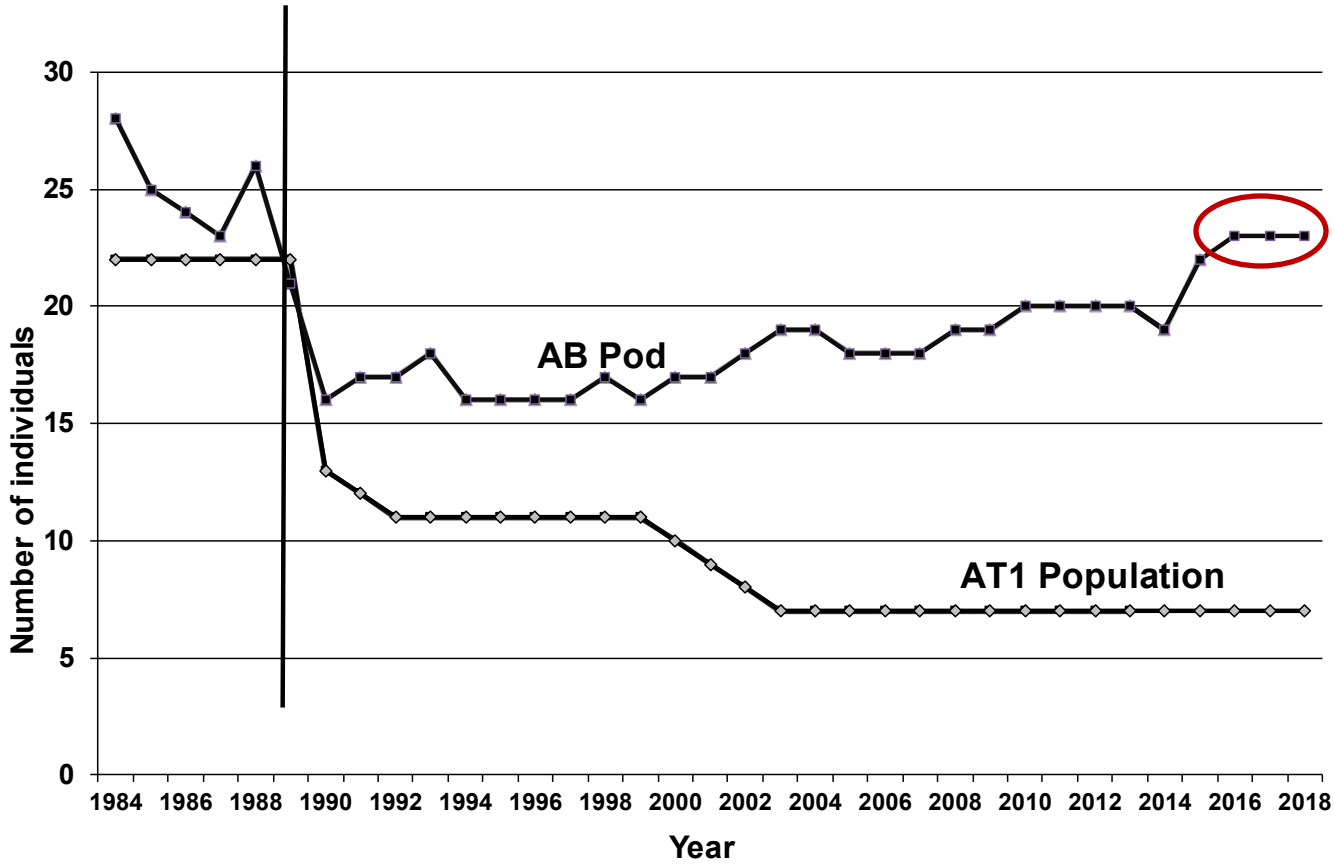

Figure 3. Number of whales in AB pod and AT1 population by year. Note: past three years total for AB pod (circled) does not take into account three missing matrilines (AB17, AB22, and AB14).

As we reported last year, there has been an increasing tendency toward temporary (and in some cases permanent) splitting of pods and this trend has continued. This may signify more challenging feeding opportunities (e.g., fewer numbers of fish/smaller school size) that favor hunting in smaller groups. A similar trend has been observed in British Columbia. In recent decades, the southern Alaska resident killer whale population (except for AB pod) has grown steadily. This trend may be changing. In 2018, of the 148 killer whales in 18 matrilines in our core pods that were photographed, only two calves were recruited and there were three apparent new mortalities. In 2017, for the 155 whales from our core groups that were photographed, there were four calves recruited and 8 mortalities (confirmed in 2018). A trend of zero or negative growth may be developing in the southern Alaska killer whale population. Growth in the British Columbia northern resident population has halted in recent years and a similar situation may be developing in southern Alaska. There has been a rebound in salmon stocks in the past 40 years that we suspect has fueled increases in numbers in most resident pods in recent decades but this response may have ended and recent declines in north Pacific Chinook salmon may be having an impact.

We collected 10 samples of fish scales and flesh from sites of kills made by resident whales and collected 26 scat samples from resident killer whales as part of our resident killer whale feeding ecology work. From offshore killer whales, we collected one scat (likely the first anywhere in their range) and 3 flesh samples from kills. These samples are currently being analyzed at the fish scale and genetics lab at the Pacific Biological Station, Nainaimo, British Columbia, Canada.

As part of our feeding habits studies we continued work determining rivers of origin for salmon consumed by killer whales (see FY17 annual report). During FY18 we examined historical samples with usable genetic material collected from 1998 to 2012. Of the 56 Chinook samples examined, 54 had the highest probability of originating in tributaries of the Stikine River system in British Columbia with 38 of these having a lesser probability of originating in the Situk River. One was attributed to the Columbia River system, and one to the Nitnat River on Vancouver Island, British Columbia. We were able to obtain genetic rearing locations from only 12 coho scales and 7 of these were from rivers on Vancouver Island or adjacent mainland, two from Queen Charlotte Island, British Columbia, two from Southeast Alaska, and one from Washington State. Genetic libraries do not cover many of the local Prince William Sound and Kenai Fjords streams so this does not necessarily indicate that they don't feed on local fish, just that there are coho that rear far from study area that are preyed upon as well. The situation is similar for chum salmon where local stocks are not represented in the library, but of 16 samples that could be typed, nine likely came from Vancouver Island streams and six came from central or southern British Columbia streams and one from the Chena River in central Alaska. Again this does not indicate local fish are not consumed but indicates how far from their streams chum travel and become part of the whales' diet, and that it is not only local chum that are found in the diet of southern resident killer whales.

We have had good success in using remote Soundtrap hydrophones to track presence and absence of killer whales in areas of importance during the winter months. One hydrophone is located on the mid-Sound oceanographic buoy, one in Hinchinbrook Entrance, one in Montague Strait, and one in outer Resurrection Bay. The hydrophone program has effectively replaced our satellite tagging program, which has numerous advantages including its non-invasive nature, its ability to track activity of whales in winter months, and its long-term economics.

Hinchinbrook Entrance was monitored in winter 2016-17 and analysis indicates a peak in killer whale use in November, with detections on 38% of days (Fig. 4). In Montague Strait, we first used the Hanning Bay site for the Soundtrap hydrophone location (Fig. 5) with peak detections in October 2016 when detections occurred on 88% of days, while detections remained above 70% of the days during the other months from November 2016 to February 2017. Little Bay has proven to be a better location for covering Montague Strait and is the current Soundtrap location (Fig. 6). Here, call detections peaked in January 2018, with detections on 92% of days. It is clear that Montague Strait is important habitat for resident killer whales not only in fall but into the winter. Although analysis has not been completed on pod specific use, the pods presence in Montague Strait November-January from both Hanning and Little bays indicate consistent use by AJ, AB, AK, and AD16 pods. Little Bay detections included many AT1 (Chugach transient) calls. Typically, increasing use of Montague Strait in late summer and early fall which is generally reflected in our field work, and appears to build into the winter period as indicated by the hydrophones.

The Soundtrap hydrophone attached to the oceanographic buoy near Naked Island has indicated killer whale presence on less than 20% of the days and we have not emphasized that location in our more time consuming detailed analysis. Likewise, the hydrophone in Resurrection Bay has not received detailed analysis due to the issues with boat noise in that location. The Resurrection Bay location did provide some specific successes, including identification of offshore killer whale calls that could be tied to a specific group (O297) and which were ground checked from field photographs.

Sorting of calls from recordings using auto-detection by Pamguard software has been valuable and nearly all sorting by using software has been completed. Ground-truthing results has been time consuming and has focused on the most productive sound stations. Sound detecting software is changing constantly and time will bring improvements in analytical efficiency. False detections occur primarily in summer or other periods of high vessel traffic. Future software may address these issues.

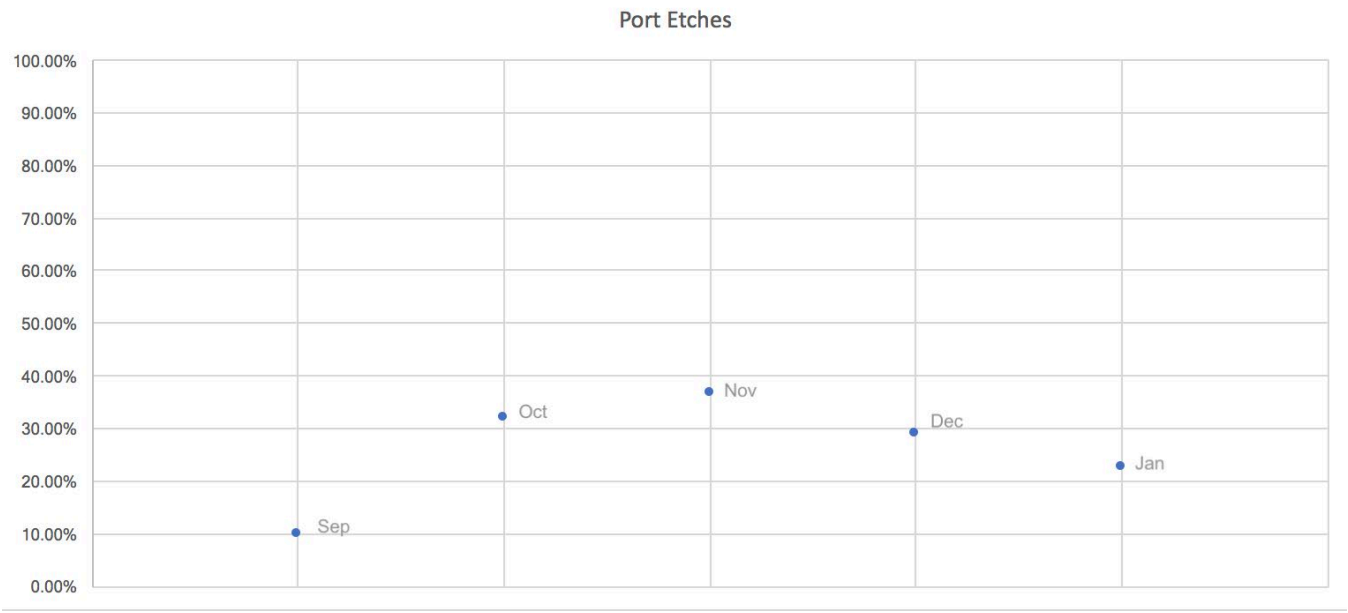

Figure 4. Percentage of days with killer whale detections by month, September 2017-January 2018.

Figure 5. Percentage of days with killer whale detections in Hanning Bay, Montague Strait September 2016-February 2017.

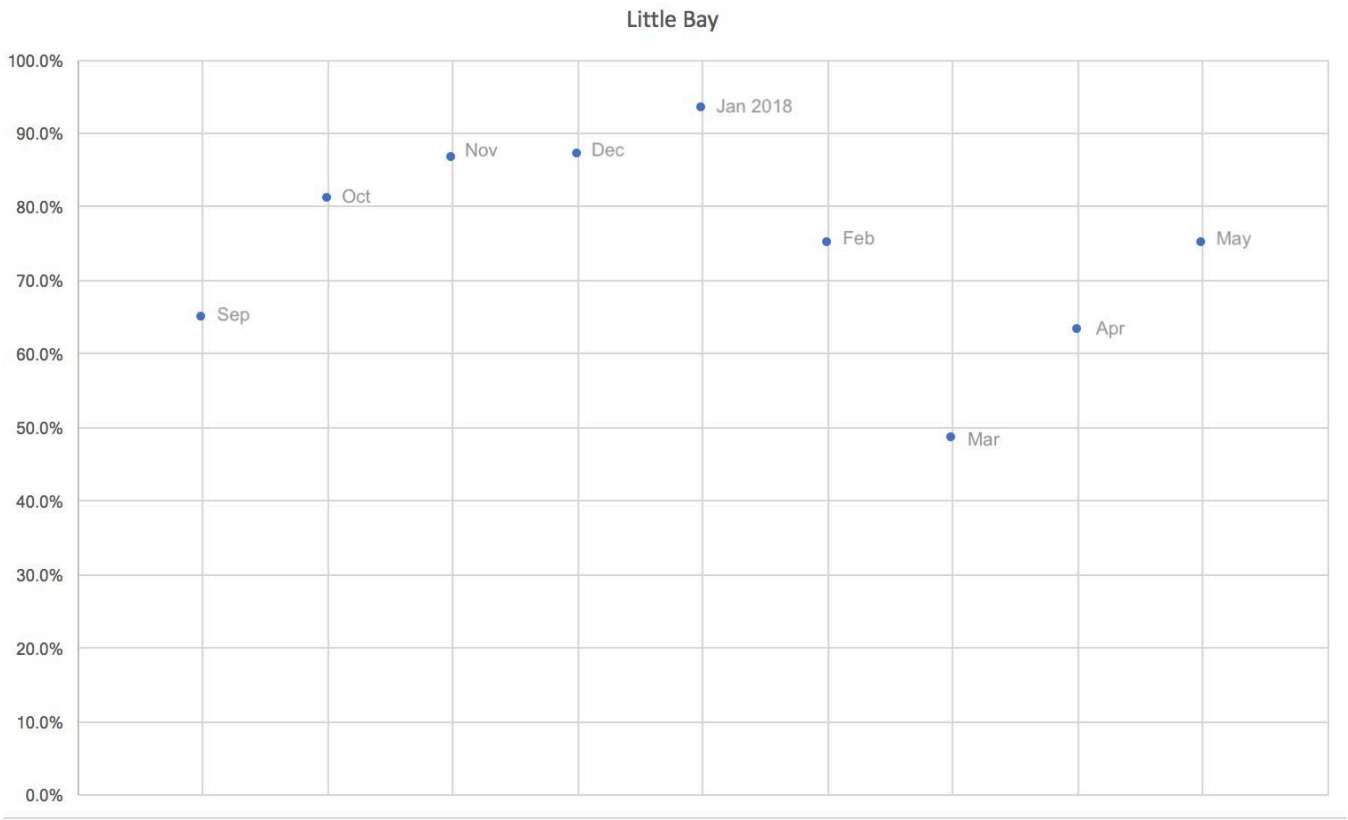

Figure 6. Percentage of days with killer whale detections September 2017- May 2018 in Little Bay, Montague Strait.

8. Coordination/Collaboration:

A. Projects Within a Trustee Council-funded program

1. Within the Program

Within the Pelagic Component of Gulf Watch Alaska, we collect humpback whale identification photos and provide data on distribution and abundance of humpback whales (encounter data) as possible during our surveys. This resulted in 28 encounters where up to 10 humpback whales were identified. The raw data are provided to the humpback whale project (PIs Moran and Straley 18120114-O.

We work cooperatively with PI Rob Campbell (Prince William Sound Science Center, project 181204114-G) to deploy hydrophones on his oceanographic moorings for our killer whale acoustic monitoring efforts.

2. Across Programs

a. Herring Research and Monitoring

NA

b. Data Management

This project coordinates with the data management program by submitting data and preparing metadata for publication on the Gulf of Alaska Data Portal and DataONE within the timeframes required.

c. Lingering Oil

NA

B. Projects not Within a Trustee Council-funded program

NA

C. With Trustee or Management Agencies

All data collected are provided to the National Marine Fisheries Service for use in stock assessments and other management actions. We directly exchange data with the National Marine Fisheries Service Northwest Fisheries Science Center (Dr. Gina Ylitalo and Dr. Kim Parsons) in a collaborative project comparing Southern Alaska resident killer whales with the endangered southern resident killer whales of Puget Sound from the standpoint of population dynamics, feeding ecology, and epigenetics. We contribute and collaborate on killer whale feeding ecology studies and share photographic data with Briana Wright, Jared Towers, and others at the Pacific Biological Station, Department of Fisheries and Oceans, Nanaimo, British Columbia, Canada.

9. Information and Data Transfer:

A. Publications Produced During the Reporting Period

Olsen, D. W., et al. Mating opportunities? Social behavior increases in multi-pod aggregations of southern Alaska Resident Killer Whales (*Orcinus orca*), submitted to Marine Mammal Science.

Chasco, B., I Kaplan, C. Matkin, et al. 2017. Competing tradeoffs between increasing marine mammal predation and fisheries harvest of Chinook salmon. Scientific Reports 7(1) DOI: 10.1038/s41598-017-14984-8 (left out of last year's report).

Danishevskaya, A.V., O. Filatova, C. Matkin, et al. 2018. Crowd intelligence can discern between repertoires of killer whale ecotypes. Bioacoustics. DOI: 10.1080/09524622.2018.1538902

B. Dates and Locations of any Conference or Workshop Presentations where EVOSTC-funded Work was Presented

2018

January	Zegrahm Expeditions, 'Killer whales of the world'
May	Kenai Fjords National Park training, 'Mom knows best: Killer whale culture in Prince William Sound'
May	Prince William Sound Science Center Brown Bag, 'Mom knows best: Killer whale culture in Prince William Sound'
May	Seward Public / naturalists / Captains, 'Mom knows best: Killer whale culture in Southern Alaska'
May	Kayak Adventures guide training, 'Mom knows best: Killer whale culture in Southern Alaska'
July	Zegrahm Expeditions, 'Killer whales of the world'
August	Seabourne Sojourn, 'Life of the Killer Whale'
October	Kenai Peninsula College 'Life History and Social Structure of Alaskan Killer Whales'
November	Kenai Peninsula College, 'Mom knows best: Killer whale culture in Prince William Sound'

2019

January Alaska Marine Science Symposium, Anchorage Alaska. Poster presentation by Craig Matkin et al., An unfortunate legacy: Continuing effects of the *Exxon Valdez* oil spill on killer whales

C. Data and/or Information Products Developed During the Reporting Period, if Applicable

All data sets for the period since the initiation of Gulf Watch Alaska (through 2017) have been supplied to Axiom and have been published.

D. Data Sets and Associated Metadata that have been Uploaded to the Program's Data Portal

All data sets are updated annually (the 2017 data set was updated in FY18). Genetic sampling of whales and prey for 2017 and 2018 are undergoing analysis at an outside lab and the GWA database will be updated when analyses are completed.

Currently the 2012-2016 data (first Gulf Watch Alaska segment) include Acoustic recordings_2012-2016, Biopsy and Genetic Data_1994-2016, Database of Surveys and Encounters_2001-2016, Photographic encounters_2012-2016, Prey Sampling, and Satellite Tagging Data_2004-2016.

10. Response to EVOSTC Review, Recommendations and Comments:

Science Panel Comments (EVOSTC FY18 Work Plan): The Panel applauds the work being conducted by the PI demonstrating the impact of oil on killer whales depends on whether the group of whales is transient or resident. These results help refine the restoration goal of this species, which might otherwise not capture the genetic differences between pods. These differences suggest unanswered questions about their social activities, which will be further addressed by the PI. The Panel appreciates that the PI does an excellent job regarding outreach.

PI Response: We appreciate the positive feedback.

11. Budget:

Please see the attached budget summary for FY18.

The budget is in need of revision as the tagging program has been put on indefinite hold due to humane considerations, reducing projected expenditures in commodities. Expenses on Soundtrap recorders have also been below budget. However, expenses for analysis of recordings and acoustic analysis software development have exceeded and likely will continue exceed expected amounts. In future years we may need to shift funds from commodities to contractual to provide for additional contract analytical time for acoustic analysis and software development and possible population dynamics analysis. Our 5-year budget plan is skewed to reduce commodities costs and increase analytical costs as we move toward the later segment of the project, but some additional adjustment might be required to balance these categories.

Budget Category:	Proposed FY 17	Proposed FY 18	Proposed FY 19	Proposed FY 20	Proposed FY 21	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$41.0	$41.0	$42.2	$42.2	$42.2	$208.6	$82.4
Travel	$3.2	$3.2	$3.5	$3.5	$3.5	$16.8	$4.4
Contractual	$49.5	$50.5	$52.3	$52.3	$54.0	$258.6	$94.3
Commodities	$33.8	$31.6	$20.6	$19.1	$16.7	$121.6	$47.9
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Indirect Costs (*10%*)	$ 13	$ 13	$ 12	$ 12	$ 12	$ 61	$22.4
SUBTOTAL	$140.2	$138.8	$130.4	$128.7	$128.0	$666.1	$251.4
General Administration (9% of	$12.6	$12.5	$11.7	$11.6	$11.5	$60.0	N/A
PROJECT TOTAL	$152.8	$151.3	$142.1	$140.3	$139.5	$726.1	
Other Resources (Cost Share Funds)	$25.0	$25.0	$25.0	$25.0	$25.0	$125.0	