FINAL

ENVIRONMENTAL ASSESSMENT

FOR

WATER DISTRIBUTION SYSTEM UPGRADES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

LYNDON B. JOHNSON SPACE CENTER

FEBRUARY 2010

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NOTICE: National Environmental Policy Act; is proposing construction of water distribution system upgrades throughout the Johnson Space Center.

AGENCY: National Aeronautics and Space Administration (NASA)

ACTION: Notice of Finding of No Significant Impact (FONSI)

SUMMARY: Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321, et seq.), the Council on Environmental Quality (CEQ) Regulations for implementing the Procedural Provisions of NEPA (40CFR 1500-1508), and the NASA policy and procedures (14 CFR part 1216 subpart 1216.3), NASA announces the availability of the Final Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) that address the environmental impacts expected to result from the construction of proposed water distribution system upgrades at the Lyndon B. Johnson Space Center (JSC) in Houston, Texas. The proposed action would result in temporary adverse impacts during the construction phase to environmental resources along approximately 80,000 linear feet of water utility line primarily located within an existing utility corridor. No long-term adverse impacts to the human environment would be realized during operation of the proposed action. The proposed action would result in beneficial impacts to water resources due to the estimated 20% reduction in potable water usage at JSC.

FOR FURTHER INFORMATION CONTACT: Written requests for copies of the Final EA and FONSI, or to provide comments or requests for information, should be directed to Mr. David Hickens, Chief, Environmental Office; NASA-JSC (Mail Code JE); 2101 NASA Parkway, Houston, TX 77058; or by Email: david.hickens-1@nasa.gov.

SUPPLEMENTAL INFORMATION: NASA has reviewed the EA prepared for the construction of all three phases of the water distribution system upgrades and has determined that it represents an accurate and adequate analysis of the scope and level of associated environmental impacts. The EA is hereby incorporated by reference in this final FONSI.

Two alternatives have been considered: the proposed action of construction of all three phases of water distribution system upgrades and the no-action alternative. The preferred alternative would upgrade the current potable water delivery system at JSC by separating the potable water and fire water distribution lines and would install a reclaimed water irrigation system. The action would alleviate the regular line flushing that is currently required to maintain water quality to drinking water standards in the existing water and would replace the potable water currently used for irrigation with reclaimed water from the Clear Lake Water Authority water treatment plant. These actions would result in a decrease in potable water use at JSC. The no-action alternative would leave a 50-year old potable water system in place that is unsustainable in terms of efficiency and maintenance and would not provide the necessary infrastructure to meet the current and future initiatives of NASA-JSC, per Executive Orders 13423 and 13514.

The potential physical, biological, socioeconomic, and cultural impacts of the construction and operation of the water distribution system upgrades have been assessed and evaluated. No impacts related to any of these environmental issues were identified. As a result of this assessment and evaluation, a FONSI has been made. Physical and biological characteristics of the installation that were considered included, although not necessarily limited to: land resources, water resources, biological resources, cultural resources, air quality, noise levels, hazardous materials, and socioeconomics and environmental justice. The proposed water distribution system upgrades would have no long term adverse impact on any of these resources. However, permanent impacts to wetlands could result if wetlands are confirmed to be present at the proposed location of the Phase III reclaimed water plant.

Cumulative Impacts: The EA reviewed cumulative impacts that could result from the incremental impact proposed activities when added to other past, present, and reasonably foreseeable future actions. Development projects within this context would be consistent with the JSC Master Plan and significant cumulative adverse impacts to the human environment would not be expected. Cumulative beneficial impacts to certain environmental resources may result from current and future development as NASA Policy Directive 8820.2C requires new construction to incorporate sustainable design features with the current recommendation to achieve LEED Silver certification through the U.S. Green Building Council.

Mitigation: Standard construction best management practices would be implemented to reduce erosion potential during ground disturbing activities and compliance with regulatory requirements would ensure appropriate storm water runoff control. The construction contractor would be required to develop a Storm Water Pollution Prevention Plan (SWPPP) and file a Notice of Intent with the U.S. Environmental Protection Agency (USEPA) and the Texas Commission on Environmental Quality (TCEQ) and file a preconstruction notice to the U.S. Army Corps of Engineers (USACE), per Nationwide Permit No. 12, prior to the start of construction. Areas of construction near drainage features would need to employ sedimentation controls to ensure minimal discharge of sediment to nearby ditches. The USACE may require additional mitigation measures if any permanent impacts to jurisdictional wetlands exceeds the allowable criteria.

In response to comments made on the Draft EA by the U.S. Fish and Wildlife Service during the public comment period, NASA intends to prohibit construction of the water line during the period of February 15 through June 15 in the vicinity of the Attwater's Prairie Chicken Captive Breeding Area, which is managed under a Space Act Agreement with the Houston Zoo. This accommodation should mitigate any potential adverse effects due to construction noise on these sensitive receptors. NASA will also include an endangered species survey at the time of the wetland delineation along the path of the line, and will perform a Section 7 consultation, if appropriate, based upon the outcome of the survey; however, NASA does not believe formal consultation will be required.

On the basis of the EA, NASA has determined that the physical, biological, socioeconomic, and cultural impacts associated with the construction of the water distribution system upgrades would not individually or cumulatively have a significant impact on the quality of the human environment. Therefore, NASA has determined that an Environmental Impact Statement need not be prepared.

Date: Comments in response to this notice should be addressed to Mr. David Hickens at the address noted above within 30 days of publication.

Michael L. Coats, Director
Johnson Space Center

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EXECUTIVE SUMMARY

Type of report

This report is an Environmental Assessment (EA) Report.

Name of proposed action

The name of the proposed action is construction of water distribution system upgrades at Lyndon B. Johnson Space Center (JSC), Houston, Texas.

Description of proposed action

The proposed action discussed in this document is the construction of water distribution system upgrades throughout the JSC campus to be used by JSC to increase the value and viability of the infrastructure on site. JSC is considered a significant consumer of potable water, consuming on the average approximately one (1) million gallons per day (MGD). The largest monthly consumption of water occurred in July 2009 when approximately 1.5 MGD was consumed. JSC operates and maintains a non-community, non-transient potable water distribution system that is regulated by the Texas Commission on Environmental Quality (TCEQ) under PWS ID No. 1010250.

The proposed action would be implemented in a phased approach: Phase I includes the installation of dedicated potable water lines parallel to the existing lines and the reconfiguration of the existing lines as fire water only distribution lines; Phase II includes the installation of new dedicated fire water lines and the abandonment in place of the existing water lines, and the Phase III includes the installation of a reclaimed water process and irrigation water distribution system with an associated 0.5 MGD water treatment plant and non-potable water distribution lines. This document provides an environmental assessment of the proposed action.

NASA-JSC estimates that implementation of the project would result in a 20% reduction in potable water consumption, based upon the Calendar Year 2007 baseline.

Description of no-action alternative

The no-action alternative would leave the existing water distribution system infrastructure in place with a co-mingled potable and fire water system that results in a significant maintenance and water use burden on JSC. The no-action alternative would result in inadequate and aging infrastructure on the JSC campus and would not meet the mission requirements for JSC. The no-action alternative would have several negative consequences for JSC, including unexpected waterline repairs in the future that may impact JSC personnel and interrupt daily operations. In addition, weekly waterline flushing events are currently required to maintain potable water quality standards. The no-action alternative would result in having to continue these flushing events, thus wasting thousands of gallons of water each week. The no-action alternative could result in JSC's inability to provide potable water in the event of a waterline breakage or leak, and could interrupt daily activities at an undetermined number of buildings or offices.

Land resources

Construction of the proposed action would not result in adverse impacts to area geological conditions or soil or agricultural resources, including prime farmland and regional ground surface subsidence. The location of permanent project components would be consistent with the recently updated JSC Master Plan, dated February 2009, and would not impact current or anticipated land use.

Water Resources

Construction of the proposed project could cause temporary disturbances to pockets of isolated wetlands at drainage crossings within the water line routes. These impacts would be temporary and permitted, as appropriate, under Nationwide Permit 12 from the U.S. Army Corps of Engineers (USACE). Although it may not be explicitly required for construction of Phases 1 and II within the existing utilities corridor, NASA will file a formal preconstruction notice with the USACE. Following installation of the lines, these areas would be restored to preconstruction conditions.

Under Phase III the construction of the proposed 0.5 MGD water treatment plant could result in permanent impacts to potential wetlands. A formal delineation within this area must be conducted prior to construction. Adverse impacts would need to be avoided or minimized to the most practicable extent possible, as required under Section 404 of the

Clean Water Act. Prior to initiating construction of Phase III, a notice will be filed with the USACE which will quantify any permanently impacted wetlands and, as appropriate, propose the associated mitigation measures to offset these permanent adverse impacts.

The proposed project would not cause long-term adverse impacts to surface water, groundwater, or floodplains. The separation of the potable water and fire water lines and the installation of a reclaimed water irrigation system would have the beneficial impact of reducing overall consumptive use of water resources at JSC. Some short-term erosion of soil and turbidity in drainage swales may occur during construction of the proposed facility; however, with appropriate storm water pollution prevention controls and practices, the anticipated impact would be minimal and temporary. JSC has a sedimentation and erosion control program in place that is designed to minimize impacts to water resources during construction activities; in addition, because the disturbed area for the project will exceed five (5) acres, the contractor will be required to develop and submit a Storm Water Pollution Prevention Plan, along with a Notice of Intent for submittal by NASA, and will be required to implement all applicable and appropriate storm water and sedimentation and erosion controls.

Biological resources

The proposed site (JSC) maintains characteristics of gulf coastal plain prairies. The footprint of the proposed water distribution system upgrades is anticipated to be minimal, as the waterlines would be designed as buried infrastructure. However, some permanent structures, including new fire hydrants and a 0.5 MGD water treatment plant, are planned to be constructed.

The remaining area of JSC that is undeveloped includes open land that provides habitat for deer, small mammals, birds, reptiles, and amphibians that are adapted to suburban environments. No impacts to these populations would be anticipated as a result of the proposed action. No long term impacts to threatened and endangered species or designated critical habitat would result from the proposed action. The enclosed Attwater's Prairie Chicken *(Tympanuchus cupido attwateri)* Captive Breeding Area located at JSC, a joint project of the Houston Zoo and the Texas Parks and Wildlife Department in conjunction with the U.S. Fish and Wildlife Service, is located within 200 feet of the proposed water lines. Construction could result in short term noise impacts,

which will be mitigated by prohibiting construction activities in this area during the primary breeding season (February 1 through June 15).

Cultural and Historical Resources

There are two buildings at JSC that are listed on the National Register of Historic Places. The proposed action would require reconnection of the new water and fire lines to these buildings. These actions would not have an adverse affect on these historic buildings. There are no known archaeological sites at JSC.

Air Quality and Noise Levels

Construction activities may cause short-term air emissions and dust. This can be mitigated with proper dust control methods. Operation of the system would not result in air emissions. Construction noise may exceed normal ambient noise levels, but normal levels are expected after construction activity ceases. Hours of construction will be limited to daylight hours to minimize noise levels to surrounding communities. Traffic flow may be temporarily affected during the construction phase due to construction through rights-of-way (ROWs) and some diversions of traffic would be anticipated. As described above, construction noise will be mitigated in the vicinity of the Attwater's Prairie Chicken Captive Breeding Area by prohibiting construction during the primary breeding season (February 1 through June 15).

Hazardous Materials and Hazardous Waste

Installation of the proposed fire and water lines would avoid areas of known or potential soil contamination, such as documented areas of contamination, former landfills, and current and former hazardous material storage areas. Water lines would be installed at depths shallower than the depths at which groundwater would be expected to occur onsite. Therefore, the proposed water lines would not be affected by groundwater.

No hazardous materials would be generated as a result of the construction or operation of the proposed system and preventive measures would be incorporated to reduce potential spills from construction equipment. Normal operations of the proposed water distribution system upgrades will not generate hazardous materials.

Socioeconomic

Construction and operation of the proposed water distribution system upgrades would not adversely impact minority or low-income populations.

Conclusions

Implementation of the proposed action would have long-term beneficial impacts due to the net reduction in potable water usage. This would result in reduced demands on surface water resources in the area. Short-term effects on the quality of the human environment, primarily associated with construction, would be minimal if the proposed action were implemented. No long-term adverse effects on the quality of the human environment are anticipated. Potential temporary impacts to wetlands and short term air quality and noise level impacts could occur during construction of the proposed action. Permanent impacts to wetlands could occur if wetlands are identified at the reclaimed water plant locations; if required, these impacts would be mitigated under the terms of a U.S. Army Corps of Engineers permit.

The proposed action, evaluated in conjunction with other current and planned development at JSC, would not be expected to contribute to cumulative adverse impacts to the human environment.

The no-action alternative would not provide the resources for meeting JSC mission requirements and objectives.

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ENVIRONMENTAL ASSESSMENT

For

WATER DISTRIBUTION SYSTEM UPGRADES

LYNDON B. JOHNSON SPACE CENTER

Houston, Texas

Lead Agency:	NASA – Lyndon B. Johnson Space Center
Proposed Action:	Water distribution system upgrades
For Further Information:	Mr. David Hickens Chief, Environmental Services Office Mail Code: JE 2101 NASA Parkway Houston, TX 77058 (281) 483-3120 Email: david.hickens-1@nasa.gov
Date:	February 2010

Abstract:

The proposed action discussed in this document is the construction of water distribution system upgrades in three distinct phases, which will enable the Lyndon B. Johnson Space Center (JSC) to provide newer and more reliable potable water system infrastructure, fire protection of government assets, and a more cost effective process and irrigation water supply system. The water distribution system upgrades are a key element in meeting NASA's infrastructure upgrade goals, including decreasing the amount of flushing of waterlines currently required in order to meet the Agency's potable water sustainability goals described in Executive Orders 13423 and 13514. This document provides an environmental assessment of the proposed water distribution system upgrades and the no-action alternative.

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Glossary: Abbreviations, Acronyms, and Terms Used

Alternative	Plan, option, choice (this EA analyzes two alternatives)
BMP	Best Management Practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CoH	City of Houston
Cumulative Impacts	Past, present, and reasonably foreseeable effects added together (regardless of who or what has caused, is causing, and might cause these effects)
Decision-maker	JSC Management (JSC Center Director), with review from NASA Headquarters
DOC	Discipline Operations Center
EA	Environmental Assessment
EIS	Environmental Impact Statement
FONSI	Finding of No Significant Impact (on the human environment, as defined in CEQ Regulations 1508.14)
FPPA	Farmland Protection Policy Act
HCFCD	Harris County Flood Control District
Issue	An environmental resource about which there is a concern; identified in NEPA, an unresolved conflict
JSC	Lyndon B. Johnson Space Center, Houston, Texas
LEED	Leadership in Energy & Environmental Design green building rating system of U.S. Green Building Council

NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act of 1969
NHL	National Historic Landmark
No-action	Continue present management, but do not implement the proposed project(s)
Objective	A subset of the project's goal
OSHA	Occupational Safety and Health Administration
Preferred Alternative	The alternative (option/plan) that the decision-maker plans to select near the end of the analysis process
PPE	Personal Protective Equipment
ROD	Record of Decision
Selected Alternative	The alternative (option/plan) that the decision-maker selects to implement
TARL	Texas Archeological Research Laboratory
TCEQ	Texas Commission on Environmental Quality
THC	Texas Historical Commission
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

1. Purpose and Need for the Proposed Project

1.1 Introduction

The National Aeronautics and Space Administration (NASA) is proposing upgrades to the existing potable water distribution system at the Lyndon B. Johnson Space Center (JSC). JSC is located in Houston in southeastern Harris County, Texas. (Figure 1).

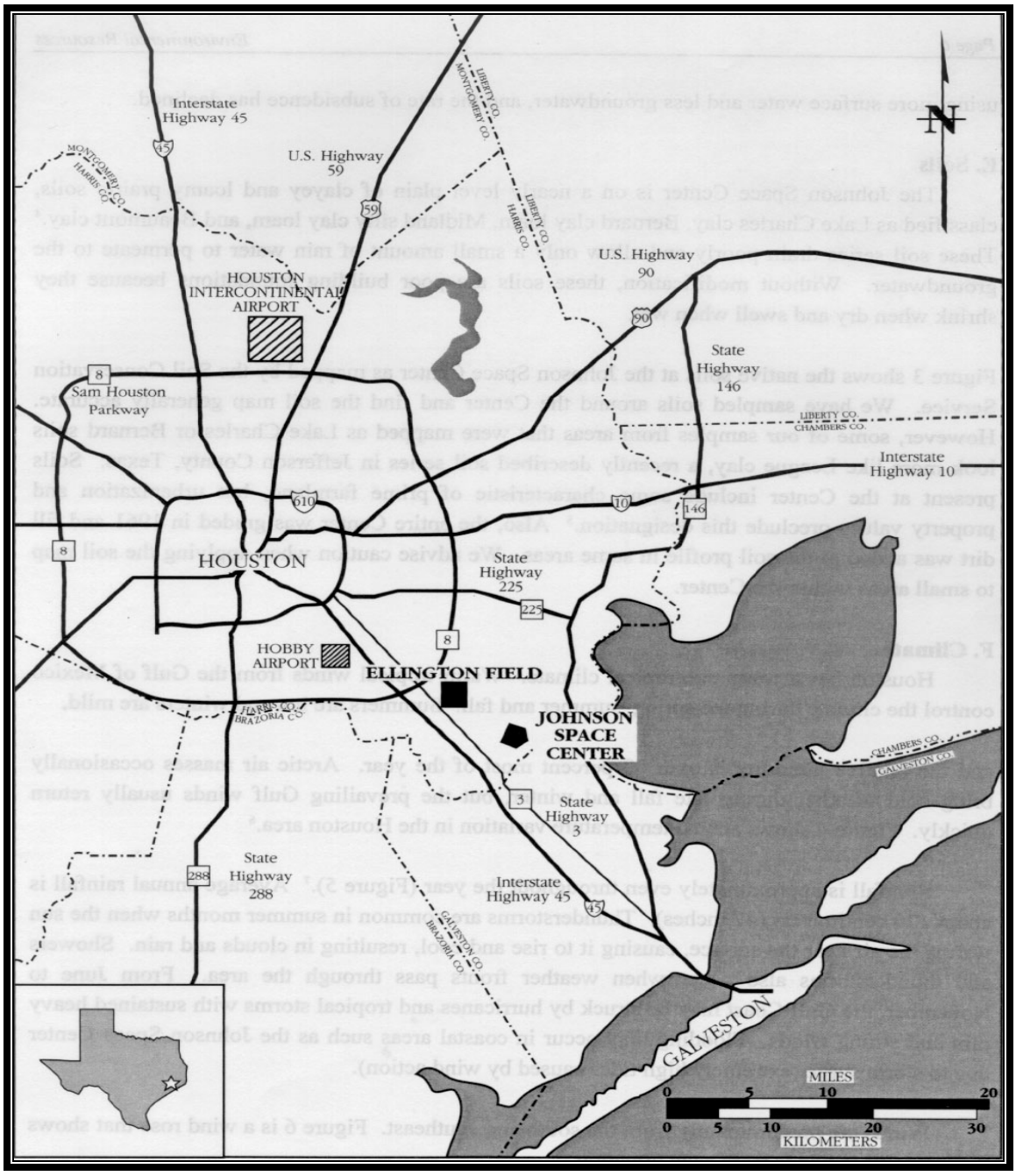

Figure 1 Vicinity and Location Map; Lyndon B. Johnson Space Center

The Johnson Space Center (JSC) is classified as a non-transient, non community (NTNC) Public Water System (PWS), and has been assigned PWS ID No. 1010250 by the Texas Commission on Environmental Quality (TCEQ). The system provides potable water both to JSC and to Space Center Houston (SCH). Although the water system has been determined to have the capacity to serve as many as 22,000 persons per day, the estimated "resident" population for JSC, as established with TCEQ in December 2004, is 8,530. Additionally, it is assumed that SCH will have an estimated 1,900 visitors daily and approximately 150 short term, full time employees. The maximum number of permanent employees at SCH at any given time is 100. The average daily water consumption at the JSC facility, as metered, is approximately 1 million gallons per day (MGD) with a daily peak use of about 1.5 MGD during the summer (which occurred in July 2009), based upon meter readings and associated billing in 2007, 2008, and 2009.

JSC purchases its water from the Clear Lake City Water Authority (CLCWA), which obtains its water from the City of Houston's Southeast Water Purification Plant (SEWPP). An 18 inch water main line from CLCWA serves JSC. Because this is a dedicated water line to the Center, the JSC water meter, read by the CLCWA, is located upstream of JSC at the CLCWA facility. The 18-inch water line traverses the western edge of JSC property and enters JSC at Gate 4 near the JSC water treatment plant building and two ground-level water storage tanks. The water line feeds through split lines directly into the ground water storage tanks.

There is also a 12-inch emergency interconnection with the CLCWA water system. It is located parallel to and about 100 feet south of the main water feed line just north of Avenue B. During emergency conditions, e.g., hurricanes, JSC closes the valve on its primary water supply line and opens its interconnection with the CLCWA water system. Under these conditions the entire JSC water system operates as an extension of the CLCWA water system. There is no water meter on the emergency interconnection with the CLCWA water system, so the water use during emergencies is estimated. An additional connection is available with the City of Nassau Bay at SCH, and an emergency contract is in place to obtain water from that entity. The water obtained from CLCWA is monitored (quantity and quality); JSC operators routinely sample the chemical characteristics of the water supplied by CLCWA (including pH and residual chlorine) at the JSC Water Treatment Plant (Building 319/322).

JSC owns, operates, and maintains two (2) on-site emergency wells (Water Wells No. 2 and No. 4) that can provide in excess of 1 million gallons per day of water. Water Well No. 2 has a capacity to supply 1,000 gallons per minute (gpm) and Water Well No. 4 has a design capacity of 1,500 gpm, but can be operated at 1,700 gpm. These wells are used for emergencies only, and do not normally provide groundwater for potable water service. The two wells are exercised regularly; the wells are flushed biweekly and bacteriological samples are collected from each well on a monthly basis. A sodium hypochlorite (bleach) system is currently used to disinfect the well water if it is to be used. Plans are being made to replace the well disinfection system with a chloramines treatment process to match the disinfection process used by the CLCWA and SEWPP.

The Center's water supply distribution system (Figure 1) was designed in the early 1960s and was sized to provide maximum fire protection for JSC structures and facility assets. The supply piping is larger than demand; consequently, the main lines are large in diameter, have long residence times, and inadequate loops, which results in depletion of chlorine residuals at its extremities. Because of this situation, sampling has historically identified low chlorine residuals at certain sampling points within the system. Consequently, JSC has established an aggressive flushing program at strategically located fire hydrants throughout the complex to reduce the potential negative impacts of low disinfectant levels. Flushing is performed monthly throughout the distribution system to ensure that the minimal disinfection residual is kept in the system, including at SCH. The water quality is regularly tested for bacteriological contaminants and disinfectant residuals.

The JSC water system itself includes the water source systems, water measurement, analysis and treatment systems, two (2) ground-level storage tanks, a booster pump station, an elevated storage tank, and a site wide corrosion control program. The system is controlled by a Programmable Logic Controller (PLC) but can be operated manually. The JSC system is required to employ at least two (2) operators who hold a Class "C" or higher license and who each work at least 16 hours per month at the distribution facilities. JSC maintains a cross connection control/backflow prevention program.

The first ground-level tank (B339) has a capacity of 1 million gallons. The second ground-level tank (B341) has a capacity of 600,000 gallons. The elevated tank (B40) has

a nominal capacity of 250,000 gallons but a working capacity of 240,000 gallons. The booster pump station has five (5) centrifugal pumps that are located at the water treatment plant next to the water storage tanks; capacities are as follows:

- Pump No.1 has a capacity of 500 gpm and is electrically powered;
- Pump No. 2 has a capacity of 1,500 gpm and is electrically powered;
- Pump No. 3 has a capacity of 1,000 gpm and is natural gas powered;
- Pump No. 4 has a capacity of 1,000 gpm and is powered by either natural gas or electricity; and
- Pump No. 5 has a capacity of 1,500 gpm and is powered by natural gas or electricity.

As a NTNC Public Water System, JSC is required to perform specific water system monitoring. This monitoring is not as extensive as some PWS' since the potable water provided by JSC is purchased from another supplier and many of the sampling requirements are obtained by the TCEQ from that water supplier. For example, testing of VOC's, minerals and metals is excluded. Asbestos is only monitored once every nine (9) years. No other inorganic monitoring is required. Testing for haloacetic disinfection byproducts (HAA5) and trihalomethane disinfection byproducts (TTHM) is performed routinely. The maximum contaminant level (MCL) for HHA5 and TTHM are 12 month running averages of 0.06 milligrams per liter (mg/L) and 0.08 mg/L, respectively. JSC monitors for fecal and E. Coli once per month from eleven sites within the distribution system. Samples are submitted to the TCEQ approved Galveston County Health District Laboratory. Only one (1) positive sample and no positives in any repeat samples are permitted. Residual chlorine within the distribution system is measured from at least one point in the distribution system daily. The maximum annual average chlorine level for the entire system is 4.0 mg/L. Minimum levels of 0.5 mg/L chloramine or at least 0.2 mg/L free chlorine (which applies when the CLCWA source switches from to chlorine alone as a disinfectant) must be maintained in 95% of the samples on an average monthly basis. Lead and copper are collected triennially and sent to a TCEQ-certified laboratory for analyses. Action levels for lead and copper are 0.015 mg/L and 1.3 mg/L in 10% of the samples, respectively. The groundwater wells are excluded from source monitoring, since they are used only in emergencies. TCEQ verified the applicability of these exclusions in a letter dated December 17, 2004.

The existing water distribution system infrastructure integrates the delivery of potable water service, fire water, and process water used for cooling tower makeup, irrigation, etc. within one service line. This service integration currently requires that the line be regularly flushed at weekly intervals in order to substantiate conformance with U.S. environmental Protection Agency (US EPA) and Texas Commission on Environmental Quality (TCEQ) drinking water standards. The proposed upgrade of services would occur in three phases:

- Phase I consists of the installation of new potable water lines parallel to the existing lines and retrofitting the existing infrastructure to serve as an interim dedicated non-potable fire water service line.
- Phase II would replace the interim fire water system with new lines and hydrants.
- Phase III would entail the installation of a reclaimed water treatment plant and distribution system for use as non-potable process water and for irrigation purposes.

The first phase of the project is anticipated to begin in Fiscal Year 2010.

The functional requirement of the water distribution system upgrades would be to provide upgrades and improvements to existing infrastructure in order to decrease the number of water main leaks or line breaks, reduce consumptive use of potable water resources currently needed for flushing of water lines, and reduce consumption for non-potable purposes, such as for process water (e.g., cooling tower water makeup) or turf irrigation.

1.2 Purpose and Need for the Proposed Project

The water distribution system upgrades are required to enable JSC to enhance the quality and reliability of potable water system infrastructure, to prevent problems with water-related infrastructure (i.e., line breaks), and to reduce the flushing of potable water lines. The separation of the potable and non potable (fire, and process / irrigation) water lines would enable NASA to attain differing water quality goals for each line separately. This will reduce the amount of waterline flushing, and thus significantly reduce overall consumptive potable water usage at NASA. In particular, the reclaimed water system would reduce overall potable water use for process makeup where potable water quality is not required (e.g., cooling tower makeup and turf irrigation). The water distribution

system upgrades are a key element in meeting NASA's goals of reducing potable water usage through engineering controls, as required by Executive Orders 13423 and 13514.

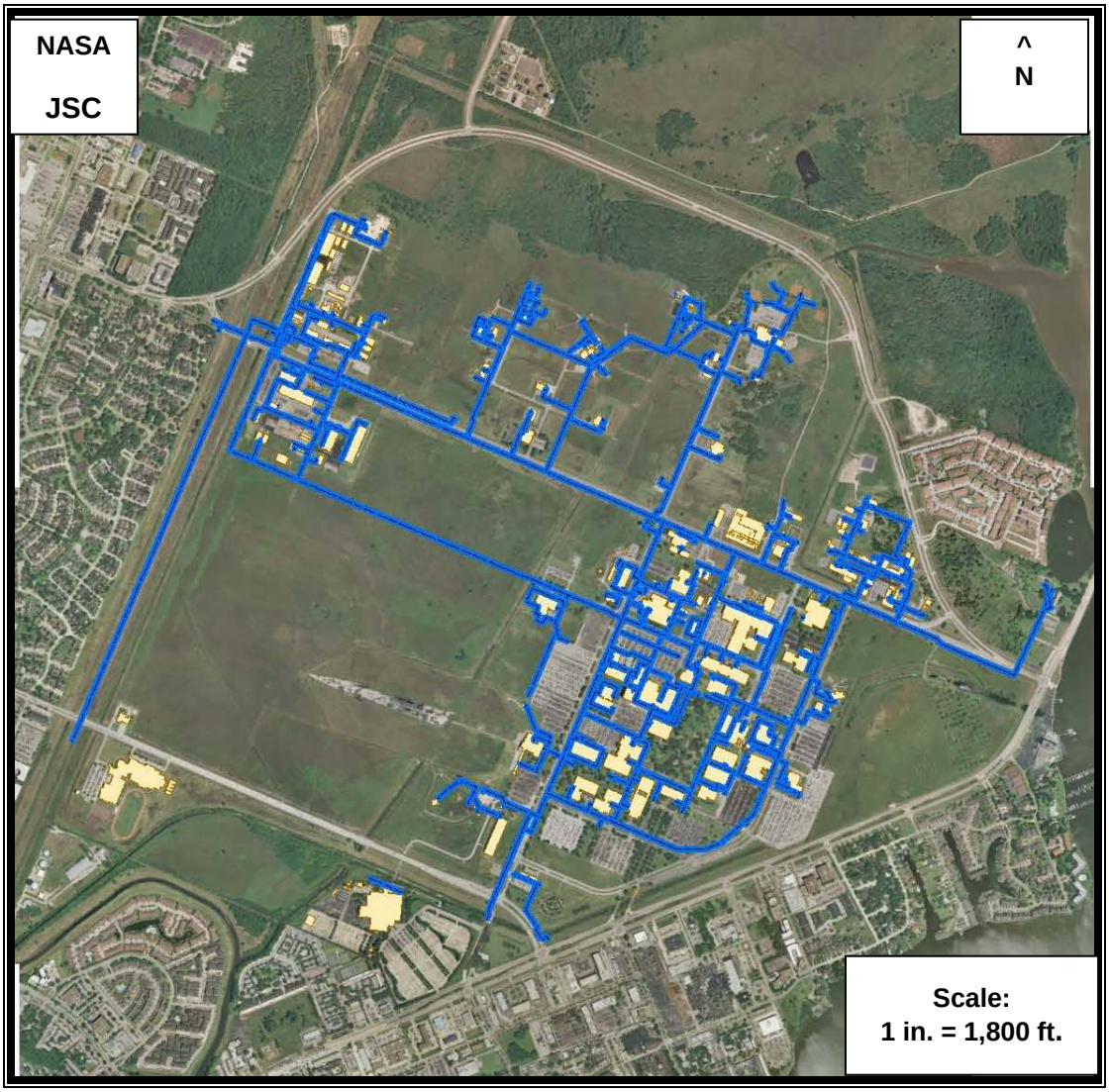

Figure 2 Existing Water Distribution System at JSC
(Primary water mains and potable water utility right of way are shown in blue)

1.3 Decisions That Must Be Made

JSC management must decide:

- Whether the proposed action would constitute a major federal action significantly affecting the quality of the human environment thereby potentially requiring the development of an Environmental Impact Statement (EIS) and a formal Record of Decision (RoD); and,
- Whether to construct the water distribution system upgrades, or choose the no-action alternative.

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2. Description of Project Alternatives

2.1 Proposed Action – Construction of Water Distribution System Upgrades

JSC proposes to construct a series of water distribution system upgrades in three phases:

- Phase I includes installing a new potable water line system and reconnecting all of the potable building services, totaling to approximately 37,700 linear feet of 8-inch PVC water line. The existing potable water/fire water line would be reconfigured to use as an interim dedicated fire water line.
- Phase II includes installation of a new fire water system, new fire hydrant assemblies, and reconnection of all the building fire services totaling to approximately 16,000 linear feet of 12-inch water line and 53,200 linear feet of 8-inch water line, and over 100 fire hydrants. The existing fire water line, consisting of iron, PVC, and non-friable asbestos-containing transite pipe, would be abandoned in place.
- Phase III includes installation of a reclaimed water system for non-potable uses (such as process water makeup and irrigation) consisting of a new non-potable "grey water" supply line (i.e., treated effluent form the Clear Lake City Water Authority (CLCWA) wastewater (sewage) treatment facility which would divert approximately 0.5 Million Gallons Per Day (MGD) from its permitted discharge outfall) totaling approximately 2,800 linear feet of force main from the Clear Lake City Water Authority water treatment facility, an offsite lift station, a 0.5 MGD treatment plant to filter the water to meet JSC irrigation standards, and a distribution system totaling to approximately 31,500 linear feet of 6-inch water line, and 3,000 linear feet of 3-inch water line.

The water distribution system upgrades would be located throughout the JSC campus in Harris County, Texas. Please refer to Figures 3 (North) and 4 (South). The proposed potable water and fire water lines in Phase I and Phase II would generally be installed within existing utility easements for the majority of the line loops and would serve developed areas of the JSC campus; however some portions of the lines would be installed through undeveloped areas.

Figure 3 Proposed Project (Water Lines and Treatment Plant in northern section of JSC)

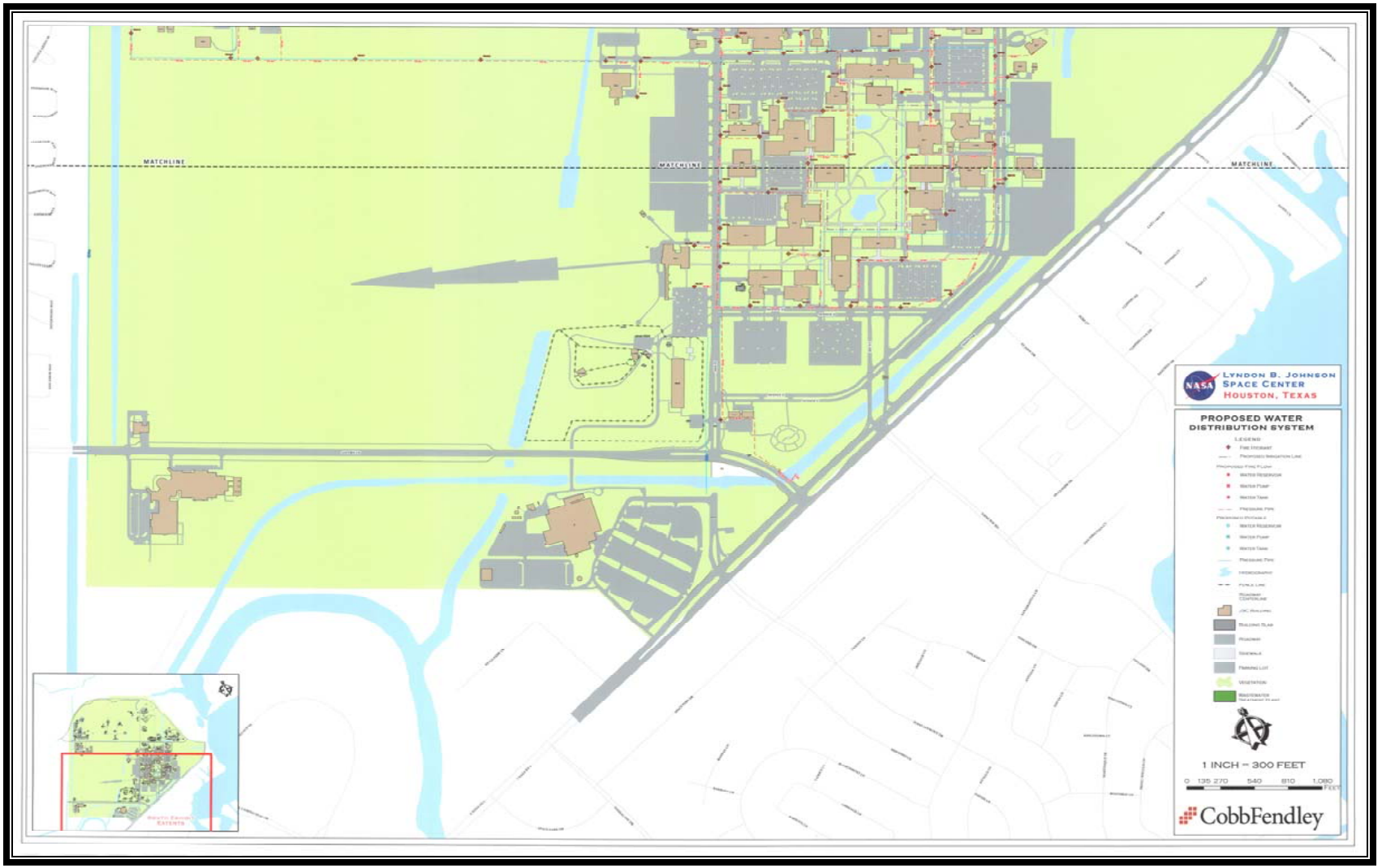

Figure 4 Proposed Project (Water Lines on southern section of JSC, including connection to Space Center Houston)

2.2 No-Build Alternative - No Upgrades to Water Distribution Systems

The no-action alternative would have several consequences for JSC and NASA. JSC has responsibilities for mission support to provide adequate facilities with functioning water distribution systems. The preventative nature of this project ensures that waterline infrastructure on the JSC campus is up-to-date and reduces the risk of unexpected repairs or maintenance, resulting in water shut-offs that may impact daily activities and work schedules. Interrupting daily activities at JSC could have detrimental effects, especially if planned tests or experiments cannot be executed as scheduled. In addition to this, a large reduction in the amount of water usage would result from the preferred alternative in that fewer flushing events of the water lines would be required.

In response to Executive Order 13423, NASA-JSC has been implementing a series of initiatives to reduce water consumption. JSC is currently on target to reduce water consumption by 2% each year, but without the elimination of excessive flushing of potable water, it is unlikely that JSC will be able to achieve the long range goals and objectives, while maintaining a healthful water supply for onsite consumption.

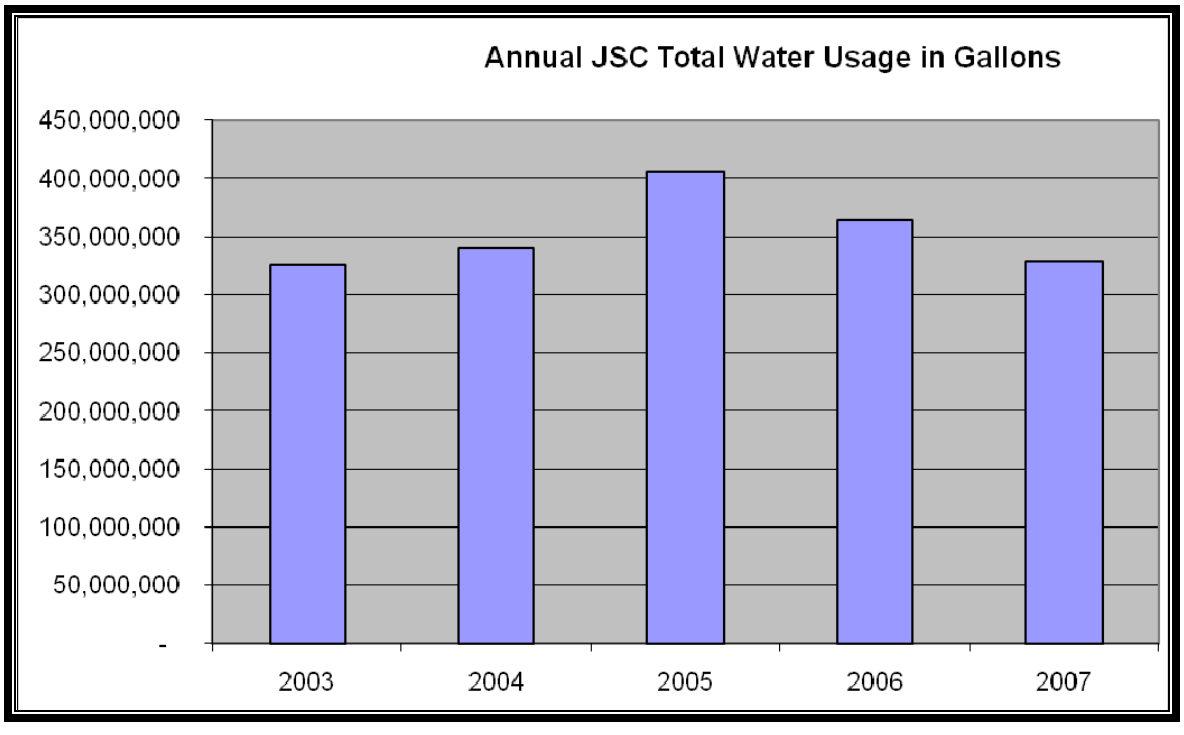

Figure 5 Annual JSC Total Water Consumption in gallons (2003 – 2007)

3. Affected Environment

The affected environment succinctly describes the relevant resources of the area that would affect or that would be affected by the proposed action if it is implemented. In conjunction with the description of the no-action alternative in Chapter 2 and with the predicted effects of the no-action alternative in Chapter 4, this chapter establishes the scientific baselines against which the decision-maker and the public can compare the effects of the preferred alternative on the environment.

3.1 Land Resources

3.1.1 Geology

According to the 1982 Geologic Atlas of Texas, Houston Sheet, published by the University of Texas at Austin, Bureau of Economic Geology, the JSC area is underlain by the Beaumont Formation of Pleistocene Age. The formation is predominantly clay, with some silt, sand, and gravel, and includes inter-distributary muds, abandoned channel-fill muds, and overbank fluvial muds, as well as stream channel and point bar deposits. The surface is almost featureless, characterized by relict river channels shown by meander patterns and pimple mounds on meander belt ridges. Pimple mounds are sandy-loam mounds, rising approximately one foot above the surrounding clay-loam soils. The Beaumont Formation is characterized by level-to-depressed relief with poor drainage and is comprised of soils that exhibit low permeability, high water-holding capacity, high compressibility, low shear strength, and high plasticity.

The coastal plain is latticed by non-tectonic growth faults primarily caused by compaction of underlying sediments. One hundred and thirty faults (active and inactive) extend over 300 kilometers (200 miles) in Harris County. Ground movement at these faults is generally gradual rather than episodic as with earthquakes; however may result in damage to pavement and buildings in urban areas. There are no mapped faults cross JSC. Underlying soils are mostly plastic clays and shales that readily convey strains to the surface.

Land surface subsidence is a common problem in the Houston-Galveston area, primarily due to withdrawal of groundwater. Approximately 5-6 feet of land surface subsidence

has occurred in the Clear Lake and NASA area, from 1906-2000 (Zilkoski, et al., 2001). Since 1975, the withdrawal of groundwater in Harris County has been regulated by the Harris-Galveston Subsidence District to limit continued land surface subsidence. The HGSD maintains an extensometer at JSC as part of its network to monitor subsidence in the region. According to the most recent annual report published by the HGSD, the rate of subsidence has significantly decreased in areas of southeast Houston due to reductions in groundwater pumping.

3.1.2 Soils

According to the 1976 Harris County Soil Survey, published by the Soil Conservation Service, soils at JSC are mapped as mostly Lake Charles clay with some Urban land complex in the developed areas, a combination of Lake Charles-Urban complex, Bernard-Urban land complex, and Verland-Urban land complex. These soils are somewhat poorly drained, and very slowly permeable, with high shrink-swell capacity. The Urban complex includes soils that have been altered or covered by buildings and structures. Fill material often covers natural soils. Soils present at the Center include some characteristic of prime farmland, but urbanization and property values preclude this designation.

3.1.3 Land Use

The Lyndon B. Johnson Space Center is located in Harris County, Texas, on 650 hectares (1,620 acres), approximately 40 kilometers (25 miles) southeast of downtown Houston and three kilometers (two miles) northeast of Webster, at 29° 33' north and 95° 05' west. The site is fairly flat, with elevations ranging from three to six meters (ten to twenty feet) above sea level.

The JSC Master Plan, published in February 2009, divides JSC into four general planning and geographic areas:

- Area I, the southeast section, includes the main complex of permanent “mall” buildings in the primary architectural style of JSC. They house administration, training, operations, major testing, engineering, development sciences, and management associated with manned space missions and tourism.
- Area II, the northeast section, includes the electrical substation and various support facilities. The southeastern part of this area is restricted for development

because it is vulnerable to tidal surge from hurricanes. The far north part of the area is for recreation, and includes the Gilruth Center, a picnic area, and a sports complex.

- Area III, to the northwest, is used for hazardous activities. The area contains the Energy Systems Test Area and includes storage areas for hazardous materials, explosives, and until recently, a training area for fire control. It also includes industrial-type support for JSC, including maintenance operations, central waste collection, service contractor construction activities, and logistics warehouses.
- Area IV is the southwest quadrant of JSC and is reserved for activities requiring large open buffer areas for antenna testing. The northwest part of the area is used for warehouses, shipping and receiving, motor pool, logistic support, and other housekeeping functions.

Several easements are present within the JSC Campus for various utilities, oil and gas exploration, and pipeline rights-of-way. Space Center Boulevard, which forms the northernmost boundary of the Center, is a public mobility easement, and government-owned tracts are located on both sides of the roadway.

3.2 Water Resources

3.2.1 Surface Water and Drainage

JSC is set in a landscape with many tidal streams and estuaries of Galveston Bay. Clear Lake is at the southeast corner; Mud Lake and Armand Bayou are northeast; Cow Bayou is southwest; and Horsepen Bayou is north of the Center. Horsepen Bayou flows east to its confluence with Armand Bayou (previously Middle Bayou). Armand Bayou and its tributaries drain about 164.5 square kilometers (63.5 square miles) of southeast Harris County. Armand Bayou flows into the northern end of Mud Lake, part of the Clear Lake estuary, which is connected to western Galveston Bay. Cow Bayou flows into Clear Creek, which drains to Clear Lake and then into Galveston Bay. Galveston Bay is recognized by the U.S. Environmental Protection Agency as an estuary of national significance and was included in the National Estuary Program in 1989.

Armand Bayou may be a "scenic river" as defined by the Wild and Scenic Rivers Act, although it is not listed by the U.S. Department of the Interior. The bayou's banks support a southern mixed hardwood forest, Gulf Coast tall grass prairie and coastal salt

marsh. The bayou supports breeding and spawning of many species of waterfowl and aquatic organisms. Recreational opportunities in Bay Area Park, along Armand Bayou, and north and east of JSC, include canoeing, hiking and bird watching. The bayou is a coastal preserve in the Galveston Bay National Estuary Program.

Surface water bodies within JSC consist of manmade ponds and drainage features. There are numerous swales and roadside water detention areas that serve as retention and conveyance areas for heavy rainfall events. The former HL&P Canal traversed JSC near the southern and eastern Center boundaries and predates development of JSC. With the deactivation of the Webster electric generating station, the canal is no longer utilized as a cooling water discharge channel, is densely wooded, and is essentially impassable with significant sedimentation and very low flow.

3.2.2 Groundwater

The Beaumont Formation, along with the underlying Lissie, Bentley, and Willis Sand Formations, comprise the Chicot Aquifer, which extends approximately 210 meters (700 feet) below surface of the JSC campus. The Evangeline Aquifer is approximately 671 meters (2,200 feet) thick and extends from the base of the Chicot Aquifer to approximately 884 meters (2,900 feet) below surface (Carr et al, 1985). Shallow groundwater can typically be encountered at a depth of 3.05 to 6.10 meters (10 to 20 feet) below the surface at JSC. The Chicot and Evangeline Aquifers are the principal sources of groundwater for public water supply in the Houston area. The Harris County Subsidence District restricts the pumping of groundwater due to the subsidence in the area.

Prior to 1976, JSC obtained water from three water wells at JSC. JSC currently does not regularly utilize groundwater; however JSC maintains two water wells for emergency and contingency use. These wells are pumped for testing and preventative maintenance weekly. Local municipal water suppliers, including the Clear Lake City Water Authority and the City of Nassau Bay, may request that JSC utilize the wells during times of drought, extremely high water demand, or emergency situations. Since 1976, JSC has obtained water from municipal water supplies utilizing surface water sources. This water comes from the San Jacinto and Trinity Rivers and flows through the Coastal Water Authority canal system to the City of Houston's Southeast Water Plant. There it is treated

and then conveyed by pipeline to the Clear Lake City Water Authority plant, just southwest of JSC. JSC uses about a billion liters of water (272 million gallons) annually.

The two uppermost groundwater bearing units underlying JSC have been impacted by releases of trichloroethylene (TCE) and Freon 113 from JSC activities, resulting in groundwater concentrations greater than State and Federal regulatory levels. The extent of the groundwater contaminant plume is approximately 10 hectares (25 acres) in the Energy Systems Test Area (ESTA). JSC has conducted remedial actions to address contaminated groundwater and continues to monitor the contaminant plume.

3.2.3 Floodplains

Floodplains are low areas adjoining inland and coastal waters. Those that have a one percent chance or greater for flooding in any given year are considered to be in a 100-year floodplain. Activities in floodplains should be compatible with the natural propensity for flooding. Structures in the floodplain may further exacerbate flooding upstream or downstream.

The Federal Emergency Management Agency (FEMA) publishes flood maps for insurance ratings. A floodplain map of the site was obtained from FEMA and is included as Figure 6 (TSARP 2007). JSC is predominantly located in a low-risk zone. However, the north and east portions of campus lie within the 500-year floodplain, and some areas closest to Space Center Boulevard and NASA Parkway lie within the 100-year floodplain. In March 2009, consistent with the aftermath of Hurricane Ike which struck the Houston – Galveston area in September 2008, the Harris County Flood Control District published an updated elevations map which identifies flooding concerns and evacuation zones in Harris, Galveston, and Brazoria Counties (Figure 7).

From June to November each year, the Texas Gulf Coast may be struck by hurricanes and tropical storms with sustained heavy rain and strong winds. Flooding may occur in coastal areas due to storm surge (extremely high tides caused by wind) and receding waters. The areas most susceptible to storm surge are the lower lying portions of JSC lying within the mapped floodplains. The JSC Master Plan restricts development within these areas due to the potential for inundation by storm surge.

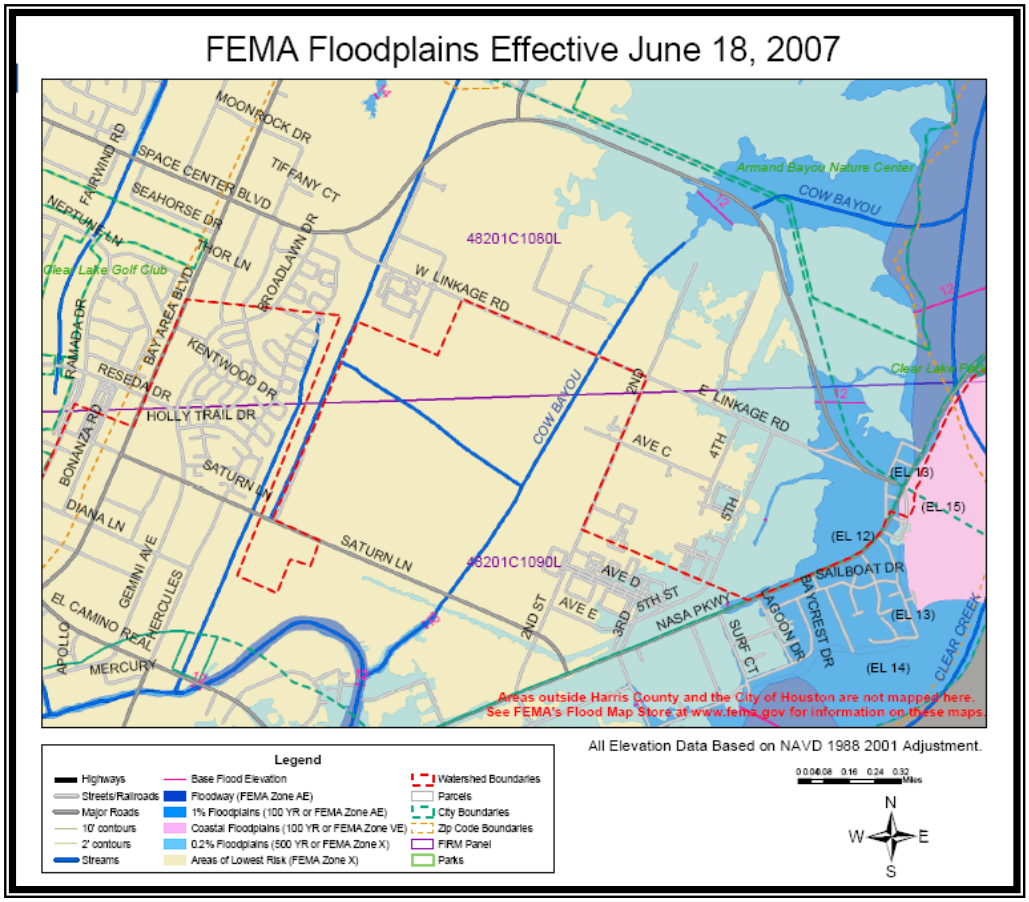

Figure 6 JSC Vicinity Floodplain Map (Federal Emergency Management Agency)

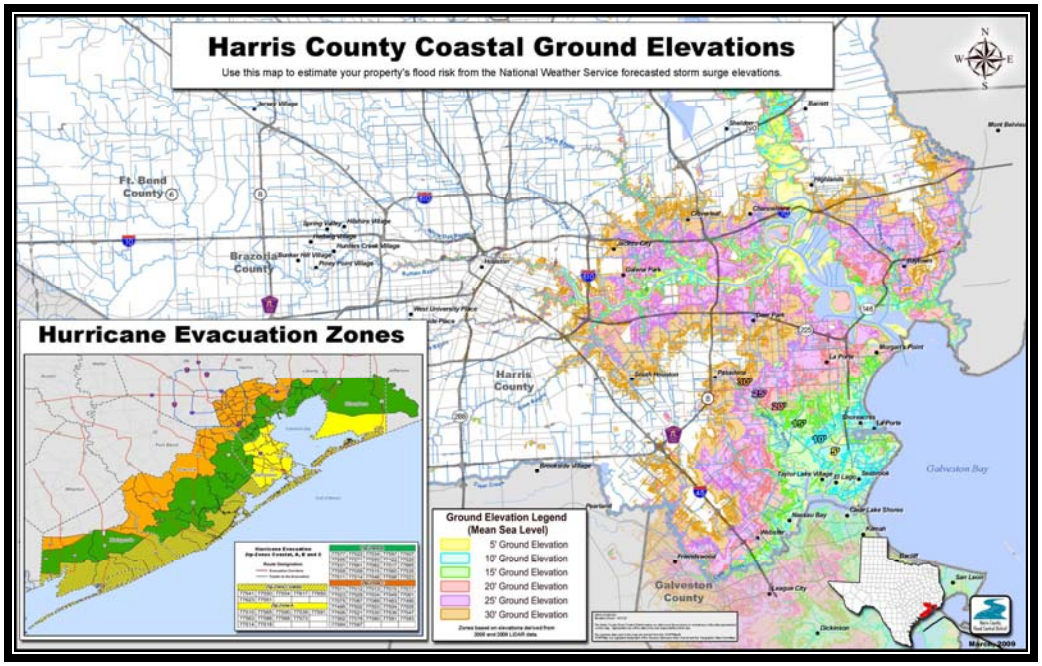

Figure 7 Coastal Elevations and Hurricane Evacuation Zones, HCFCD March 2009

3.2.4 Wetlands

The U.S. Army Corps of Engineers (USACE) is responsible for administering and enforcing Section 404 of the Clean Water Act. Wetlands are defined in Title 33, Code of Federal Regulations (CFR) Part 328, Section 3(b), as those areas that are inundated or saturated by surface of groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. A wetland, as defined by the 1987 Corps of Engineers Wetland Delineation Manual, must meet three mandatory criteria: hydric soils, wetland hydrology, and hydrophytic vegetation. A jurisdictional wetland must have a nexus to interstate commerce, commensurate with recent EPA/USACE guidance. The U.S. Department of the Interior, Fish and Wildlife Service has published National Wetland Inventory maps that identify wetland areas. These "wetlands" are not defined the same as USACE, but are an excellent planning tool. No wetlands were shown on or directly adjacent to the proposed water line locations, although wetlands are mapped on other portions of the JSC property (Figure 8).

Wetland vegetation consistent with gulf coast prairie assemblages is present in some areas of the JSC campus, predominantly in the northwest corner and through the southwestern undeveloped areas. Several drainage features throughout JSC display narrow wetland fringes dominated by herbaceous vegetation (smartweed) and shrubs. The former HL&P canal to the south and east supports a dense shrub layer of hydrophytic vegetation, as it is no longer maintained and has filled with sediment and soil. Several site-specific wetland surveys have been conducted at various locations throughout JSC; however, a comprehensive investigation of the entire facility has not been conducted. Consequently, there may be wetlands located onsite that are not yet identified or delineated. Previously conducted surveys have identified at least 11 additional isolated wetland areas not depicted on the USFWS National Wetland Inventory (NWI) maps. A preliminary analysis of vegetation in the project area identified herbaceous areas dominated by invasive vegetation including Dewberry (*Rubus trivialis*), King Ranch Bluestem (*Bothriochloa ischaemum*) and forested areas dominated by Chinese Tallow (*Triadica sebifera*). Consequently, a formal wetland delineation is warranted, particularly prior to Phase III, since the treatment plant could result in permanent displacement of wetlands.

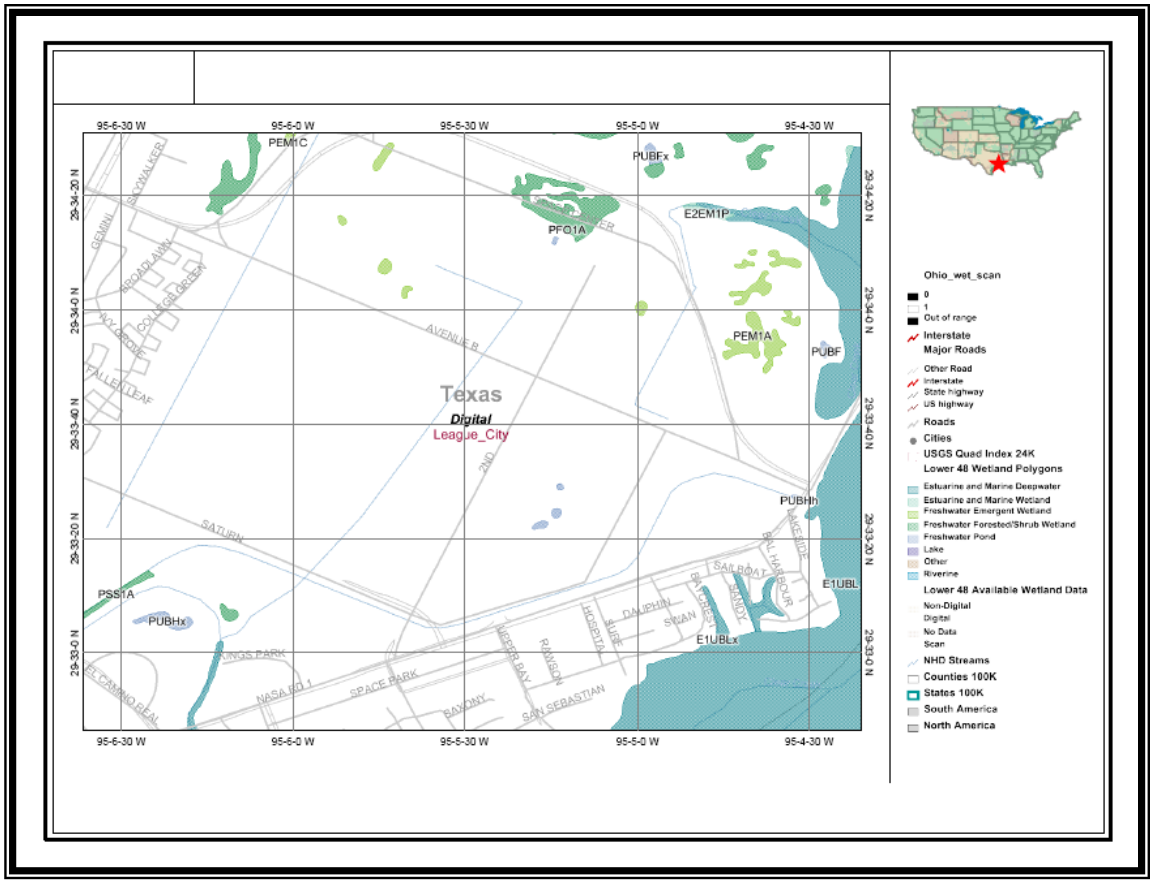

Figure 8 Areas at JSC included within the National Wetland Inventory (NWI).

3.2.5 Coastal Zone Consistency

All of JSC is located within the boundaries of the Texas Coastal Zone. All federal actions located within the Texas Coastal Zone must be reviewed for consistency with the Texas Coastal Management Program. The Coastal Coordination Council of the Texas General Land Office is the agency responsible for reviewing federal actions to determine consistency with the Coastal Management Program.

3.3 Biological Resources

3.3.1 Vegetation

The proposed water distribution system upgrade sites are located throughout the JSC campus; predominantly along the roadway ROWs. These ROWs are either maintained, mowed, or paved. Development has affected the natural plant communities at JSC through landscaping, building and paving, and grounds keeping and maintenance.

However, some areas of JSC have vegetative assemblages that are consistent with gulf coast prairie ecosystems. The general area is in the Gulf Prairies and Marshes area of Texas, with nearly level coastal prairie, slowly drained by many slow-moving streams, surrounded by low woodlands (Hatch et al. 1990). Tall prairie grasses are the dominant vegetation in coastal prairies.

3.3.2 Wildlife Habitat

The upper Texas Gulf Coast is home to many species of birds, mammals, reptiles, and amphibians. However, agriculture and urban development have fragmented and altered wildlife habitat. Open fields, administrative and operation buildings, roadways, and parking lots surround the proposed site. The open land near the proposed sites provide habitat for deer, small mammals, birds, reptiles, and amphibians that are adapted to suburban and rural environments. Species that have been observed at JSC include, but are not limited to, green heron (*Butorides striatus*), great egret (*Casmerodius albus*), grackle (*Quiscalus sp*.), barn swallow (*Hirundo rustica*), mottled duck (*Anus fulvigula*), red-winged blackbird (*Agelaius phoeniceus*), Eastern meadowlark (*Sturnella magna*), loggerhead shrike (*Lanius ludovicianus*), purple martin (*Progne subis*), scissor-tailed flycatcher (*Tyrannus forficatus*), snowy egret (*Egretta thula*), doublecrested cormorant (*Phalacrocorax auritus*), killdeer (*Charadrius vociferus*), and American crow (*Corvus brachyrhynchos*). Birds such as mourning doves (*Zenaida macroura*), European starling (*Sturnus vulgaris*), house sparrows (*Passer domesticus*), Northern mockingbird (*Mimus polyglottos*), Northern cardinal (*Cardinalis cardinalis*), and blue jay (*Cyanocitta cristata*) may also be found in open areas. Small mammals such as raccoon (*Procyonlotor sp.*), opossum (*Didelphis virginiana*), and rodents are found in open areas. Whitetail deer (*Odocoileus virginianus*) that are frequently observed on JSC property are considered a captive population due to the high security fencing that surrounds the site. Amphibians and reptiles are also common throughout JSC.

3.3.3 Threatened and Endangered Species

In cooperation with the U.S. Fish and Wildlife Service, the Texas Parks and Wildlife Department (TPWD) maintains listings of both potential and currently listed state and federally endangered and threatened species that may occur within a particular county. The TPWD maintains the Biological and Conservation Data System (BCDS). The list for Harris County (Table 1) was obtained from TPWD and was last revised on May 4, 2009.

Table 1 Harris County Threatened and Endangered Species, TPWD (BCDS), May 2009

HARRIS COUNTY THREATENED AND ENDANGERED SPECIES			
AMPHIBIANS		Federal Status	State Status
Houston toad	*Bufo houstonensis*	LE	E
BIRDS			
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	
Bald Eagle	*Haliaeetus leucocephalus*	DL	T
Brown Pelican	*Pelecanus occidentalis*	LE-PDL*	E
Peregrine Falcon	*Falco peregrinus*	DL	T
Red-cockaded Woodpecker	*Picoides borealis*	LE	E
White-faced Ibis	*Plegadis chihi*		T
White-tailed Hawk	*Buteo albicaudatus*		T
Whooping Crane	*Grus americana*	LE	E
Wood Stork	*Mycteria americana*		T
FISHES			
Creek chubsucker	*Erimyzon oblongus*		T
Smalltooth sawfish	*Pristis pectinata*	LE	E
MAMMALS			
Louisiana black bear	*Ursus americanus luteolus*	LT	T
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*		T
Red wolf	*Canis rufus*	LE	E
REPTILES			
Alligator snapping turtle	*Macrochelys temminckii*		T
Green sea turtle	*Chelonia mydas*	LT	T
Kemp's Ridley sea turtle	*Lepidochelys kempii*	LE	E
Leatherback sea turtle	*Dermochelys coriacea*	LE	E
Loggerhead sea turtle	*Caretta caretta*	LT	T
Smooth green snake	*Liochlorophis vernalis*		T
Texas horned lizard	*Phrynosoma cornutum*		T
Timber/Canebrake rattlesnake	*Crotalus horridus*		T
PLANTS			
Texas prairie dawn	*Hymenoxys texana*	LE	E

Status Key: LE, LT -Federally Listed Endangered/Threatened;
DL, PDL -Federally Delisted/Proposed for Delisting;
E, T -State Listed Endangered/Threatened;
"Blank" -Rare, but with no regulatory listing status
*The Brown Pelican has been approved for delisting on December 17, 2009

Neither threatened or endangered species nor habitat for threatened or endangered species are believed to exist in their natural state at the JSC. The Houston toad was reportedly observed at JSC during the 1950's, but it is no longer believed to be present. The only plant species listed for Harris County is the Texas prairie dawn-flower (*Hymenoxys texana*). Jill Seed, Senior Biologist of URS Corporation in Austin, Texas, performed a preliminary plant and wildlife survey of JSC in 2005. The Texas prairie dawn-flower was not reported to be observed during the survey.

The Houston Zoo operates a captive breeding program at the JSC campus to help restore the critically endangered population of Attwater's Prairie Chicken *(Tympanuchus cupido attwateri)* Through a Space Act Agreement, JSC licensed 1.7 acres of land to the Zoo to move their captive breeding program from the Zoo to JSC. The Zoo is fully responsible for the operation and maintenance of the program under a permit with the U.S. Fish and Wildlife Service. The Attwater's Prairie Chickens are housed in an enclosure located near Building 426. The proposed project will replace the main water line located within 200 feet of the southernmost boundary of the Attwater's Prairie Chicken captive breeding enclosure.

3.4 Cultural and Historical Resources

The Clear Lake area has been inhabited for over 2000 years. Archeological site records on file with the Texas Archeological Research Laboratory (TARL) at the University of Texas at Austin were previously reviewed to determine the presence of recorded sites around the project area. Based on a review of these records, no archeological sites have been recorded within the JSC campus; however, archaeological sites are present in the Clear Lake area. An absence of recorded sites on file with the TARL is not necessarily an indication of a lack of historical or archaeological sites; an apparent absence of sites may result from a lack of archaeological surveys in a given area.

Three buildings at JSC house National Historic Landmarks: the large vacuum chamber in Building 32, the Apollo mission control room in Building 30, and the Atmospheric Re-entry Materials and Structures Evaluation Facility (ARMSEF) located at building 222.

3.5 Air Quality and Noise

As described in Table 2, the U.S. EPA has established National Ambient Air Quality Standards (NAAQS) for ozone, lead, carbon monoxide, sulfur dioxide, nitrogen dioxide, and respirable particulate matter.

Table 2 National Ambient Air Quality Standards established by the US EPA

Type	***Primary Standards***		***Secondary Standards***	
Pollutant	***Level***	***Averaging Time***	***Level***	***Averaging Time***
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour [(1)]	None	
	35 ppm (40 mg/m^3)	1-hour [(1)]		
Lead	0.15 $\mu g/m^3$ [(2)]	Rolling 3-Month Average	Same as Primary	
	1.5 $\mu g/m^3$	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 $\mu g/m^3$)	Annual (Arithmetic Mean)	Same as Primary	
Particulate Matter (PM_{10})	150 $\mu g/m^3$	24-hour [(3)]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 $\mu g/m^3$	Annual [(4)] (Arithmetic Mean)	Same as Primary	
	35 $\mu g/m^3$	24-hour [(5)]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour [(6)]	Same as Primary	
	0.08 ppm (1997 std)	8-hour [(7)]	Same as Primary	
	0.12 ppm	1-hour [(8)]	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Mean)	0.5 ppm (1300 $\mu g/m^3$)	3-hour [(1)]
	0.14 ppm	24-hour [(1)]		

Table 2 Notes:
(1) Not to be exceeded more than once per year.
(2) Final rule signed October 15, 2008.
(3) Not to be exceeded more than once per year on average over 3 years.
(4) To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m3.
(5) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3 (effective December 17, 2006).
(6) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (Effective May 27, 2008)
(7) (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(8) (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq$ 1.
(b) As of June 15, 2005 EPA has revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact (EAC) Areas. For one of the 14 EAC areas (Denver, CO), the 1-hour standard was revoked on November 20, 2008. For the other 13 EAC areas, the 1-hour standard was revoked on April 15, 2009.

Within the State Implementation Plan, the TCEQ classifies the air quality status of each county with respect to NAAQS as attainment, non-attainment, maintenance, or unclassified. Attainment indicates that the air quality is within the NAAQS. Non-attainment indicates that the air quality exceeds NAAQS for a specified pollutant or pollutants. Unclassified indicates insufficient data to categorize a particular county. Harris County is classified as a "severe non-attainment" area for ozone. It is in attainment for all other NAAQS. Ozone is not emitted directly into the air. It is formed through chemical reactions between natural and man-made emissions of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of sunlight. Ozone pollution is the periodic increase in the concentration of ozone in the ambient air. When temperatures are high, sunshine is strong, and winds are weak, ozone can accumulate at ground level to unhealthful levels (TCEQ, accessed 2009).

Sources of air pollutants at JSC, other than mobile sources such as automobiles, include combustion sources (e.g. boilers), surface coating activities, laboratory hood vents, photograph processing, degreasing, woodworking, metal parts cleaning, and

fugitive emissions due to chemical product usage at various locations. The total pollution load from all stationary sources at the Center is shown in Table 3.

Table 3 Annual Emissions of Criteria Pollutants at JSC (2006 -2008)

Criteria Pollutant	***CY 2006 Emissions (tons/yr)***	***CY 2007 Emissions (tons/yr)***	***CY 2008 Emissions (tons/yr)***
$PM_{2.5}$	1.54	1.66	1.68
PM_{10}	20.50	18.85	20.99
SO_2	0.42	0.88	0.21
NO_x	26.26	19.26	14.40
CO	9.36	6.62	6.02
VOC	17.64	19.14	27.50

Source: JSC Annual Emission Inventories, 2006 - 2008

Mobile pollution sources include motor vehicles and construction equipment. The estimated 10,000 autos entering JSC each day travel an average of 20 kilometers (twelve miles) to JSC. Based on emission factors published by EPA using MOBIL5 (national averages) and assuming the average speed of driving is 55 km/hr (35 mph). NASA and contractor employees' cars produced an additional 50 tons of NO_X, 717.6 tons of carbon monoxide (CO) and 96.7 tons of non-methane hydrocarbons (HC) per year.

3.6 Hazardous Materials and Solid and Hazardous Wastes

3.6.1 Current hazardous material usage and hazardous waste generation

Due to the nature of research and work done at JSC, hazardous materials are utilized and industrial solid and hazardous wastes (ISHW) are generated on a daily basis. JSC is classified as a large ISHW generator by the TCEQ. All ISHW is accumulated and contained in properly labeled drums or bins at a designated 90-day accumulation area (Building 358), and are subsequently shipped offsite via manifest to approved, permitted Treatment, Storage, Disposal, or Recycling (TSDR) Facilities. Metal finishing in the Technical Services Facility (B9) generates spent concentrated baths and rinse water. These wastes are accumulated in tanks until shipped for treatment. Waste solvents and

oils are generated by maintenance activities such as painting, compressor cleaning and degreasing. Other ISHW generated include sludge from oil-water separators, wastewater containing hazardous organic compounds, lab packs, plating filter cake, contaminated filter media, used batteries, and contaminated rags; ISHW is also generated when chemical or petroleum spills are cleaned up and contamination is removed.

Radioactive materials are used at JSC for experiments and operations that require a source of radiation. Less than one curie of radioactive materials is stored at the Center under strict procedures. Many devices at JSC produce radiation, including x-ray machines, lasers, microwave generators, and radio transmitters. Devices that produce radiation that are publicly available without restriction (e.g., microwave ovens and video display terminals) are also at JSC, but are not included in NASA's inventory of radiation sources. NASA inventories its radiation sources. Most radioactive materials are stored in the Health Physics Laboratory (B263). Other radioactive materials are stored in the Planetary and Earth Sciences Laboratory (B31), and the Life Sciences Laboratory (B37). Excess material is stored at the Health Physics Laboratory (B263). The amount of radioactive materials at JSC is comparable to that of a major research-oriented university.

3.6.2 Historical Contamination Remediation Activities

The US EPA and TCEQ have developed strict regulations that require facilities to identify the locations and contents of past disposal sites and to take actions to eliminate any hazards in an environmentally responsible manner. In Texas, the primary set of regulations governing the management of restoration activities are under the Texas Risk Reduction Program (TRRP), established under 30 TAC 350. This program provides a consistent corrective action process directed toward protection of human health and the environment balanced with the economic welfare of the citizens of Texas. TRRP uses a tiered approach incorporating risk assessment techniques to help focus investigations and to determine appropriate protective concentration levels for human health and ecological receptors. The program also sets reasonable response objectives that are intended to protect human health and the environment and preserve the active and productive use of land.

JSC applied for and received a Resource Conservation and Recovery Act Hazardous Waste Storage Permit in November 1993; this permit was voluntarily withdrawn in 2004 when JSC determined that it was no longer required. However, a condition of the original permit was to implement the corrective action process for two areas on site: the Abrasive Blast Facility and the Fire Training Area. Each area is described further below:

3.6.2.1. Abrasive Blast Facility (ABF)

A significant quantity of abrasive blasting grit was removed from the ABF location in 1993. Following submittal of the work plan to the State on December 20, 1993, and approval in April 1995, soil borings and groundwater monitoring wells were installed and numerous samples were collected. Very low levels of constituents exceeding the Tolerance Interval Concentration Limits were detected. The results of this investigation were submitted to the TCEQ for review. On July 16, 1998, JSC received a letter from the State stating that "no further action" was required for this site. All of the monitoring wells have been plugged and the area is now considered "clean closed".

3.6.2.2. The Astronaut Fire Training Area (AFTA)

An Initial RCRA Facility Investigation (RFI) of the AFTA was completed in August 1993; an amended work plan was submitted in May 1995 and approved by the State in January 1997. The investigation was conducted in several Phases. During the Phase I investigation, ethylbenzene, o-xylene and m, p-xylene were detected in the soil requiring addition investigation. Groundwater monitoring wells were installed in order to sample the shallow groundwater in the area. During Phase II the area of contamination was delineated at depths of 6 feet and 11 feet. No groundwater contamination was detected. The Corrective Measures Implementation involved excavating the contaminated soil, removing the 2 sumps, cleaning and removing the 250 -gallon AST and fuel piping. Soil was excavated to a depth of 12 feet in several locations and to a depth of 7 feet in other locations. A total of 400 cubic yards of soils was removed for disposal at a Class 1 landfill. The excavations were sampled and the sample results revealed that no contaminants of concern remained in the soil. The area was backfilled, all groundwater monitoring wells plugged, and the site was restored to surrounding conditions. In December 1999, the final Corrective Measures Implementation report was submitted to the TCEQ for review. On March 16, 2000, JSC received a "no further action" letter from the TCEQ for the AFTA, and this area is likewise considered “clean closed”.

There are several closed and graded landfills at JSC. A pond at the Surplus Equipment Staging Warehouse (Building 338) was used during the Apollo program in the 1960s and early 1970s to evaluate the impact of spacecraft landing on water. After the Apollo program ended, it was filled with construction debris and closed in 1975. The Northwest Landfill, which was located north of what is now Space Center Boulevard, also received construction debris and was closed in 1985. The Northeast Landfill received sewage sludge that may have contained heavy metals from 1962 to 1972. The North Landfill received dredge spoil from Clear Lake that may have contained heavy metals. A Facility Assessment was conducted for each of the units, and both JSC and the TCEQ have concluded that no further action is required for each of these sites.

3.6.3 Current Restoration Activities: Energy Systems Testing Area (ESTA)

The EO has been actively engaged for over 20 years in identifying and mitigating the identified sources of chlorinated organic contamination in the groundwater underlying the Energy Systems Test Area (ESTA), formerly known as the Thermochemical Test Area. The primary constituents of concern are 1,1,2-trichloro-1,2,2-trifluroethane (Freon 113), trichlorofluoromethane, and trichloroethene (TCE). A Facility Investigation and Corrective Measure Study and a subsequent Remedial Investigation Report were prepared. These reports concluded that the shallow soil zone (zero to five feet below existing grade) had no detectable concentrations of the above contaminants, but that the deeper soil zone (near the identified source, greater than 25 feet below ground surface), the uppermost groundwater zone (shallow sand zone / water table at approximately 10-20 feet below ground surface) and the first underlying aquifer at 60 to 80 feet below ground surface had been impacted by the above contaminants. To address the remaining contamination, NASA has implemented the following remediation activities:

- **Conventional Pump and Treat System**

  A treatment system was designed and installed in 1991 for control of contaminants within the uppermost aquifer. The system consists of the following: Five groundwater wells (called extraction wells) that contain submersible pumps that are used to pump groundwater into a 10,000-gallon double-walled tank. From here the groundwater is pumped into an air-stripping tower that strips the contaminants from the groundwater. The scrubber air is vented through two carbon beds and the water is pumped through a second air- stripping tower for polishing. From here, the

water is discharged to the sanitary sewer system for further treatment. Although a downward trend in contaminant concentration levels occurred, the time to complete the remediation suggested that other alternative techniques be considered to complete the remediation activities; consequently, this system was shut down in 2005.

- **Innovative Treatment Technology**

  Since 2005, NASA, in conjunction with its environmental contractors, has designed, developed, and implemented an in-situ chemical oxidation (ISCO) treatment methodology. Potassium permanganate has been injected into the underlying soil and groundwater in strategically identified locations that are identified based upon a host of hydrological and mass transport parameters. After each injection, monitoring is performed to assess the effectiveness of the treatment and to plan the next injection area where further treatment is warranted. The initial injections were performed in February-March 2006. Substantial reductions in concentrations of the constituents of concern have been recorded within the shallow sand water table and within the uppermost aquifer. Injections and monitoring are continuing.

3.7 Socioeconomics

3.7.1 Demographics and Economic Activity

NASA's JSC is located in the Clear Lake area, which lies within Houston city limits in Harris County, Texas. The greater Clear Lake area includes the cities of Friendswood, Kemah, League City, Nassau Bay, Seabrook, Webster, Clear Lake Shores, El Lago, Taylor Lake Village, and parts of Houston and Pasadena. The 2000 population estimate for the Clear Lake area is about 200,000 persons (Clear Lake Economic Development Foundation 2000). The aerospace industry, specialty chemical industry, tourism, and boating and recreation dominate the Clear Lake area economy. Additional area businesses include the service, wholesale, and retail sectors (Bay Area Houston Economic Partnership website).

Table 4 Demographics of Harris County, TX, 2000 Census

Demographics: Harris County, TX	
White	42.1%
Black	18.5%
Other race	14.2%
Chinese	1.0%
Vietnamese	1.6%
Asian Indian	1.1%
Total Persons:	3, 693, 050
Types of Workers	
Government	11%
Private Wage/Salary	83%
Self Employed, not incorporated	6%
Persons in Work Force:	1, 827, 239
Households	
Average Household Income:	$44, 002
Average Household Size:	
Harris County	2.8
Texas	2.7
Median Monthly Rent:	$590
Median Resident Age:	31.2
Texas Median Age:	32.3

Source: www.city-data.com

3.7.2 Transportation, Traffic, and Parking

JSC is a controlled-access facility. In general, there is regular vehicular traffic for authorized (badged) personnel driving personal or government-owned vehicles, and no through (public access) traffic on the grounds of JSC. The primary roadways within the

Center are 2nd Street, 5th Street, and Avenue B, which connect to all areas of JSC. Traffic signals and signs regulate traffic on the roadways within JSC. Large parking lots are located throughout JSC; however, pedestrian traffic must often cross roadways to access onsite buildings. Speed limits are posted and are strictly enforced by JSC's Security personnel. Civil service and contractor personnel operating motor vehicles must have valid drivers' licenses, be able to demonstrate appropriate liability insurance coverage, and must otherwise conform with state driving regulations and JSC policies. For example, cell phone operation (text messaging) is strictly prohibited when operating a motor vehicle at JSC.

A METRO bus stop is located at Saturn Boulevard and 2nd Street just north of the main entrance to JSC. Service is provided daily.

Limited taxi service is provided, particularly for offsite contractor personnel who must frequent meetings or work areas within JSC. Courtesy vans are provided to transport authorized personnel.

4. Environmental Consequences

4.1 Land Resources

4.1.1 Geology

4.1.1.1. Effect of the Proposed Action

The proposed action would not have any significant adverse impact on geological features. The potential risk for impact to project components from seismic activity, movement along growth faults, or land surface subsidence is considered low.

4.1.1.2. Effect of the No-action Alternative

The No-action alternative would have no impact on site geology or geological resources.

4.1.2 Soils

4.1.2.1. Effect of the Proposed Action

The proposed action would not impact any soils that could be used as prime farmland, due to urbanization within the JSC area. Portions of both the Phase I potable water line and the Phase II fire water line routes would be installed in the general area of the delineated TCE and Freon 113 groundwater contaminant plume. Since the proposed lines would be installed within 1.5 meters (5 feet) of the ground surface, contact with any contaminated subsurface soils at depths of 3.05 to 6.10 meters (10 to 20 feet) below the ground surface is not anticipated.

4.1.2.2. Effect of the No-action Alternative

The No-action alternative would have no impact to soil resources.

4.1.3 Land Use

4.1.3.1. Effect of the Proposed Action

The proposed action would be consistent with the existing land use and current Master Plan at JSC. The proposed project would not impact any easements for utilities, oil and gas exploration, or pipeline rights-of-way within the JSC Campus. The proposed Phase III reclaimed water system may require off-site easements for the proposed force main and lift station to supply the reclaimed effluent from the Clear Lake City Water Authority.

4.1.3.2. Effect of the No-action Alternative

The No-Action alternative would have no impact on existing land use. If the proposed water distribution system upgrades are not completed the existing water system may not be able to provide an adequate water supply for future development within JSC.

4.2 Water Resources

4.2.1 Surface Water and Drainage

4.2.1.1. Effect of the Proposed Action

The proposed potable water lines (Phase I), fire water lines (Phase II), and irrigation supply mains and distribution lines (Phase III) would be installed underground and the ground surface would be restored to pre construction contours. There would be no impacts to surface water bodies or drainage of storm water within the JSC Campus due to operation of the lines. The proposed 0.5-MGD water plant may include minimal grading, but would not be expected to impact surface water bodies or storm water drainage.

The Phase I installation of a dedicated potable water line and re-configuration of the existing line as a dedicated fire water line would reduce the need to flush the potable lines to maintain potable water quality and thus reduce the total potable water usage at JSC and would result in less demand on surface water sources utilized by the Clear Lake Water Authority and City of Houston. The Phase III reclaimed water process / irrigation system would also reduce the amount of potable water usage by an estimated 2.0 MG per week during the peak growing season, assuming a water demand of 0.75 inches per week over the 103 irrigated acres within the JSC Campus. The water used for irrigation would be reclaimed effluent from the Clear Lake City Water Authority's water treatment facility instead of the potable water currently used in the irrigation system. The irrigation system would also be upgraded with automatic controls which could result in additional reductions in water use. The proposed line routes would be installed across drainage features, as listed in Table 5.

Table 5 Surface Water and Drainage Crossings

Phase	***Line***	***Drainage Feature***	***Location***
I	Potable Water	Ditch 26	West Linkage Road
I	Potable Water	Ditch 25	West of Bldg 44
I	Potable Water	Ditch 19	Between Bldg 358 and Gilruth Center
I	Potable Water	HL&P Canal	At 2nd Street
II	Fire Water	Ditch 25	South of Avenue B
II	Fire Water	Ditch 25	West of Bldg 44
II	Fire Water	Ditch 19	West of Bldg 380
II	Fire Water	Ditch13	North of Avenue B and South of Bldg 227
II	Fire Water	HL&P Canal	Near Saturn Rd and NASA Rd 1
III	Reclaimed Water Distribution	Ditch 25	South of Avenue B
III	Reclaimed Water Main	Low Easement	North of Space Center Blvd.

Construction activities may result in temporary erosion, causing sedimentation and turbid waters in nearby streams and ditches. A Storm Water Pollution Prevention Plan (SWPPP) will be required in accordance with JSC and regulatory guidelines before construction begins. The SWPPP requires implementation of erosion control measure to minimize impacts. These sedimentation and erosion control procedures must be implemented for the duration of construction.

4.2.1.2. Effect of the No-action Alternative

Increases in surface drainage and non-point source discharges are not anticipated with the no-action alternative. The site would remain undeveloped with general maintenance continuing in its current manner.

The no-action alternative would not result in any reduction in potable water use, because potable water would still be required to flush the water lines at the current frequency and potable water would still be used for irrigation purposes.

4.2.2 Groundwater

4.2.2.1. Effect of the Proposed Action

The reduction in potable water usage realized through the Phase I water, Phase II fire line reconfiguration, and the Phase III reclaimed water process and irrigation system would not be expected to significantly reduce demand on groundwater resources used by the Clear Lake Water Authority and City of Houston since treated surface water is now used almost exclusively for potable water purposes. JSC operates and maintains two water wells for emergency use only.

Portions of both the Phase I potable water line and the Phase II fire water line routes would be installed in the general area of the delineated TCE and Freon 113 groundwater contaminant plume. Since the proposed lines would be installed within 1.5 meters (5 feet) of the ground surface, they would not be expected to be in contact with the groundwater table, which is present at depths of 3.05 to 6.10 meters (10 to 20 feet) below the ground surface.

4.2.2.2. Effect of the No-action Alternative

The No-action alternative would not result in any reduction in potable water use, because potable water would still be required to flush the water lines at the current frequency and potable water would still be used for irrigation purposes. Therefore there would be no reduction in use of groundwater resources.

4.2.3 Floodplains

4.2.3.1. Effect of the Proposed Action

The proposed water lines would be installed underground and portions of the lines installed within the floodplain would not be affected by potential flooding events. Once the lines are installed the areas would be restored to pre-construction contours and would not impact existing floodplain boundaries.

Aboveground components, such as water meters (Phase I) and the Phase III lift station and 0.5 MGD water plant would be located outside the mapped 100- or 500-year floodplain boundaries.

4.2.3.2. Effect of the No-action Alternative

The No-action alternative would not alter the surface elevation of the designated floodplain.

4.2.4 Wetlands

4.2.4.1. Effect of the Proposed Action

Executive Order 11990 calls for the avoidance and minimization of wetland impacts wherever there is a practicable alternative on federally funded projects. There is not a current wetland delineation for the water distribution system upgrades at JSC; however, there are some isolated areas that appear to have wetland characteristics, based on soil and vegetation observed. Water lines may be routed around wetland areas, so that no adverse long-term or temporary impacts would result from water line installation. Based on a preliminary assessment, some portions of the proposed water lines and 0.5 MGD water plant may transect or impact wetland areas. Impacts to wetlands resulting from construction of the 0.5 MGD water plant would be permanent and may require a permit from the USACE and compensatory mitigation. Impacts to wetlands present at drainage ditch crossings could be avoided or would fall within nationwide permit criteria.

Nationwide Permit (NWP) 12, administered by the U.S. Army Corps of Engineers (USACE), historically has authorized impact of up to ½ acre of wetlands associated with the installation of utility lines (by the trench-and-backfill method) or through directional drilling provided that the pre-existing contours are maintained or restored upon completion. In March 2007, the USACE modified this NWP to (1) allow authorization of utility lines within navigable (Section 10) waters and (2) require a pre-construction notification when certain impact thresholds are met. Pre-construction notification is required if (1) the utility line crossing extends more than 500 feet through waters of the US, (2) the utility line is installed parallel to an existing stream bed instead of across a stream bed, (3) any mechanized clearing of a forested wetland is required, (4) greater than 1/10 acre could be permanently impacted by the project. Wetland delineation of all project areas is necessary to quantify impacts to wetlands that would result from the proposed project prior to construction. Formal wetland delineations must be performed prior to construction; as necessary or appropriate, preconstruction notifications or permit applications must be filed with the USACE.

4.2.4.2. Effect of the No-action Alternative

No wetlands will be impacted regarding the No-action Alternative. If the water distribution system upgrades were not constructed, all wetlands that may be present throughout JSC would remain intact.

4.2.5 Coastal Zone Consistency

4.2.5.1. Effect of the Proposed Action

The proposed action is consistent with the Texas Coastal Zone Management Program. The Coastal Coordination Council of the Texas General Land Office will be consulted for a consistency determination in conjunction with the public comment period.

4.2.5.2. Effect of the No-action Alternative

The No-action alternative would not result in any development within the Texas Coastal Zone and would therefore be consistent with the Texas Coastal Zone Management Program.

4.3 Biological Resources

4.3.1 Vegetation

4.3.1.1. Effect of the Proposed Action

The proposed construction areas would be located throughout JSC, and most areas consist of regularly mowed or maintained roadways or ROWs. However, some areas that would be transected in non-maintained areas have vegetative assemblages consistent with native gulf coastal prairies. Impacts to vegetation in these areas would be temporary, existing grass would be removed during construction of the waterline upgrades, but would be expected to return to its original assemblage after construction is completed.

4.3.1.2. Effect of the No-action Alternative

The present vegetative communities would persist as maintained areas and non-maintained areas would continue to preside in the same manner with the No-action alternative.

4.3.2 Wildlife Habitat

4.3.2.1. Effect of the Proposed Action

Proposed water distribution system upgrades at JSC would not support or create any new habitat suitable for wildlife; however, non-maintained areas may provide small pockets of habitat for adaptive species. Substantial displacement of wildlife is not anticipated, although a minor amount of habitat would be lost with regard to the construction of the 0.5 MGD water plant. Remaining fields at or near the site would easily accommodate displaced wildlife.

4.3.2.2. Effect of the No-action Alternative

The existing vegetation at JSC does offer some protective cover and food resources for wildlife. The No-action alternative would involve continuation of either maintenance mowing or non-maintained areas.

4.3.3 Threatened and Endangered Species

4.3.3.1. Effect of the Proposed Action

Construction of the proposed Phase I, Phase II, and Phase III water distribution system upgrades would not impact any native threatened or endangered species and would not be expected to permanently disturb habitat for any threatened or endangered species.

The Phase I and Phase II potable and fire water lines would be installed in the general vicinity of the Attwater's Prairie Chicken captive breeding program enclosure. Installation of the lines may cause temporary noise disturbances to the Attwater's Prairie Chicken population. In addition to restricting construction during the breeding season (from February 1 through June 15), JSC will consult with the Houston Zoo and implement identified measures to mitigate any other potential adverse impacts to the Attwater's Prairie Chicken Captive Breeding Area population. NASA has determined that formal consultation with the USFWS under Section 7 of the Endangered Species Act is not required.

4.3.3.2 Effect of the No-action Alternative

The No-Action alternative would not cause impacts to any threatened or endangered species or their habitat.

4.4 Cultural and Historical Resources

4.4.1.1. Effect of the Proposed Action

Section 106 of the National Historic Preservation Act of 1966 requires that federal agencies having direct or indirect jurisdiction over a proposed federal, federally assisted, or federally licensed undertaking, prior to approval of the expenditure of funds or the issuance of a license, take into account the effect of the undertaking on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places. Phase I and Phase II of the proposed action would require minor work to connect the new potable water and fire water lines to the JSC properties classified as National Historic Landmarks (i.e.; vacuum chamber in Building 32 and the original Mission Control in Building 30). These tie-in connections would be located approximately 100 feet from each building and would not result in adverse impacts to the buildings designated as National Historic Landmarks. The Texas Historical Commission will be contacted in conjunction with the public comment period to provide concurrence that the proposed action will not adversely impact the facility components designated as National Historic Landmarks.

In the event that archeological deposits or features are encountered during construction, the construction operations shall cease within the immediate area and the Archeological Division of the THC and NASA shall be immediately contacted for further consultation. Work would cease in the vicinity until the requirements of Section 106 of the National Historic Preservation Act were met.

4.4.1.2. Effect of the No-action Alternative

The No-action alternative would not result in land alterations; consequently, any unknown archeological deposits or features would not be disturbed. There are no records of cultural resources for this site.

4.5 Air and Noise

4.5.1 Air Quality

4.5.1.1. Effect of the Proposed Action

The construction of the proposed water distribution system upgrades would not be expected to introduce any harmful substances into the atmosphere. Heavy machinery and trucks used during water line installation and facility construction emit carbon monoxide, particulate matter, nitrogen oxides, hydrocarbons, and sulfur oxides. Best Management Practices would be implemented to mitigate emissions and control any dust created during construction. Air quality effects from construction equipment and associated vehicular traffic would be localized and temporary. These actions should pose no substantial long term impact upon air quality.

4.5.1.2. Effect of the No-action Alternative

There would be no changes in air quality if the No-action alternative were implemented. Construction equipment would not be necessary and general maintenance activities would continue.

4.5.2 Noise Levels

4.5.2.1. Effect of the Proposed Action

Operation of heavy machinery and increased vehicular traffic would temporarily increase noise levels during the construction of the water distribution system upgrades on-site and to surrounding buildings. The temporary noise increase would not be likely to pose a threat to occupants, but the potential for hearing loss in construction workers at the site would exist during most construction phases. Construction noise levels could be a nuisance to JSC employees and contractors working in buildings near water line installation activities. These nuisance noise levels would be temporary and expected to be limited to onsite areas in the immediate vicinity of the construction activities.

Best management practices shall be incorporated to minimize the impact of construction related noise to surrounding areas. JSC would require OSHA safety standards be

followed including wearing personal protection equipment (PPE) at all times during the construction of the water distribution system upgrades.

In the vicinity of the Attwater's Prairie Chicken captive breeding area, construction will be scheduled such that noise levels are reduced significantly during the breeding season (February 1 through June 15).

4.5.2.2. Effect of the No-action Alternative

Noise levels in the area would remain unaltered if the no-action alternative were implemented.

4.6 Hazardous Materials and Hazardous Waste

4.6.1 Effect of the Proposed Action

The proposed action would install potable, fire, and irrigation water lines in existing utility corridors, adjacent to roadways, and through some undeveloped portions of the Center. Known hazardous material storage and use areas would be avoided and would not impact the proposed action. Normal operations of the proposed action would not generate hazardous materials or wastes. No effects from hazardous materials, when managed in compliance with environmental regulations, are anticipated.

The Phase II fire water line and a small section of the Phase I potable water line would traverse the general area of the TCE and Freon 113 groundwater contaminant plume. Current soil and groundwater contaminant concentrations within the proposed water line routes have been evaluated with respect TCEQ Texas Risk Reduction Program Protective Concentration Levels to ensure that existing concentrations are protective of human health for the construction workers that would install the lines. Water lines located within this area would be installed at depths shallower than the affected groundwater and would not be impacted by direct contact with contaminated groundwater.

The Phase III 0.5 MGD reclaimed water plant would be located in the vicinity of Building 338, which was formerly used to store PCB-containing materials. A former landfill was also located near Building 338. JSC has determined that the proposed water plant

would not be located in the areas of the historic landfill and PCB storage areas. These former activities would not impact construction or operation of the proposed water plant.

Heavy construction equipment brought from outside JSC has resulted in spills of hydraulic fluid and other petrochemicals at other construction sites. JSC would take precautions at the water distribution system upgrade sites to prevent potential spills by requiring construction equipment be adequately maintained and serviced.

4.6.2 Effect of the No-action Alternative

Existing conditions should remain unchanged if the no-action alternative were implemented.

4.7 Socioeconomics and Environmental Justice

4.7.1 Demographics and Economic Activity

4.7.1.1. Effect of the Proposed Action

The three phases of the water distribution system upgrades would not employ any new civil service and/or contract personnel. Some temporary jobs may be created during the construction.

Executive Order 12898, dated February 11, 1994, requires the preparation of an environmental justice strategy that follows the framework of the National Environmental Policy Act (NEPA) and Title VI of the Civil Rights Act. The Executive Order requires identifying and addressing disproportionately adverse human health or environmental impacts within minority populations and low-income populations.

Studies conducted for this project indicate that there will not be any disproportionate impacts to low-income populations or minority populations from the proposed action or any of the alternatives. No displacements will be required, and no impact to community cohesion is anticipated now or in the future, as the project area is confined to JSC property. Because no residential households will be displaced, no minority populations or low income populations will be divided or isolated by the proposed project, and no adverse effects from noise or air emissions will be created, no environmental justice issues have been identified for the proposed project.

4.7.1.2. Effect of the No-action Alternative

The implementation of the No-action alternative would have no effect on employment. If the water distribution systems were not constructed, new jobs consisting of temporary construction work would not be created and potential learning opportunities would cease to exist.

4.7.2 Transportation, Traffic, and Parking

4.7.2.1. Effect of the Proposed Action

Minor transportation impacts would be expected at JSC with the proposed action. Some minor traffic congestion and partial lane closures could occur during construction, but major delays would not be anticipated. Steps would be taken to ensure safe roadway conditions and access to all facilities. The proposed action would have no long-term effects on traffic flow or parking within the JSC Campus or offsite.

4.7.2.2. Effect of the No-action Alternative

Alterations in the traffic flow patterns are not anticipated with the No-action alternative. Any changes in traffic flow or volume would be a result of changes occurring elsewhere at JSC.

4.7.3 Environmental Justice

4.7.3.1. Effect of the Proposed Action

The proposed project would be entirely located within the JSC Campus and would not have adverse impacts beyond the JSC Campus. As such, the proposed action would not be expected to have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations.

4.7.3.2. Effect of the No-action Alternative

The No-action alternative would not have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations.

4.8 Recommendations

The proposed actions would not be anticipated to have any measurable adverse effects on local resources and facilities at JSC. With the exception of installing the 0.5 MGD reclaimed water treatment facility during Phase III, construction of the water lines would cause only temporary displacement of soil, vegetation, and wildlife habitat; impacted areas would be re-graded to pre-construction contours. Construction activities could also result in temporary and localized increases in air emissions and noise levels from heavy equipment.

Wetland impacts may occur, since wetland characteristics have been observed in and around some of the project area. Impacts to wetland due to water line installation would be avoided by routing lines around wetland areas. Construction of the proposed Phase III 0.5 MGD reclaimed water treatment facility may result in permanent impacts to wetlands. Prior to construction, a wetland delineation pursuant to current USACE guidance would be performed in this area as well as drainage crossings and other areas where wetland characteristics have been observed to quantify potential impacts to wetlands that would result from the proposed action. Impacts to wetlands may require permitting by the USACE and permanent impact could require compensatory mitigation. Close coordination with the USACE is recommended as a mitigation measure, including the filing of a preconstruction notification (as required by NWP 12) and for Phase III a permit application for the permanent removal of wetlands with proposed wetland offsets or mitigation, if required.

The proposed phases of water distribution system upgrades are anticipated to have an overall beneficial impact at JSC by decreasing potable water consumption by an estimated 20% over the 2007 base year. The upgrades would separate the potable and fire water lines so that less flushing is needed to maintain potable water quality standards. In addition, the upgrades will prevent unexpected line leakages or breakages that could adversely impact daily operations and mission requirements at JSC. Overall, this project will cause minimal impacts compared to the benefits of enhanced reliability of replacing the greater than 40 year old water lines and significantly reducing potable water consumption, consistent with the stated goals of Executive Orders 13423 and 13514.

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5. Cumulative and Indirect Impacts

The evaluation of the cumulative and indirect impacts of the proposed action on the human environment must account for impacts resulting from other concurrent development and impacts that may result from actions undertaken in response to the proposed action.

The Phase I, Phase II, and Phase III water distribution system upgrades would be limited to within the JSC Campus and easements immediately adjacent to JSC. The design capacity of these systems accounts for projected growth at JSC for the next 20 years, including buildings currently under construction and future anticipated buildings. Cumulative impacts resulting from the projected growth at JSC would be consistent with JSC Master Plan and not be expected to have adverse impacts to land resources, biological resources including threatened and endangered species, or socioeconomic resources.

The cumulative impacts to wetlands, cultural/archaeological resources, air quality, noise levels, or hazardous materials and wastes cannot be completely evaluated without resource-specific information for each development project. There is potential for wetlands and cultural/archaeological resources to be present at JSC; therefore, cumulative adverse impacts could occur to these resources. However, the proposed action would not be expected to contribute significant adverse impacts to these resources. The proposed actions are designed to meet existing and projected water supply and distribution needs and would not be expected to unduly spur additional development thereby affecting sensitive resources within JSC. The proposed project would not contribute to long-term adverse cumulative impacts to air quality, noise levels, and hazardous materials. Other development projects could result in adverse impacts to these resources, depending on the nature of the activities conducted; however adverse impacts to these resources would be restricted by the appropriate regulatory authority (TCEQ for air quality and hazardous materials) or may require design features to mitigate potential impacts (e.g., USACE wetland mitigation measures).

Current and future development at JSC, including the proposed action, would not be expected to have adverse impacts on water resources and would result in beneficial

impacts. NASA Policy Directive NPD 8820.2C requires all NASA new construction projects to incorporate sustainable design features with the current recommendation to achieve Silver certification through the Leadership in Energy and Environmental Design (LEED) Green Building Rating System of the U.S. Green Building Council. The estimated 20% reduction in potable water consumption resulting from the proposed action in conjunction with water-conservation measures required to achieve LEED certification for new construction and rehabilitation projects would be expected to have a cumulative beneficial impact on surface water resources by reducing demand for these resources.

Table 6 summarizes the status of discrete projects that are currently in progress at JSC. The table includes projects that are in varying stages of design, construction, or that are included with the federal recovery program associated with repairs resulting from damage sustained at JSC due to Hurricane Ike.

Table 6 JSC Construction of Facilities (CoF) Projects

Project Description	***Type FY Project No.***	***Schedule Design Start Design Finish Const Start Const Finish***
B20 Construct New Office Building -	CoF 2007, 2008 05100	4/28/06 4/20/07 12/15/07 10/15/09
B44 Ike Phase 1, Replace Roof	CoF 2009 08112 Ike Rprs.	NA NA 6/9/09 11/16/09
JSC Mall Ike Phase I, Mall Package, Repairs	CoF 2009 08107 Ike Rprs.	NA NA 11/5/08 9/30/09
Replace Roof Various Facilities, Roof Package I	CoF 2009 09010 Ike Rprs.	2/19/09 3/6/09 7/26/09 4/21/10
B9S Ike Phase II, Replace Roof, 8A Package -	2009 09012	NA NA 8/31/09 5/28/10
Barge Dock Ike Phase II, Barge Dock, B8A Package -	2009 09012	NA NA 9/30/09 3/28/10

Project Description	***Type FY Project No.***	***Schedule Design Start Design Finish Const Start Const Finish***
B2S Ike Phase II, Replace Carpets	N/A 2009 N/A	NA NA 5/1/09 9/15/10
B14, B33, & B49 East Tower Ike Phase I, Replace Roofs	CoF 2009 08113 Ike Rprs.	B. 14 10/10/08 2/28/09 11/5/09 9/18/09 B. 33 10/10/08 2/28/09 11/5/09 9/11/09 B. 49 E. Tower 10/10/08 2/28/09 11/5/09 9/26/09
Ike Phase II, Replace Roofs & Loggias, Repairs, Roof Package 2	CoF 2009 09011 Ike Rprs.	2/19/09 3/6/09 5/1/09 9/15/10
B31N Upgrades (AH 12, 13, 14) & Option 1 (AH15)	CoF 2008, 2009 09001	B31N Upgrades (AH 12, 13, 14) 4/24/08 11/21/08 3/20/09 9/4/09 (AH 15) NA NA 6/30/09 11/30/09
B3 Cafeteria Serving Line Renovation	EAA 2009 07360	11/20/07 10/1/09 12/1/09 5/1/10
B3 West Re-Roof & Renovations	2009 08117	4/10/09 10/1/09
B46 UPS 1, 2, 3, & 4 Replacement	CoF 2009 06106	6/20/06 9/22/06 8/25/08 12/31/09
B16 Switchgear Replacement	COF 2008 06107	NA NA 8/1/08 10/31/09

Project Description	***Type FY Project No.***	***Schedule Design Start Design Finish Const Start Const Finish***
B30A, 30M, 46 Mechanical System Upgrade	2011 09004	8/18/09 8/18/10 4/2011 4/2012
B29 CAIL - CEV Avionics Integration Lab.	CoF 2008 07110	7/20/07 5/2/08 8/11/08 4/27/10
B110 Remodel Customer Service Area	LOC	12/20/07 11/14/08 6/24/09 10/23/09
B5S - Partially Refurbish B. 5S to Move PTT's from B. 4S -	LOC	12/20/07 11/9/08 3/6/09 12/21/09
B8 Consolidate Wet Film Process Equipment	LOC	12/20/07 11/9/08 2/5/09 9/4/09
B8 Partially Refurbish B-8 1st Floor to Consolidate IRD Personnel	LOC	12/20/07 12/5/08 12/4/09 5/31/10
B4S Partially Refurbish B-4S 1st Floor to Relocate CDPA from B-35	LOC	9/25/08 10/31/09 2/1/10 7/1/10
B35 - Partially Refurbish B-35 to Relocate IRD Media Personnel from B. 8	LOC	12/20/07 12/31/08 8/1/10 1/1/11
B8 - Partially Refurbish B-8 2nd Floor to House Flight Physicians	LOC	12/20/07 12/5/08 6/30/10 11/30/10
Var. Bldgs. B7A, B5N, B207, & B11 Fire Protection Sys., & B37, B48, B422, & E135 Replace Halon Sys.	CoF 2009 07109	5/30/08 5/8/09 8/17/09 8/17/10
B26 Ctr. for Human Space Flight Perf. & Research (CHSFPR)	CoF 2008 07113	9/14/07 7/15/08 11/17/08 11/29/09
B7, B32, & B33 Upgrade Fire Protection Systems, Mission Critical Facilities	CoF 2011 09006	8/17/09 8/17/10 12/1/11 4/1/13

Project Description	***Type FY Project No.***	***Schedule Design Start Design Finish Const Start Const Finish***
B420 Re-Roof	CoF NA 08115	Design Build Design Build 1/1/09 9/30/09
B422 Re-Roof	CoF NA 08114	Design Build Design Build 1/1/09 9/30/09
B7HB & 35 Re-Roof	CoF 2009 08111	B. 7HB Design Build Design Build 1/1/09 9/30/09 B. 35 Design Build Design Build 1/1/09 9/30/09
B32 Upgrade Cranes for Critical Lifts	CoF 2008 07106	11/20/07 4/18/08 9/23/08 8/30/09
B32 Upgrade Helium Support System	CoF Prog. Direct 2009 07112	2/23/08 10/23/08 6/4/09 1/25/10
B1 Upgrade 9th Flr. Center Director's Suite	CoF 2009 00612	5/3/08 3/8/09 7/23/09 12/30/09
B32 Rehabilitate & Modernize HVAC Systems (32) Phase 2	CoF 2009 07103	7/16/08 2/16/09 8/26/09 2/22/10
B32 Clean Air Sys. for Chamber A, JWST Program Support	CoF 2009 08101	NA NA NA NA
B12 Renovation	CoF 2010	9/25/08 11/30/09 3/1/10 6/30/11
B1 Upgrade Lobby	Sm. Proj. 2009 00605	9/4/07 4/4/08 6/15/08 10/15/08

Project Description	***Type FY Project No.***	***Schedule Design Start Design Finish Const Start Const Finish***
B1 Upgrade 8th Flr. Center Operations Suite	Sm. Proj. 2009 00614	9/4/07 4/4/08 6/15/08 9/30/08
B4N Loggias, B. 13HB Roof, B. 1 PH Roof & Window Replacement, B. 1 Main Roof	CoF 2009 08110 Ike Repairs	B. 4N 11/5/08 9/18/09 B. 13 HB 11/5/08 9/18/09 B. 1 PH 11/5/08 8/17/09 B. 1 Window Rplcmt. 11/5/08 8/29/09 B. 1 Main Roof 8/24/09 11/18/09
B1 Replace Leaking Windows & Gaskets, Floors 1-8	CoF 2010 09012	NA NA 5/1/09 9/15/10
B28 Upgrade Auxiliary Chiller Plant	2009 07102	9/19/07 1/19/08 3/15/09 3/15/11
B24 & B30 Repair/Replace Roofs	2009 08109	N/A N/A 1/1/09 9/30/09
B24 Flue Gas Recirculation Retrofit, Boiler 24-2A	2009 ?	NA NA 8/24/09 12/24/09

Note: Construction of Facilities (CoF) projects are discrete projects identified within the NASA facilities budget line item. Start and Finish dates listed are approximate dates, and are primarily intended primarily to indicate the approximate status of design or construction completion.

6. Agency Coordination and Public Involvement

6.1 Federal Agencies

Federal Emergency Management Agency, Region VI
800 North Loop 288
Denton, Texas 76201-3698

Regional Environmental Review Coordinator
United States Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Planning and Environmental Quality
Intermountain Regional Office
National Park Service
12795 W. Alameda Parkway
Denver, Colorado 80228

State Resource Conservationist
Natural Resource Conservation Service
101 South Main
Temple, Texas 76501-7682

United States Fish and Wildlife Service
Division of Ecological Services
17629 El Camino Real, Suite 211
Houston, Texas 77058

6.2 State Agencies

Chief Engineer
Texas Commission on Environmental Quality
Austin, Texas 78711-3087

Texas Parks and Wildlife Department
Wildlife Habitat Assessment Program
4200 Smith School Road
Austin, Texas 78744

State Historic Preservation Officer
Texas Historic Commission
P.O. Box 12276
Austin, Texas 78711-2276

Texas General Land Office
1700 North Congress Avenue
Austin, Texas 78701-1495

6.3 Local Agencies

Harris County Flood Control District
9900 Northwest Freeway
Houston, Texas 77092

Regional Director
Texas Archeological Society
414 Pebblebrook
Seabrook, Texas 77586

Harris County Historical Commission
929 Waxmyrtle
Houston, Texas 77079

Community and Environmental Planning
Houston-Galveston Area Council
3555 Timmons, Suite 120
Houston, Texas 77027

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Texas Commission on Environmental Quality. The National Ambient Air Quality Standards. Accessed October 1, 2009 online at http://www.tceq.state.tx.us/compliance/monitoring/air/monops/naaqs.html.

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Facilities Master Plan, Lyndon B. Johnson Space Center, Houston, Texas, February 2009.

WeatherBase – National Climatic Data Center; Great Falls, VA (http://www.weatherbase.com/weather/weather.php3?s=34227&refer=&units=us)

8. List of Preparers

NASA – Johnson Space Center

David Hickens, Chief, Environmental Services Office

Doug Conover, Acting Chief, Utilities Branch, Facilities Maintenance and Operations

Earth Resources Technology, Inc.

Virginia Baldwin, PE, Program Manager

John Herrmann, PE, Senior Engineer

Corrigan Consulting, Inc.

Gail Corrigan, President

Scott Davis, Natural Resources Manager

Rachel Schultz, Environmental Scientist

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APPENDIX A RESPONSES TO COMMENTS

As stipulated within NASA's administrative procedures for processing environmental assessments, JSC published a public notice, made copies available for public review (as described within the notice), and circulated a courtesy notice to the agencies listed in Section 6 of the availability of the Draft EA and provided a link to the document, which was made available through a password-protected ftp web site. One comment was received during the public review period.

Comments received from U.S. Fish and Wildlife Service

(by E-mail)

From: David_Hoth@fws.gov [mailto:David_Hoth@fws.gov]
Sent: Wednesday, January 13, 2010 10:54 AM
To: Herrmann, John P. (JSC-JA)[CSC]
Cc: Edith_Erfling@fws.gov; Terry_Rossignol@fws.gov
Subject: Johnson Space Center Water Distribution Upgrades

Dear Mr. Herrmann,

Thank you for letter dated December 9, 2009, concerning the proposed water distribution upgrades at NASA's Johnson Space Center. We have reviewed the proposed project and recommend extending the breeding period so that work around the APC facility would not be conducted from February 1 to June 15 instead of March 15 to June 15. Based on conversations with the Attwater's Prairie Chicken NWR, males start exhibiting signs of breeding by late January and early February and construction noise could potentially affect their breeding if construction was allowed during the recommended breeding timeframe. In addition, we also recommend that you coordinate with Ms. Hannah Bailey at the Houston Zoo regarding the details associated with this project so that she is aware of the proposed work. Her phone number is (713) 533-6565.

We are attaching a letter that describes the consultation process pursuant to Section 7 of the Endangered Species Act (ESA) for your information. If you are wanting a official concurrence concerning the project's effects on threatened and endangered species, please refer to the consultation handbook link at the bottom of the letter for information on definitions, process, and

fulfilling ESA requirements. If you have any questions or concerns regarding our recommendations or if you need further assistance in understanding a federal agencies obligation under the ESA , please feel free to contact me at (281) 286-8282.

Sincerely,

David Hoth
Fish & Wildlife Biologist
U.S. Fish & Wildlife Service
17629 El Camino Real, Suite 211
Houston, Texas 77058-3051
281-286-8282 ext. 237
fax 281-488-5882

NASA-JSC Response

NASA has accepted the recommendation regarding the restriction (prohibition) for construction noise during the period of February 1 through June 15 near the Attwater's Prairie Chicken Captive Breeding Area. The contract drawings and specifications have been modified, and the construction contractor will be reminded of this restriction during the preconstruction meeting and when filing the construction schedule. NASA has a strong working relationship with the Houston Zoo and will ensure full and open communication during any construction activities near the sensitive noise receptors. NASA does not believe that formal consultation under Section 7 of the Endangered Species Act is warranted, but will consult with the USFWS if the results of any additional surveys indicate it is necessary to do so.