FINAL

ENVIRONMENTAL ASSESSMENT
HYDRO-IMPACT BASIN AT THE LANDING AND IMPACT RESEARCH FACILITY AT NASA LANGLEY RESEARCH CENTER, HAMPTON, VIRGINIA

Lead Agency: National Aeronautics and Space Administration, Langley Research Center (LaRC), Hampton, Virginia

Proposed Action: Hydro-Impact Basin at the Landing and Impact Research Facility (LandIR) at NASA LaRC

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Abstract: NASA LaRC is proposing the construction of a Hydro-Impact Basin at the Landing and Impact Research Facility (LandIR), Building 1297. Construction of the basin would allow for full-scale water-impact testing for simulated Orion Crew Exploration Vehicle (CEV) ocean splashdown research in support of NASA's Constellation Program. The Proposed Action consists of construction of a rectangular basin of steel mesh and spray-on concrete; use of the water-filled basin for CEV testing for approximately five years; and draining and refilling of the basin following completion of the testing program. The Hydro-Impact Basin would measure 35 meters (115 feet) by 27 meters (90 feet) with a maximum depth of 7.6 meters (25 feet), and would be filled with 4.5 million liters (1.2 million gallons) of potable water. This Environmental Assessment (EA) evaluates the impacts of the Proposed Action and the No-Action alternative. This EA is tiered from the Constellation Programmatic Environmental Impact Statement, which is included in this EA by reference.

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1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

This Environmental Assessment (EA) has been prepared to analyze the potential environmental impacts associated with construction, use, and deactivation of the Hydro-Impact Basin at the Landing and Impact Research Facility (LandIR) at NASA Langley Research Center (LaRC), located in Hampton, Virginia.

This EA was prepared in accordance with the requirements of the National Environmental Policy Act of 1969, as amended (NEPA) (42 United States Code (U.S.C.) 4321 *et. seq*.), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations (CFR) Parts 1500–1508), NASA's regulations (14 CFR Part 1216 Subpart 1216.3), and NASA Procedural Requirements (NPR) 8580.1, "Implementing the National Environmental Policy Act and Executive Order 12114." Information contained in this EA will be used by NASA and the appropriate regulatory agencies to facilitate the NEPA decision-making process and to determine if the Proposed Action would significantly affect the quality of the natural or human environment. If implementing the Proposed Action is determined to potentially have significant environmental impacts, an Environmental Impact Statement would be prepared. If the implementation of the Proposed Action is determined not to be significant, the NEPA decision-making process would conclude with a Finding of No Significant Impact (FONSI).

Chapter 1 of this EA includes background information, as well as the purpose and need for the Proposed Action. Chapter 2 includes a description of the Proposed Action, the No-Action alternative, and a description of alternatives not carried forward for consideration in the EA. Chapter 3 describes the existing conditions of various environmental resources in the areas of the Proposed Action and Chapter 4 describes how those resources would be affected by implementation of the Proposed Action and the No-Action alternative. Chapter 5 addresses the cumulative effects of other past, present, and reasonably foreseeable actions that may be implemented in the area of the Proposed Action. Appendices include drawings of the Hydro-Impact Basin; consultation letters and correspondence, and tables of common metric/British unit conversions. NASA requires that numeric calculations and figures be presented in metric units with the British equivalent provided in parenthesis.

1.2 PROJECT LOCATION

LaRC is situated near the southern end of the lower Virginia Peninsula, approximately 241 kilometers (km) (150 miles) south of Washington, D.C. and 80 km (50 miles) southeast of Richmond, Virginia. LaRC is located within close proximity to several surface water bodies within the tidal zone of the Chesapeake Bay. The cities of Hampton, Poquoson, Newport News, and York County form a major metropolitan statistical area around LaRC. The Center is comprised of research facilities located in two areas which are approximately 4.8 km (3 miles) apart. The two areas, commonly called the West Area and the East Area, are divided by the runways of Langley Air Force Base (LAFB), the headquarters of the Air Combat Command. The East Area is located on 8 hectares (20 acres) of land leased by NASA from LAFB. This area is the original 1917 portion of LaRC and contains several wind tunnels, research facilities, and administrative offices. The West Area occupies 318 hectares (788 acres) of land and contains

the major portion of LaRC with the majority of the facilities located there. Figure 1-1 shows LaRC's regional location and relation to LAFB.

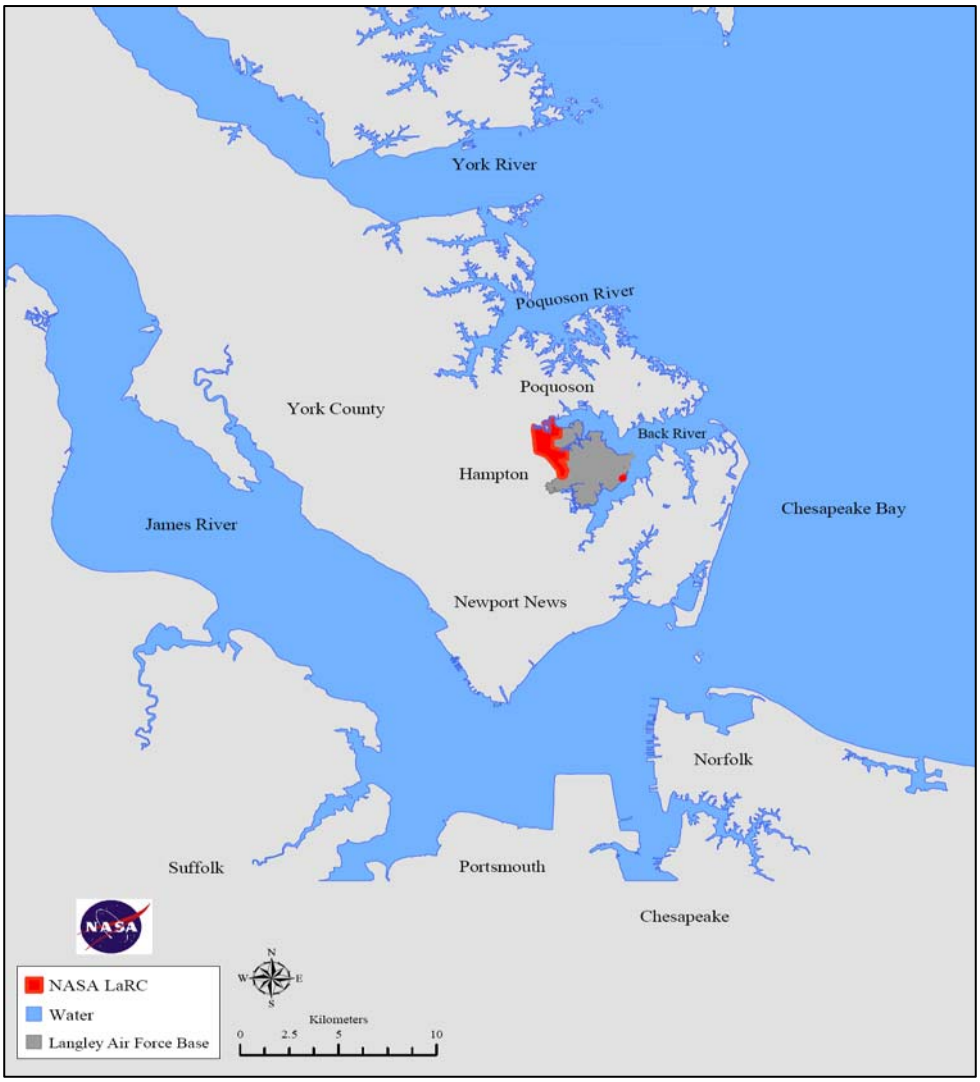


Figure 1-1 – Location of NASA Langley Research Center

1.3 BACKGROUND

In 2004 President George W. Bush announced a new exploration initiative (the *Vision for Space Exploration*) to return humans to the moon by 2020 in preparation for human exploration of Mars and beyond. In order to meet the goals of the exploration initiative and to accomplish the specific directives given to NASA by the President and by Congress, NASA has initiated the Constellation Program. Under the Constellation Program, NASA is developing flight systems and Earth-based ground infrastructure necessary to enable continued human access to space. As part of this initiative, NASA will build and fly a new Crew Exploration Vehicle (CEV), named

Orion, by 2014. The Orion spacecraft will be capable of transporting humans to the International Space Station, the moon and Mars.

NASA assessed the environmental impacts of the Constellation Program in the *Constellation Programmatic Environmental Impact Statement* (PEIS), published in January 2008. The PEIS described the purpose and need for the Constellation Program and the anticipated environmental impacts of the Constellation activities that would be conducted by participating NASA Centers throughout the country. LaRC's contribution to Constellation includes managing the Orion Launch Abort System development, the Orion landing system development and testing, and the Ares ascent development flight test vehicle integration. Based on the PEIS it was determined that Constellation Program activities at LaRC would not be expected to significantly impact the natural or human environment.

Because the Constellation PEIS addresses a broad program and because the specific details of Constellation activities at individual NASA Centers could not necessarily be foreseen at the time of the PEIS development, NASA has begun developing tiered NEPA documents to address related actions at participating Centers. Tiering eliminates repetitive discussions of issues and focuses on the real issues at each level of a program or project. Tiering is appropriate for broad program actions and related individual component actions of the broad program; and proposed actions having broad effects (e.g., global, national, or regional) with component actions having more localized effects. This EA is tiered from the Constellation PEIS and incorporates the PEIS by reference.

1.4 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of constructing the Hydro-Impact Basin at NASA LaRC is to provide cost-effective water-impact testing capability for the Orion CEV in order to simulate ocean splashdown scenarios. The Proposed Action is needed because there is no available testing facility that has both a water-impact basin and the capability to impart controlled horizontal and vertical impact velocities to the full-scale Orion CEV. The testing would support the development of the Orion CEV landing system for the CEV Project Office, as part of the Agency's Constellation Space Program. Details of the CEV and the purpose and need for the Constellation Space Program are provided in the Constellation PEIS.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Proposed Action consists of constructing a Hydro-Impact Basin to the west of NASA LaRC's LandIR (the "gantry") facility, Building 1297. The location is shown in Figures 2-1 and 2-2. The proposed water-filled basin would add full scale water-impact testing to the LandIR's current ground-impact capabilities and allow for simulated Orion CEV ocean splashdown recovery research in support of the Agency's Constellation Program.

The rectangular shaped basin would have a maximum depth of 7.6 meters (25 feet) with length and width dimensions of 35 meters (115 feet) by 27 meters (90 feet) at the surface waterline. Engineering drawings are included in Appendix A and a schematic of the basin is shown in Figure 2-3. Three of the four walls would be sloped 45 degrees and stabilized with helical soil anchors, geotextile fabric and steel mesh wire. The soil anchors would be embedded at a minimum depth of 7.6 meters (25 feet) below the face of the slope and spaced a minimum of 3 meters (10 feet) apart. The surface of the walls would be finished with 7.6 centimeters (3 inches) of spray-on concrete, also known as shotcrete. The east wall closest to the LandIR would be vertical and constructed of driven steel sheet piles. This wall, as well as the floor of the basin, would be reinforced with steel mesh wire and shotcrete. An eco-friendly, water-proof coating of polyurethane elastomer may be sprayed on just underneath the shotcrete to ensure groundwater does not leak in to the basin. The basin floor would measure 27 meters (90 feet) long by 12 meters (40 feet) wide. The excavated soil would be stockpiled in the grassy areas to the west of the LandIR facility, and the soil mounds would be planted with native plants and grasses in order to control erosion and fugitive dust emissions. While not currently included in the design plans, up to eight de-watering wells could be installed to reduce the inward pressure of groundwater on the walls of the basin. Should they be needed, the wells would be drilled to 15 meters (50 feet) and each would pump approximately 20 gallons of water per day.

The perimeter of the basin would be surrounded by 6 meters (20 feet) of concrete pads to support vehicle access, as models dropped during impact testing would be removed by a truck-mounted crane rented for this purpose during periods of test activity. Sections of the LandIR facility perimeter fencing would be extended to close gaps and increased in height for added security. Additionally, temporary warning signs with barrier pipe posts and about 125 meters (410 feet) of chain would be erected as a barricade around the basin.

The Hydro-Impact Basin would be filled with approximately 4.5 million liters (1.2 million gallons) of potable water from the city of Newport News in order to best meet clarity requirements for impact-testing data retrieval. Chemical treatment would be used to maintain the water in a clear enough state to support underwater photography to a distance of about 7.6 vertical meters (25 feet) and 10.7 horizontal meters (35 feet). The water treatment would be used to maintain pond water quality and would consist of the following chemicals:

- calcium carbonate, for pH control
- hydrochloric acid (muriatic acid), for pH and alkalinity control
- sodium bicarbonate, for alkalinity control
- calcium chloride, to raise hardness
- lanthanum chloride/sulfate, to reduce phosphate

- copper sulfate pentahydrate, for algae control
- Poly(diallyldimethylammonium chloride), to reduce phosphate
- Tetrasodium ethylenediamine tetraacetate, to reduce metals
- 1,2-Ethanediamine, polymer with (chloromethyl)oxirane and N-methylmethanamine, for turbidity control
- Aluminum chlorhydrate for turbidity control

The water would be tested weekly following the *Operations Plan for NASA Gantry Hydro-Impact Basin Water Chemistry*. The appropriate levels of chemicals would be added as necessary to maintain the expected water clarity and quality to established standards for copper sulfate, phosphates, pH, calcium hardness, alkalinity and turbidity. It is anticipated that the water treatment chemicals would be kept at a storage facility near the Hydro-Impact Basin. The chemicals would be stored in accordance with all applicable NASA LaRC chemical safety and storage policies. A robotic vacuum would keep the bottom clear of silt, mud and other organics, and would provide minimal circulation and filtration.

NASA LaRC plans to utilize the Hydro-Impact Basin beginning with a one-year testing program using a steel plate CEV mock-up in 2009, followed by tests with the Ground Test Article in 2010 and the structural test article in 2011. Hangar space in Building 1262 would be utilized as an integration facility for storage and refurbishment of full-scale crew modules. Hydro-impact testing would use the same pivot winches and pull-back bridge as are used for ground-impact testing. For water impacts, the model would be released from the pull-back winch to begin falling in a circular arc, swinging through the bottom of the arc without ground impact. It would be released from the pivot winches at the appropriate time to allow for free fall through a parabolic arc to impact with the water.

The temporary basin would remain in service for 5 years and then be deactivated. The soil excavated and stockpiled during construction and use of the facility would be returned to the basin at the completion of hydro-impact testing activity. Although the water would be pumped out and the basin would be refilled with soil, the concrete walls and floor would be left intact. This would allow the LandIR facility to return to conventional drop-testing of aircraft, but would allow for reactivation of the basin for future water-impact testing.

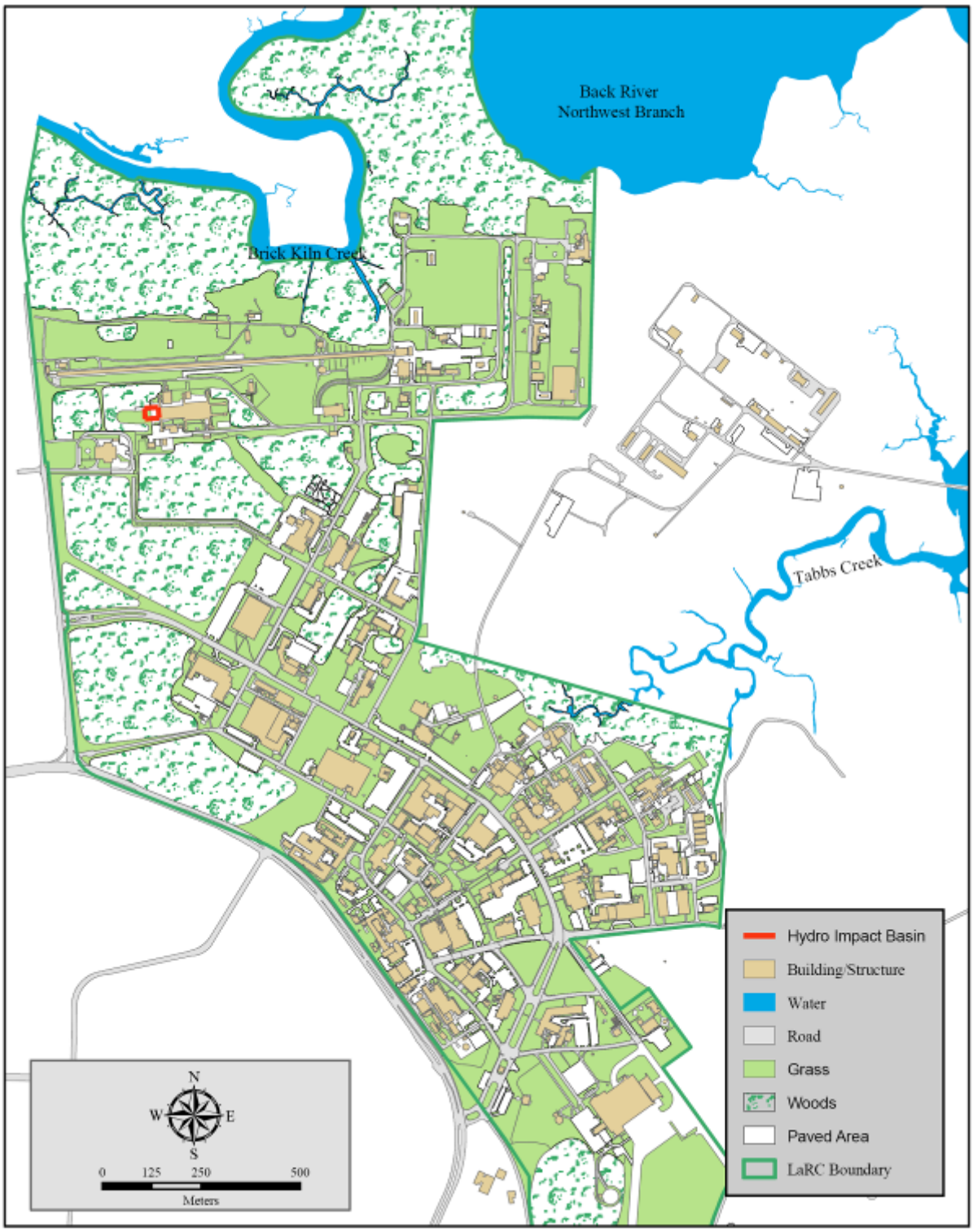


Figure 2-1 – Proposed Location for Hydro-Impact Basin

Figure 2-2 – Aerial Photo of Proposed Location for Hydro-Impact Basin

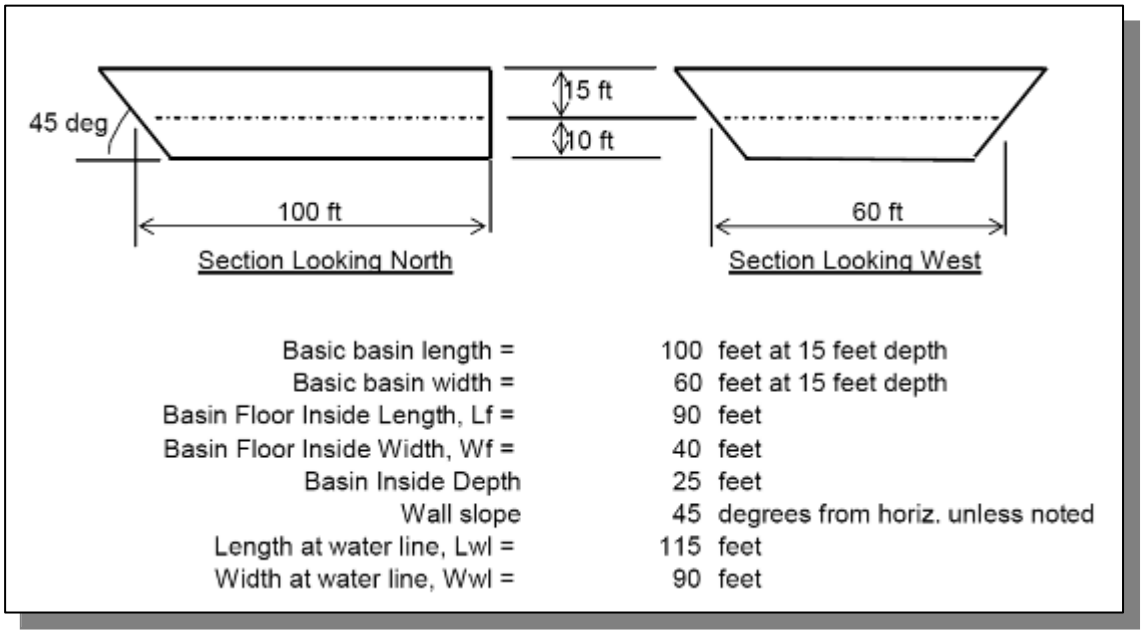


Figure 2-3 – Schematic Drawing of Hydro-Impact Basin

2.2 NO-ACTION ALTERNATIVE

Under the No-Action alternative, LaRC would not construct the Hydro-Impact Basin. There would be no full-scale testing of simulated ocean splashdown landing scenarios of the Orion CEV and there would be no hydro-impact testing in support of the Constellation Program. Current ground-impact testing would continue at the LandIR facility at LaRC. The No-Action alternative could potentially compromise the Agency's ability to design and develop the landing system of the Orion CEV and may impact the implementation of the Constellation Program.

2.3 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

Several alternatives for performing water-impact testing were evaluated but eliminated from further consideration. In March of 2008, the Orion Landing System Advanced Development Project (ADP) performed a national survey of existing commercial, military, or public water basin facilities potentially capable of performing full scale water-impact testing of the Orion crew module. The survey resulted in a selection of NASA LaRC and three additional facilities for evaluation: Sandia National Labs in New Mexico, Aberdeen Proving Grounds in Maryland, and Carderock Naval Surface Warfare Center in Maryland. Information on the Orion landing system and water impact testing requirements were given to the facilities and each one was visited for assessment. The requirements include a rail or swing system with the ability to impart both vertical and horizontal impact trajectories at specific velocities for a full scale crew module, the ability to transport the full scale crew module and all tools safely to the testing site, and an integration facility for refurbishment and storage of the module and the refurbishment tools. The site assessment identified whether the facility could meet the requirements, identified any missing elements, and evaluated the reasonable cost of having all the missing elements built and provided.

Sandia National Labs would provide experience in vertical impact testing, as well as plenty of test resources and infrastructure. A rail system utilizing rocket motors and variable height projections would need to be designed and built in order to impart required horizontal impact velocities and the correct vertical velocities. Air Force runways exist onsite for transportation of the test modules, and one of the hangars could be used as an integration facility.

Aberdeen Proving Grounds would provide relevant experience in vertical impact testing. A rail and sled system utilizing rocket motors and variable height projections would need to be designed and built in order to impart required horizontal impact velocities and the correct vertical velocities. There are Department of Defense runways onsite for transportation of the test modules; however, there would be no structure available other than a temporary tent for use as an integration facility. The basins are filled with brackish pond water, and NASA personnel expressed concern that the water could potentially impact the ground test article and its data acquisition systems.

Carderock Naval Surface Warfare Center would provide relevant vertical impact testing experience. A rail and drop mass accelerator utilizing a crane and pulley system would need to be designed and built in order to impart required horizontal impact velocities and correct vertical velocities. There are no nearby airports available for transportation of the crew module test articles. There would be the possibility of reconfiguring a lab into an integration facility, but the space available would be less than the minimum requirements. Additionally, there is limited space on site for the rail system or to house other large hardware.

The evaluation of the three alternative locations revealed that the use of LaRC was the most technically and logistically feasible option that was also financially viable. None of the other three sites had an existing rail or swing system that could control the orientation and desired impact trajectory, especially at horizontal velocities, of full scale test articles according to required lift and test conditions. Consequently, NASA has determined that the estimated costs of building the rail and swing systems necessary to meet these conditions would not be practical. Furthermore, two of the three sites would not be able to provide the space necessary for storage and refurbishment of the full scale crew modules. Since the alternatives would not technically, logistically or cost-effectively fulfill the purpose and need of the Proposed Action, they were eliminated from further analysis in this EA.

3.0 AFFECTED ENVIRONMENT

This chapter describes relevant environmental conditions at LaRC for resources potentially affected by the Proposed Action and the No-Action alternative described in Chapter 2.0. In compliance with guidelines contained in NEPA and CEQ regulations and NPR 8580.1, the description of the existing environment focuses on those environmental resources potentially subject to impacts. The environment includes all areas and lands that might be affected, as well as the natural, cultural, and socioeconomic resources they contain or support.

Resources Eliminated From Detailed Consideration

Several resources were not evaluated in this EA because it was determined unlikely that implementation of either the Proposed Action or the No-Action alternative would have any impact on these areas of concern. A brief explanation of the reasons why each resource has been eliminated from further consideration in this EA is provided below.

Virginia Coastal Zone Programs. The following Virginia Department of Environmental Quality (DEQ) enforceable programs and policies are not applicable to the Proposed Action as the construction and use of the Hydro-Impact Basin would not have any effect on the resources. Additionally, the No-Action alternative would not have any effect on the resources. The programs and policies include:

Fisheries Management. Neither the Proposed Action nor the No Action alternative would have an effect on the conservation and enhancement of finfish and shellfish resources or the promotion of commercial and recreational fisheries.

Subaqueous Lands Management. Neither the Proposed Action nor the No Action alternative would involve encroachment into, on or over state-owned subaqueous lands.

Dunes Management. There are no sand covered beaches or sand dunes in the vicinity of the Proposed Action.

Shoreline Sanitation. Neither the Proposed Action nor the No Action alternative would have an effect on shoreline sanitation.

Other Virginia Coastal Zone Program areas that are applicable to the Proposed Action are addressed in Chapters 3 and 4.

Socioeconomic. The No-Action alternative would have no effect on the socioeconomic character of the communities surrounding LaRC. There would be no change in the number of NASA employees as a result of the Proposed Action. The construction work would be performed by contractors from the regional work force or from elsewhere in Virginia. There is a sufficient pool of local workers to accomplish these tasks in the anticipated timeframe. Because these are temporary jobs that would be filled by the existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in the region. Therefore, the Proposed Action would have a negligible effect on the socioeconomic character of the surrounding communities, and this resource was eliminated from further analysis.

Climate. Climate is the prevalent long-term weather conditions in a particular area. Climatic elements include precipitation, temperature, humidity, sunshine and wind velocity and other natural occurrences such as fog, frost, and hail storms. Implementation of either the Proposed Action or the No-Action alternative would have no measurable effect on the local climate and as such, this resource was eliminated from further analysis.

Visual resources. The aesthetic quality of an area or community is composed of visual resources. Physical features that make up the visible landscape include land, water, vegetation and man-made features, such as buildings, roadways and structures. As defined in the Center Master Plan, LaRC's buildings and structures reflect two broad architectural themes: an entirely functional architecture, such as wind tunnels; and institutional architecture, typical of various period architectural styles. The Proposed Action would take place beneath one of LaRC's most recognizable pieces of functional architecture, the LandIR. The LandIR structure is visible throughout the Center and from adjacent areas of Hampton and Poquoson. However the Proposed Action would have no effect on the LandIR structure itself, and the Hydro-Impact Basin would only be visible to personnel working at the LandIR. Implementation of the Proposed Action and the No-Action alternative would not affect visual resources, therefore this resource was eliminated from further analysis.

Environmental Justice. Low-income populations and minority populations that are subject to environmental justice considerations are not located within or near the location of the Proposed Action. Since implementation of either the Proposed Action or the No-Action alternative would not have disproportionately high or adverse human health or environmental effects on low-income populations or minority populations, this resource was eliminated from further analysis.

Wild and Scenic Rivers. None of the waterways within the LaRC property qualify for the provisions of the Wild and Scenic Rivers Act, therefore, analysis of this resource was not carried forward in this EA.

Transportation. Implementation of the Proposed Action would not change the use of transportation resources in the region. Local highways currently accommodate the traffic generated by LaRC employees and other individuals traveling the roads on a daily basis. Transportation of the basin construction materials would be along an established haul route leading off the Center. The increase in truck traffic would be minimal because the basin construction is a small, short-term project. Implementation of the No-Action alternative would not affect transportation resources. Therefore, this resource was eliminated from further analysis.

Since LaRC does not have any prime or unique farmland or conservation areas, these resources were also eliminated from further analysis.

3.1 LAND USE

Coastal Zone Management Act

LaRC is located within the coastal zone of the Commonwealth of Virginia. Federal agency activities within the coastal zone must be carried out in a manner that is consistent to the maximum extent practicable with the applicable enforceable policies. All Federal actions are subject to this consistency requirement if they would affect natural resources, land uses, or water

uses in the coastal zone. The Virginia DEQ oversees activities in the coastal zone of the State through a number of enforceable programs. In reviewing the Proposed Action, DEQ may require agencies to coordinate with its specific divisions or other agencies for consultation or to obtain permits; they also may comment on environmental impacts and mitigation. Virginia DEQ enforceable programs and policies pertain to: Fisheries Management, Subaqueous Lands Management, Tidal and Nontidal Wetlands Management, Dunes Management, Non-Point Source Pollution Control, Point Source Pollution Control, Shoreline Sanitation, Air Pollution Control, and Coastal Lands Management. Not all of these enforceable programs are applicable to the Proposed Action, as explained in Section 3.0. The remaining programs (coastal lands management, air pollution control, non-point source pollution control, point source pollution control, and wetlands) are discussed in relevant resource sections (e.g., air quality and water resources).

The Coastal Lands Management program regulates activities in the Chesapeake Bay Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). RPAs include tidal shores, tidal wetlands, and non-tidal wetlands that are contiguous to and connected by surface flow to tidal wetlands and perennial streams, and a 30-meter (100-foot) buffer located landward of these features. RMAs include floodplains, highly erodible soils, highly permeable soils, steep slopes, and areas 30 meters (100 feet) landward of an RPA. Both RMA and RPA features exist on LaRC property, but the area of the Proposed Action is not located within either an RPA or RMA.

Functional Zones

Land uses are frequently regulated by management plans, policies, ordinances, and regulations that determine the types of uses that are allowable or protect specially designated or environmentally sensitive areas. LaRC has a current Center Master Plan (CMP) that supports the Center's strategic approach to programmatic facility planning and prioritization. The CMP identifies the following functional zones:

Administration - The LaRC administrative core, which contains the Center's Headquarters building, is distinguishable by its executive character.

Center Operations and Services - Most of the Center's oldest assets and most dense development are included in these areas. This heavy traffic zone either borders or embraces Langley Boulevard, the primary Center traffic artery.

Labs and Science - Labs are located in two main areas on either side of Langley Boulevard. Science offices are grouped along Dryden Avenue.

Tunnels and Testing - LaRC's large-scale tunnels are contained in this zone. These large tunnel complexes along the property boundary form a compact and strongly related functional grouping. The zone is characterized by noisy exhausts, vibration, and the remote, well-regulated potential for uncontrolled energy release.

Aeronautics - This area contains the aircraft hangar and associated site improvements and required open space. Considerable undeveloped land area exists here and is strictly utilized for functions directly connected to the hangar and flight line operations.

Outreach - Outreach offices include training facilities, student programs, the offices of public affairs, legislative affairs, news media, and affiliated universities/institutions.

Back 40 – This area includes approximately 89 hectares (220 acres) of largely undeveloped land. Various small facilities and structures are scattered throughout the area, many of which have been abandoned.

Vegetation Buffer - Undeveloped areas are maintained as vegetation buffers along some portions of the LaRC fence line.

The proposed Hydro-Impact Basin would be located in the Tunnels and Testing zone.

3.2 NOISE

The fighter aircraft operating from LAFB are by far the dominant and most widespread noise source in the area. LAFB has developed an Air Installations Compatible Use Zone report to document areas of high noise resulting from aircraft flight patterns. The southern portions of LaRC are in LAFB's documented high-decibel noise zones, but the proposed location of the Hydro-Impact Basin is outside the LAFB noise contour zones.

Primary noises generated at LaRC itself include the wind tunnels, the compressor stations, and the substations. Most of the wind tunnels are closed-loop tunnels in which the test gas medium is re-circulated and the noise generated by the tunnel is contained largely within the building. Noise level surveys conducted on the various wind tunnels during peak operating mode have identified noise levels ranging from 45 to 80 decibels. The daily operation of motor vehicles in and around LaRC is considered a minor source of noise.

Although Virginia does not have noise control regulations, the City of Hampton has enacted a Noise Ordinance (Hampton City Code, Section 22) which prohibits creating any unreasonably loud or disturbing noise of such character, intensity, or duration that may be detrimental to the life or health of any individual or which disturbs the public peace and welfare. LaRC's Industrial Hygiene staff monitors noise levels both inside and outside of the Center facilities to ensure excessive noise does not harm human health or the environment. In addition, the Industrial Hygiene staff ensures proper controls are in place to protect Center personnel from exposure to excessive noise levels in accordance with Occupational Safety and Health Administration (OSHA) requirements.

3.3 CULTURAL RESOURCES

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious or other purposes. They include archaeological resources, traditional resources, and historic architectural resources. Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Archaeological resources are locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains (e.g., arrowheads, bottles). Historic architectural resources include standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. Historic properties (as defined in 36 CFR 60.4) are significant archaeological, architectural, or traditional resources that are either eligible for listing, or listed in, the National Register.

The management of cultural resources is primarily regulated by the National Historic Preservation Act (NHPA). Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties. Impacts to cultural resources may be considered adverse if the resources have been determined to be eligible for listing in the National Register. Section 110 of the NHPA advocates proactive management of resources through the incorporation of historic preservation into the comprehensive plans of agencies, facilities, or programs. The act requires agencies to compile cultural resource inventories which should be integrated into systems for property administration, land use planning and project planning.

LaRC has a Cultural Resource Management Plan (CRMP) that contains information on LaRC's historic background, cultural resources and historic properties. It provides information on cultural resource surveys and investigations that have been performed at the Center and the types of LaRC activities that may affect cultural resources. The CRMP also provides information and guidelines necessary for proper preservation and management of LaRC's cultural resources and historic properties. Although oversight of the cultural resource program at LaRC is primarily the responsibility of LaRC's Historic Preservation Officer (HPO), all persons involved in project planning and implementation at the Center also have a responsibility to be aware of the cultural resource management goals of both NASA and LaRC, and to see that NASA complies with the pertinent historic preservation laws and regulations. Sections of LaRC's CRMP are integrated with the Center's Master Plan and Geographic Information System (GIS) database in order to facilitate project planning and ensure historic preservation issues are addressed in project planning at the Center.

3.3.1 Architectural Resources

LaRC has five properties that are National Historic Landmarks (NHLs): the Variable Density Tunnel, the 8-Foot High Speed Tunnel (Building 641), the Full Scale Tunnel (Building 643), the Rendezvous Docking Simulator, and the Lunar Lander Facility (Building 1297), which is now called the LandIR. These properties were identified during a 1985 survey performed by the National Park Service as part of the "Man in Space" theme study. The wind tunnels provided the technological base from which the early space program was initiated, and the training facilities played an important role in preparing astronauts to operate in space and land on the moon. The Proposed Action would take place beneath and to the west of Lunar Lander Facility NHL (the LandIR).

LaRC recently completed a Phase I reconnaissance level survey of 164 architectural resources. The survey identified that most of LaRC's architectural resources are not individually eligible for the National Register. However, many are potentially eligible as contributing resources to a proposed LaRC Historic District. NASA is consulting with the Virginia State Historic Preservation Officer (SHPO) regarding a proposed discontiguous historic district, consisting of four defined significant areas separated by non-significant areas. Two areas would be located in LaRC's West Area, and two would be located in LaRC's East Area. The Hydro-Impact Basin site would be located within this proposed historic district. Figure 3-1 shows the location of the Hydro-Impact Basin project in relation to LaRC's proposed West Area Historic District boundaries.

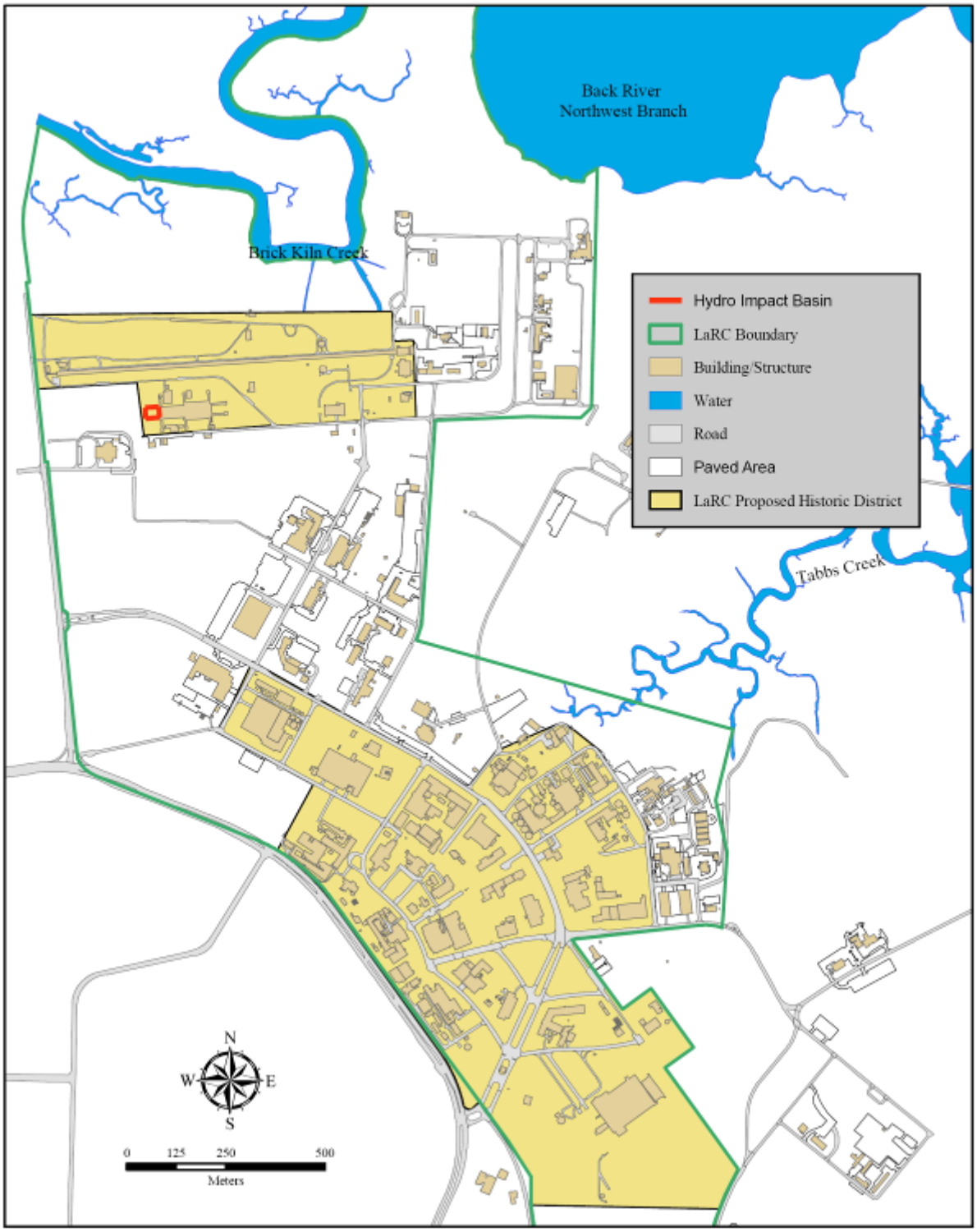


Figure 3-1 – Proposed LaRC West Area Historic District

3.3.2 Archaeological Resources

Since the mid-1970s, LaRC has conducted eleven archaeological surveys, which have identified more than 20 archaeological sites located throughout LaRC. Native American artifacts have been discovered as well as the remains of colonial and early American plantations. One of the sites, known as the Chesterville Plantation, is listed in the National Register, as it was the birthplace of George Wythe, an original signer of the Declaration of Independence. The site has been preserved in place. At least ten other archaeological sites are potentially eligible for listing in the National Register. These sites would require additional survey work if any future LaRC activity involving ground disturbance were planned at or near any of the sites. The proposed Hydro-Impact Basin is located 130 meters (426 feet) south of the Chesterville Plantation site's southern boundary.

3.3.3 Traditional Resources

Several State-recognized tribes reside in eastern Virginia; however, American Indian traditional resources have not been identified at LaRC.

3.4 HAZARDOUS MATERIALS AND HAZARDOUS/SOLID WASTE

NASA LaRC personnel use various hazardous materials to support the Center's mission. A hazardous material is any substance that because of its quantity, concentration, physical or chemical characteristics, poses a hazard to human health and safety or to the environment if released into the workplace or the environment. By law and by necessity, hazardous materials must be carefully managed to prevent harm to the public, employees, equipment and the environment. Center personnel and on-site contractors are required to use LaRC's web-based Chemical Material Tracking System (CMTS) to manage their hazardous material inventories. CMTS also has an online Material Safety Data Sheet (MSDS) library to allow employees to understand the hazards of materials they handle or encounter at the Center. The information in the CMTS inventories is provided to local fire departments to aid them in identifying the storage location of hazardous chemicals in the event of a fire or other emergency event. All chemicals are stored in accordance to OSHA requirements.

Hazardous wastes generated at LaRC are managed and disposed of according to established Center policies and applicable laws and regulations. LaRC is considered a large quantity generator of hazardous waste. The Center is not authorized to transport hazardous waste off-site, store hazardous waste beyond a 90-day accumulation period, or treat or dispose of hazardous waste on site. The hazardous and regulated wastes generated at LaRC include of a wide variety of items, such as solvents, fuels, oils, gases, batteries, fluorescent light bulbs and laboratory chemicals. Waste generated from remediation projects such as paint removal and spill cleanup are sampled and analyzed to ensure proper waste characterization and disposal. Any materials that contain hazardous waste or exhibit hazardous characteristics are transported by an appropriately permitted contractor to a permitted hazardous waste disposal facility.

The soils in the location of the Proposed Action were sampled in June 1999 for possible contamination from LandIR restoration activities, such as sandblasting and scraping of paint. 32

soil samples were taken underneath and around the LandIR structure and analyzed for the presence of lead and chrome contamination. No contamination was identified.

LaRC has one active remediation site under the Comprehensive Environmental Responsibility Compensation and Liability Act (CERCLA): a Construction Debris Landfill located in the northern part of the Center. The proposed location of the Hydro-Impact Basin would be approximately 400 meters (1,312 feet) southwest of this remediation site. LaRC is also conducting site investigation work in coordination with the EPA and the Virginia DEQ at the Former Wastewater Treatment site and at the Stratton Substation. Neither of these sites is near the proposed location for the Hydro-Impact Basin.

LaRC maintains an Integrated Spill Contingency Plan that provides information on applicable regulatory requirements and procedures related to oil and hazardous material spill control at LaRC. In addition, it documents the policies and procedures regarding the management of underground and aboveground storage tanks. No storage tanks are located in the area proposed for the Hydro-Impact Basin.

LaRC generates large volumes of municipal solid waste. The major items are paper, wood, metals, cardboard, plastics, grass and tree clippings, glass, and maintenance wastes. LaRC recycles white and mixed paper, cardboard, toner cartridges, plastic bottles, aluminum cans, scrap metal, used oil, batteries, fluorescent light bulbs, and used tires. Non-hazardous, non-regulated, solid materials that are not collected for recycling are consolidated and transported for disposal to a local landfill or for energy recovery at Hampton's Refuse-Fired Steam Generating Facility.

3.5 POLLUTION PREVENTION

Pollution prevention (P2) is a multimedia approach to environmental management based on the priorities outlined in the Pollution Prevention Act of 1990. When applying P2 methodologies to LaRC activities (e.g. operations generating air emissions, wastewater, or solid/hazardous waste), priority is given to the use of source reduction techniques. Source reduction is the prevention of waste generation through process modifications or material substitutions. Where source reduction is not feasible, other environmentally preferable methods such as reuse or recycling may be appropriate. Remaining wastes are then managed to minimize potential present and future environmental impacts. LaRC developed a P2 Plan in 1992 to document P2 initiatives and has been implementing a Center-wide P2 Program since that date.

Over the last few years LaRC's P2 Program has been integrated into the broader Environmental Management System (EMS) program that:

1. incorporates people, procedures, and work practices in a formal structure to ensure that the important environmental impacts of the organization are identified and addressed,
2. promotes continual improvement including periodically evaluating environmental performance,
3. involves all members of the organization as appropriate, and
4. actively involves Senior Management in support of the environmental management program.

LaRC's EMS is committed to the goals of Executive Order 13423, "Strengthening Federal Environmental, Energy and Transportation Management," which calls for Federal facilities to conduct their environmental activities in a continuously improving, efficient, and sustainable manner. Executive Order 13423 also dictates Agency goals regarding:

- Vehicles
- Petroleum conservation
- Alternative fuel use
- Energy efficiency
- Greenhouse gases
- Renewable power
- Building performance
- Water conservation
- Procurement
- Toxic materials and chemicals
- Electronics management

One of the P2 objectives of LaRC's EMS is to ensure that concrete and asphalt debris from deconstruction activities is reused and recycled to the maximum extent practical. When using chemicals, LaRC attempts to use less-hazardous alternatives where feasible.

3.6 HEALTH AND SAFETY

LaRC adheres to OSHA and applicable Federal, State and local safety and health regulations. In addition to Federal regulations, LaRC also implements its own health and safety regulations, many of which are referenced in Langley Policy Directive 1700.1, "Safety Program." This directive sets forth the Center's Safety Policy, which is to provide employees a safe and healthful work environment that is free from hazards that can cause or result in loss of life or injury or damage to equipment and property.

The Center Director is the ranking official charged with the ultimate responsibility for the Center's Safety Program. Implementation of the program is achieved through specific delegation of responsibilities. The LaRC Safety Office is responsible for the day-to-day implementation of LaRC's Safety Program. Each building at the Center is assigned a Facility Safety Head (FSH) and Facility Coordinator (FC) to ensure operations are carried out in accordance with LaRC's safety requirements. The FSH and FC responsibilities include establishing emergency operation procedures, reviewing and implementing facility operational procedures, and personnel training.

LaRC has been recognized by OSHA as a leader in health and safety by awarding the Center the Star designation level of achievement in the Voluntary Protection Program (VPP). In addition to its VPP and Safety Programs, LaRC has its own fire program and maintains a fire department on site which is centrally located at Building 1248. In the event of an emergency such as fire, explosion, chemical spill or other accident, fire department personnel serve as first responders to initiate actions as necessary to minimize hazards to all personnel and limit damage to property and the environment.

As part of its Safety Program, contractors performing work at LaRC must comply with all applicable safety and health regulations, including OSHA, Agency and Center regulations. Contractors are responsible for providing their own employees with a safe and healthful workplace, and for ensuring their work is performed in a safe manner. Every major on-site contractor must have a designated Safety Officer and site-specific safety and health plan. For off-sight contractors performing temporary work at the Center, supervisory personnel must attend a safety briefing provided by the LaRC Safety Office prior to project startup.

3.7 AIR QUALITY

The Virginia DEQ administers the state's air Operating Permit Program. LaRC has a State Operating permit that establishes emission limits for specific stationary air pollution sources as well as Center-wide emission limits. The Center is not required to have a Title V Federal Operating Permit. LaRC qualifies as a synthetic minor source because its air emissions are limited below the prescribed thresholds by its air permit. The Center's air permit contains enforceable conditions that limit the amount of air pollutants that LaRC may emit. Specific permit requirements vary according to the air pollution source, but they generally include physical, operational, record keeping and reporting requirements.

The Clean Air Act (42 U.S.C. 7401 et. seq.), as amended, establishes the authority to set safe concentration levels for six criteria pollutants: particulate matter measuring less than 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O_3), and lead (Pb). LaRC is located within the Hampton Roads Intrastate Air Quality Control Region (AQCR). The Hampton Roads AQCR includes four counties (Isle of Wight, James City, Southampton, and York), as well as ten cities (Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg). Air quality in the Hampton Roads AQCR is currently designated as attainment for all criteria pollutants. However, the Hampton Roads AQCR is considered an 8-hour ozone maintenance area.

The General Conformity Rule of the Clean Air Act (Section 176(c)) prohibits Federal actions in nonattainment or maintenance areas which do not conform to the State implementation plan (SIP) for the national ambient air quality standards. An action is subject to the general conformity rule if the emissions from a proposed Federal action in a nonattainment or maintenance area exceed certain annual emission thresholds (de minimis levels) or are regionally significant (i.e. greater than or equal to 10% of the emissions inventory for the region). In the Hampton Roads AQCR, the applicable de minimis thresholds are 100 tons per year of NO_x and 100 tons per year of VOCs. Regionally significant (10%) emissions inventories in the Hampton Roads AQCR would be 715.2 tons per year of NO_x and 879 tons per year of VOCs.

3.8 SOILS AND GEOLOGY

NASA LaRC is located on the Virginia Coastal Plain, characterized by flat land that dips gently eastward and is cut by rivers, creaks, and streams. The Coastal Plain is underlain by a thick wedge of sediment, two-thirds of which is late Jurassic and Cretaceous clay, sand, and gravel. A thin layer of fossilized marine sands overlies the older sediment. The youngest deposits of the Coastal Plan are sand, silt, and mud. LaRC is located in an area designated as Seismic Risk Zone 1, which is an area with minor damage expected.

The soils at LaRC range in texture from clay and silt to fine gravel, with most of the soils being fine to medium sandy loam. The surface is a deposited loam from 0.6 meters (2 feet) to 1.8 meters (6 feet) in depth. These types of soil are considered to be poorly-drained to moderately well-drained.

LaRC prepared a geotechnical engineering study of the proposed Hydro-Impact Basin location to determine the subsurface soils and groundwater conditions of the area. The subsurface exploration consisted of performing two Standard Penetration Test (SPT) borings to a depth of 23 meters (75 feet) below the existing grades. The soil samples were subjected to a laboratory testing program to determine natural moisture content and grain size and were classified and stratified using the Unified Soil Classification System (USCS). The borings indicated that soils consisted of a layer of clayey sand to an approximate depth of 2.4 meters (8 feet), followed by a layer of silt-like sand with shell fragments to a depth of 10.7 meters (35 feet), followed by clayey sand with shell fragments to a depth of 21.3 meters (70 feet) and underlain by a layer of silt-like clay to the termination depth of 23 meters (75 feet). The seasonal normal high groundwater table was estimated to be at a depth in excess of 0.3 meters (1 foot) throughout the site. Groundwater levels are expected to fluctuate in response to rainfall, infiltration, tidal fluctuations, site topography, and drainage.

3.9 WATER RESOURCES

3.9.1 Surface Waters

LaRC is located on the coastal basin of the Back River, which flows into the Chesapeake Bay. Approximately forty percent of the LaRC drains into the Brick Kiln Creek, which runs along the northern boundary of LaRC and joins the Back River Northwest Branch. Tabbs Creek, which drains most of the rest of the Center, also flows north into the Back River Northwest Branch. A small portion of the Center in the south drains to Tides Mill Creek, which joins the Back River Southwest Branch. An upstream segment of Brick Kiln Creek, all of Tabbs Creek, and the Back River are listed as impaired waters by the EPA. All local waterways are influenced by tides in the Chesapeake Bay.

LaRC operates under three water discharge permits. A permit from the Hampton Roads Sanitation District (HRSD) allows LaRC to discharge non-hazardous industrial wastewater and sanitary sewage to the HRSD sanitary sewer system. The Center has a water permit under the Virginia Pollutant Discharge Elimination System (VPDES), which regulates industrial process wastewater and storm water discharges to the Center's storm sewer system and surrounding surface waters. LaRC has ten permitted outfalls and the VPDES permit requires periodic sampling and monitoring of the effluent from the outfalls to ensure compliance with permit limits. Figure 3-2 shows the location of LaRC's permitted outfalls in relation to the proposed Hydro-Impact Basin. Outfall 005 primarily drains the area to Brick Kiln Creek. LaRC also has a municipal separate storm sewer system (small MS4) covered under the Virginia Stormwater Management Program (VSMP) that includes best management practices (BMPs) and measurable goals for LaRC's MS4 program.

LaRC has few water pollution sources due to the relatively low level of industrial operations at the Center. The major pollutants are the chemicals used to treat the boilers and cooling towers,

and these are discharged in accordance with LaRC's permits. LaRC employs various BMPs to prevent or mitigate storm water and/or sewer system pollution from facility activities.

In accordance with Virginia's Department of Conservation and Recreation (DCR), construction activities at LaRC that disturb equal to or greater than 0.4 hectares (one acre) require coverage under the General Permit for Discharges of Stormwater From Construction Activities. Additionally, since LaRC is within a Chesapeake Bay Preservation locality, construction activities larger than 232 square meters (2,500 square feet) also require coverage.

3.9.2 Wetlands

The US Army Corps of Engineers and the EPA define wetlands as those areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs, and similar areas. Executive Order 11990, Protection of Wetlands, requires Federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. LaRC has a 2005 Army Corps of Engineers-confirmed wetlands delineation. Figure 3-3 shows the scrub shrub, emergent and forested wetlands identified at LaRC. There are forested wetlands to the north and west of the proposed location of the Hydro-Impact Basin. The closest area of forested wetlands is located approximately 25 meters (82 feet) northwest of the project site.

3.9.3 Floodplains

Floodplains are the flood-prone, lowland areas adjoining inland and coastal water including areas of offshore islands. The 100-year floodplain area is considered the area where there is a one percent chance of flooding in any given year. Due to its proximity to the Chesapeake Bay and Back River, approximately one-third of LaRC is within the 100-year floodplain. The site of the proposed Hydro-Impact Basin is located within this floodplain. The stillwater elevation for the 100-year floodplain for LaRC is estimated by the Federal Emergency Management Agency (FEMA) to be 2.6 meters (8.5 feet) above mean sea level (MSL). FEMA has estimated 100-year floodwater levels with accompanying waves at about 3.3 meters (11 feet) above MSL near the Center. The stillwater level for the 500-year floodplain is 2.9 meters (9.8 feet) above MSL.

Executive Order 11988, Floodplain Management, requires each Federal agency to "take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural beneficial values served by floodplains in carrying out its responsibilities." NASA regulations (14 CFR §1216.2), *Floodplain and Wetlands Management*, expand on the Agency's requirements for assessing and avoiding adverse impacts to floodplains at NASA centers.

Figure 3-4 shows the extent of the floodplains on LaRC and the location of the proposed Hydro-Impact Basin. The proposed location of the Hydro-Impact Basin would be in the identified 100-year floodplain.

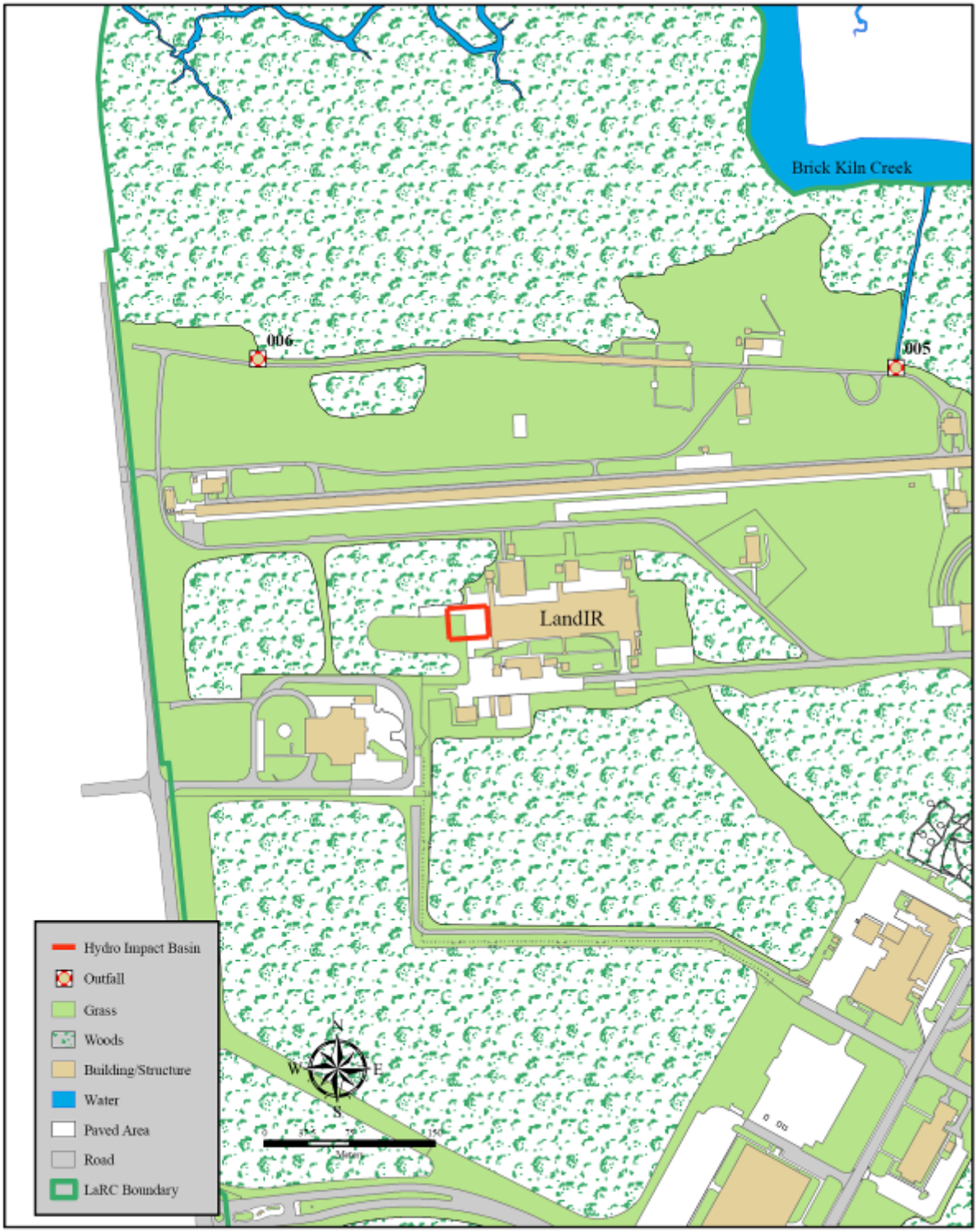


Figure 3-2 – LaRC Outfalls in Area of Proposed Action

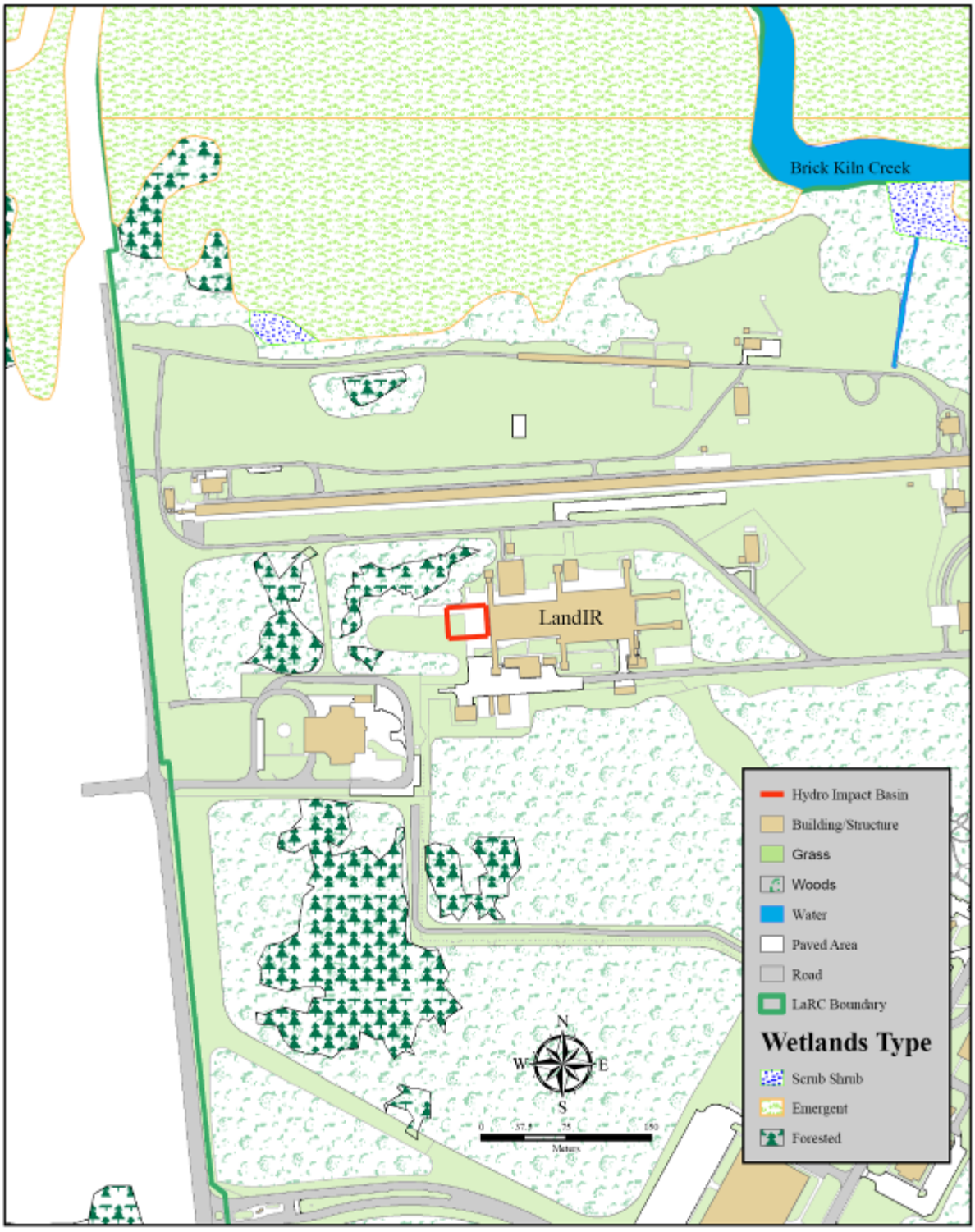


Figure 3-3 –Wetlands in Area of Proposed Action

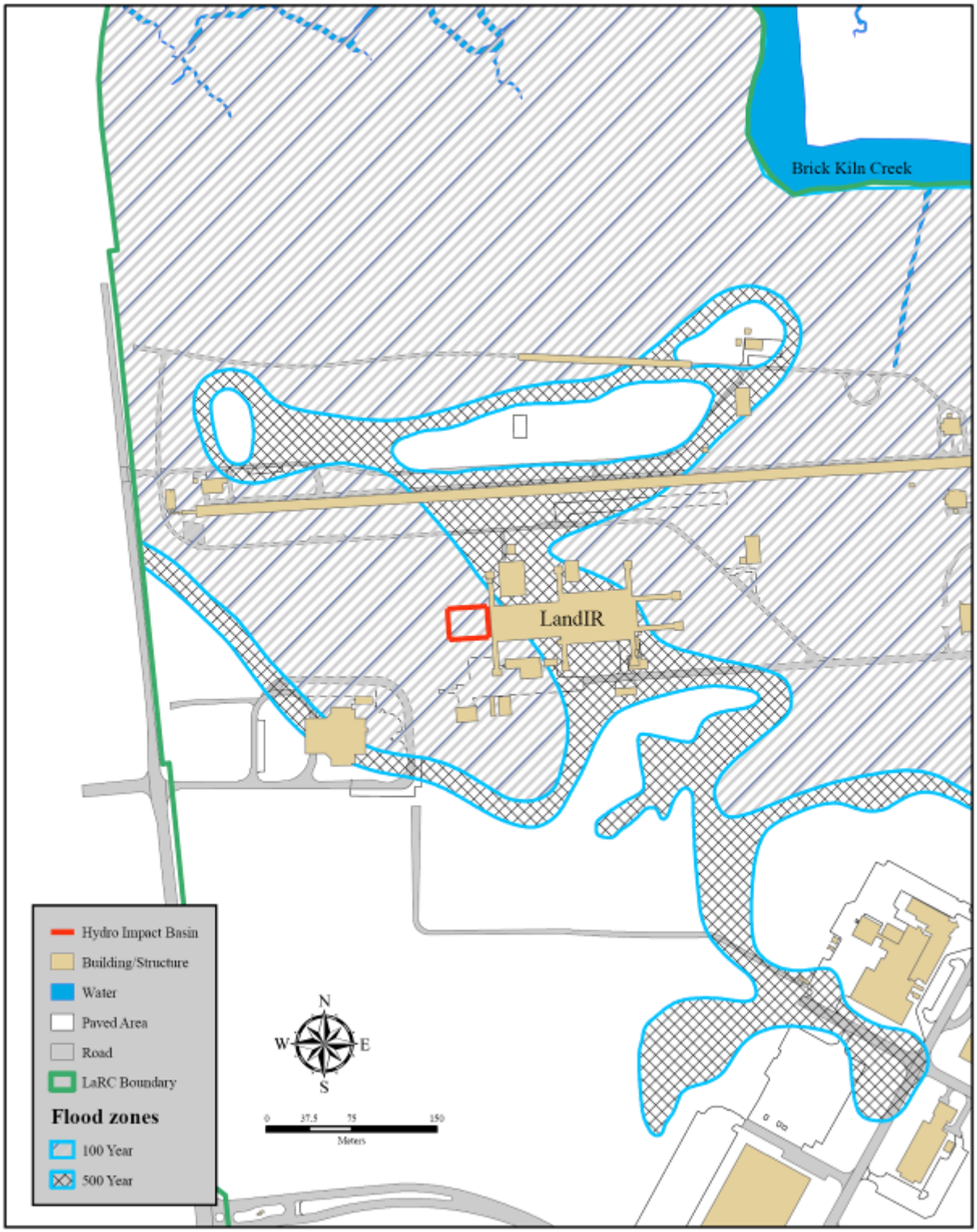


Figure 3-4 –Floodplains in Area of Proposed Action

3.10 ECOLOGICAL RESOURCES

3.10.1 Threatened and Endangered Species

The Endangered Species Act of 1973 (16 U.S.C. 1531 through 1543) was enacted to identify imperiled species and to protect the ecosystems upon which these species depend. The term, endangered species, applies to "any species that exists in such small numbers that it is in danger of extinction throughout all or a significant portion of its range." The term threatened species pertains to "any species which is likely to become an endangered species within the foreseeable future through all or a significant portion of its range." The list of endangered and threatened species, and proposed candidates for listing, are published in the Federal Register on an annual basis (50 CFR Part 17). Section 7 of the Endangered Species Act requires Federal agencies to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species.

The Virginia Endangered Species Act (Title 29.1-563) was enacted to provide protection to species of fish and wildlife threatened with extinction in Virginia. Under the Virginia Endangered Plant and Insect Species Act (Title 3.1-1020 through 3.1-1030), the Virginia Department of Agriculture and Consumer Services conserves, protects, and manages endangered and threatened plant and insect species.

No Federal or State-listed threatened or endangered species were documented at LaRC during the most recent biological survey of the Center: the 1995 "Baseline Biological Survey of Terrestrial and Aquatic Habitats at NASA Langley Research Center, With Special Emphasis on Endangered and Threatened Flora and Fauna" conducted by Old Dominion University. Although not encountered during the survey at LaRC, the species in Table 3-3 have been identified in the City of Hampton.

Table 3-3. Threatened and endangered species identified in Hampton, VA

Common Name	Scientific Name	Status
Turtle, Kemp's (Atlantic) Ridley sea	Lepidochelys kempii	Federal Endangered, State Endangered
Turtle, leatherback sea	Dermochelys coriacea	Federal Endangered, State Endangered
Beetle, Northeastern beach tiger	Cicindela dorsalis dorsalis	Federal Threatened, State Threatened
Turtle, loggerhead sea	Caretta caretta	Federal Threatened, State Threatened
Plover, piping	Charadrius melodus	Federal Threatened, State Threatened
Turtle, green sea	Chelonia mydas	Federal Threatened, State Threatened
Rattlesnake, canebrake	Crotalus horridus	State Endangered
Falcon, peregrine	Falco peregrinus	State Threatened
Sandpiper, upland	Bartramia longicauda	State Threatened
Shrike, loggerhead	Lanius ludovicianus	State Threatened
Salamander, Mabee's	Ambystoma mabeei	State Threatened
Shrike, migrant loggerhead	Lanius ludovicianus migrans	State Threatened

Source: VA Fish and Wildlife Information Service
VA Department of Conservation and Recreation, Division of Natural Heritage

The Natural Heritage Program, which is part of the Virginia Department of Conservation and Recreation, was established to conserve Virginia's biodiversity through inventory, protection, and stewardship. The Natural Heritage Program maintains a statewide database for conservation planning and project review, land protection for the conservation of biodiversity, and the protection and ecological management of natural heritage resources (the habitats of rare, threatened, and endangered species, significant natural communities, geologic sites, and other natural features). The databases of the Natural Heritage Program were queried for occurrences of natural heritage resources in Hampton, Virginia. The databases document the local presence of threatened and endangered species (such as those in Table 3-3), as well as additional species that contribute to the local biodiversity, including the great egret (*Ardea alba*), the bald eagle (*Haliaeetus leucocephalus*), and the least tern (*Sterna antillarum*).

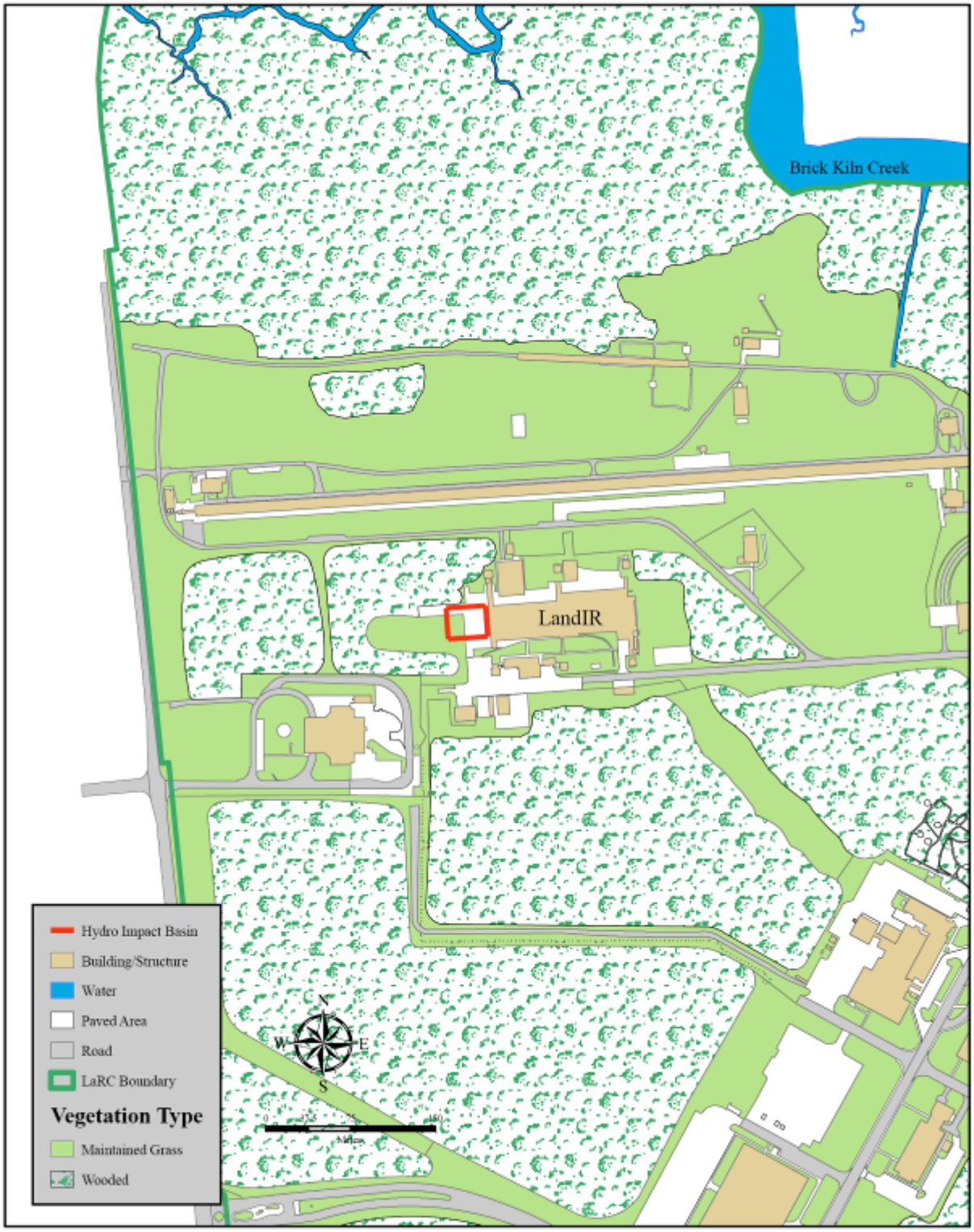
3.10.2 Wildlife

LaRC supports several wildlife species with its unimproved lands providing habitat for fur-bearing (game) mammals, small mammals, birds, reptiles, amphibians, and fish. Tall fencing surrounding the property limits movement of many larger animals on and off the property from adjacent unimproved lands. Some species that would be expected in this area include common rodents, such as house mouse or white-footed mouse; birds such as American robin, blue jay, fish crow, and common grackle, and reptiles such as eastern box turtle. LaRC also attracts some white-tailed deer, raccoons, and Virginia opossum that forage from the adjacent woods and wetland areas. The site of the proposed Hydro-Impact Basin is located in a developed area that offers limited value to native wildlife. The wooded areas adjacent to the location could support the wildlife species listed above.

3.10.3 Vegetation

Significant portions of LaRC contain undeveloped wooded vegetation (Figure 3-5) as well as large areas of maintained grass and landscaping. The LandIR structure is located in a maintained grass area adjacent to wooded areas. The proposed Hydro-Impact Basin would be constructed in a location previously developed as part of the LandIR structure.

Figure 3-5 – LaRC Vegetation Resources



4.0 ENVIRONMENTAL IMPACTS

This chapter describes the potential impacts or effects of both the Proposed Action and the No-Action alternative on the environmental resources described in Chapter 3.

4.1 LAND USE

4.1.1 Proposed Action

Coastal Zone Management
Since LaRC is located within the coastal zone as defined under Virginia DEQ's Coastal Zone Management Program, proposed LaRC activities must be consistent with its enforceable policies regarding coastal resources. As noted in Section 3.1, the following enforceable policies are not applicable to the location of the Proposed Action: Fisheries Management, Subaqueous Lands Management, Dunes Management, and Shoreline Sanitation. The Coastal Lands Management policy is addressed in this section and the remaining Coastal Zone Management Program policies relating to air and water pollution are addressed in Section 4.8 and Section 4.10 respectively. As described in these sections, the Proposed Action would be consistent with the Coastal Zone Management Program's enforceable policies. LaRC submitted a Consistency Determination to DEQ on October 20, 2008 (See Appendix B).

The Coastal Lands Management program regulates activities in the Chesapeake Bay Resource Management Areas (RMAs) and Resource Protection Areas (RPAs). The Proposed Action would have no impact on an RPA or RMA.

Functional Zones
The Hydro-Impact Basin project would have no impact on LaRC's functional zones. The Hydro-Impact Basin and the associated testing activities would be compatible and consistent with its location in the Tunnels and Testing functional zone.

4.1.2 No-Action

Under the No-Action alternative, LaRC would not construct the Hydro-Impact Basin, and there would be no change to the current land use or functional zones at LaRC.

4.2 NOISE

4.2.1 Proposed Action

With the excavation/construction activities associated with building the Hydro-Impact Basin, heavy equipment and machinery would cause temporary increases in noise at the project area and along traffic corridors. The high noise levels would be intermittent over the construction period, and similar noises would be generated by the deactivation activities. Although the Proposed Action would occur in an area of LaRC that is not highly developed, the project area does experience fairly high noise levels generated from aircraft, the Refuse Fired Steam Generating Facility, testing operations at the LandIR, and traffic noise from the nearby Wythe Creek road. Compared to the ambient noise levels, noise produced by the excavation, construction, and deactivation activities would generally be more impulsive, relatively lower in magnitude, and spread out during the day. Table 4-1 shows examples of sound levels produced by construction

equipment at a distance of 15.2 meters (50 feet). Use of heavy machinery and equipment could result in a temporary minor adverse impact on tenants of the buildings and offices near the project site.

Table 4-1. Examples of Noise Levels Generated by Construction Equipment

Equipment	***Typical Noise Level (decibels) at 15.2 meters (50 meters)***
Backhoe	*80*
Concrete Mixer	*85*
Crane Mobile	*83*
Dozer	*85*
Generator	*81*
Grader	*85*
Jack Hammer	*88*
Loader	*85*
Saw	*76*
Shovel	*82*
Truck	*88*

Source: http://www.fhwa.dot.gov/environment/noise/handbook/09.htm

The noise generated by the CEV testing activities at the Hydro-Impact Basin would be sporadic and insignificant compared to the ambient noise levels.

4.2.2 No-Action

Under the No-Action alternative, LaRC would not initiate the Hydro-Impact Basin project, and there would be no change in noise levels in the area.

4.3 CULTURAL RESOURCES

4.3.1 Architectural Resources

4.3.1.1 Proposed Action

As one of LaRC's five NHLs, the LandIR facility is covered by the Programmatic Agreement (PA) among NASA, the National Conference of State Historic Preservation Officers, and the Advisory Council on Historic Preservation (ACHP) for management and use of NASA's NHL properties. In accordance with Stipulation I.B. of the PA, in November 2006, NASA notified the SHPO, the ACHP, and the National Park Service of proposed modifications to the LandIR including the construction of the Hydro-Impact Basin. (See Appendix B). The SHPO concurred with LaRC's determination that the proposed modifications would result in "no adverse effect" to the facility.

In addition, the Proposed Action would not adversely affect the integrity of the proposed LaRC Historic District as construction and use of the Hydro-Impact Basin would be consistent with the character and function of research and testing facilities located throughout the district. Therefore, implementation of the Proposed Action would not adversely impact LaRC's architectural resources.

4.3.1.2 No-Action

Under the No-Action alternative LaRC would not build the Hydro-Impact Basin, and there would be no change to LaRC's architectural resources.

4.3.2 Archaeological Resources

4.3.2.1 Proposed Action

The Hydro-Impact Basin would be located in highly developed area that has experienced previous ground disturbance and the discovery of undisturbed archaeological resources would not be anticipated. In consultation with the SHPO regarding the proposed project, LaRC agreed to perform shovel testing to confirm the area is clear of archeological resources. Qualified archaeologists conducted 13 shovel tests in the project area in September of 2008 and no artifacts were discovered. LaRC submitted the Phase I Cultural Resource Survey of the Hydro Impact Basin Area to the SHPO with a determination of "no further survey work required." Correspondence indicating the SHPO's concurrence is included in Appendix B. In the event that resources were uncovered during excavation, all earthmoving activity would immediately stop in the vicinity of the discovery and LaRC would notify the SHPO. In addition, LaRC would implement the procedures included in the CRMP for unanticipated discovery of cultural materials. As such, implementation of the Proposed Action would not affect archaeological resources.

4.3.2.2 No-Action

Under the No-Action alternative LaRC would not build the Hydro-Impact Basin, and there would be no impact to archaeological resources.

4.3.3 Traditional Resources

4.3.3.1 Proposed Action

There are no traditional resources located at LaRC so the Proposed Action would have no impact on traditional resources.

4.3.3.2 No-Action

There are no traditional resources located at LaRC so the No-Action alternative would have no impact on traditional resources.

4.4 HAZARDOUS MATERIALS AND HAZARDOUS/SOLID WASTE

4.4.1 Proposed Action

Hazardous materials used in for Hydro-Impact Basin operations would include water treatment chemicals and pyrotechnic cable cutters. The hazardous materials would be reviewed, acquired, stored and disposed of in accordance with applicable OSHA and environmental regulations and NASA LaRC policy. The water treatment chemicals and other hazardous materials would be tracked and managed using LaRC's web-based Chemical Material Tracking System. Personnel

handling and working with the water treatment chemicals would be properly trained and would wear the appropriate personal protective equipment.

All hazardous and regulated waste generated from the excavation, construction, operation or deactivation of the Hydro-Impact Basin would be disposed of in accordance with LaRC's waste management procedures and applicable Federal, State, and local regulations. In the event that petroleum contaminated soils or groundwater were discovered during the excavation or construction activities, LaRC would properly characterize and dispose of such materials at an appropriately permitted waste management facility.

Initially, the Proposed Action would generate solid waste because existing concrete and asphalt must be removed to facilitate excavation and construction of the Hydro-Impact Basin. The concrete and asphalt would be recycled to the maximum extent possible in order to reduce the amount of waste disposed in landfills. If non-hazardous, non-regulated, solid materials require disposal and the materials cannot be recycled, they would be consolidated and transported for disposal to a local landfill or for energy recovery at Hampton's Refuse-Fired Steam Generating Facility. As such, implementation of the Proposed Action would have a negligible impact on the environment resulting from the generation of hazardous, regulated and solid waste.

4.4.2 No-Action

Under the No-Action alternative, LaRC would not build the Hydro-Impact Basin, and there would be no change to the current levels of hazardous, regulated or solid waste generation at the Center.

4.5 POLLUTION PREVENTION

4.5.1 Proposed Action

The Hydro-Impact Basin project would be carried out following LaRC's principles of pollution prevention, to include source reduction, recycling/reuse, treatment and proper disposal of wastes. Materials generated from construction activities such as concrete and asphalt would be recycled to the maximum extent possible. Furthermore, contractors would be required to follow applicable best management practices to further reduce pollution.

The water quality in the Hydro-Impact Basin would be maintained to pond water quality through the use of chemical treatment. Consistent with the Center's pollution prevention principles, LaRC would strive to use the least hazardous water treatment chemicals and use the smallest quantity of chemicals that would effectively maintain water quality and clarity.

To avoid soil erosion and sediment runoff to the storm sewers, the excavated soil mounds would be seeded with native grasses.

4.5.2 No-Action

Under the No-Action alternative, LaRC would not build the Hydro-Impact Basin, and there would be no change in the levels of wastes or pollution generated at the Center.

4.6 HEALTH AND SAFETY

4.6.1 Proposed Action

The excavation and construction activities associated with the Hydro-Impact Basin would be carried out by qualified and properly licensed and permitted contractors. Contractors performing work at LaRC are required to comply with all applicable safety and health regulations, including OSHA and NASA regulations. Contractors involved in the project would be required to prepare and follow a site-specific Health and Safety Plan that complies with the regulations to ensure the safety of human health and the environment during excavation and construction. Contractors would receive a digging permit from LaRC subsurface utilities coordinator prior to any ground disturbance. Adherence to applicable health and safety procedures during excavation and construction would minimize the risk of injury to both the contractors working in the active project areas and the surrounding LaRC personnel.

Additional health and safety measures would be employed to ensure that the Hydro-Impact Basin does not pose a risk to LaRC personnel during operation and use of the facility. The existing perimeter fence around the LandIR complex would be surveyed and upgraded as necessary to prevent pedestrians from approaching and entering the facility or falling into the basin. Twenty high visibility vinyl warning signs would be mounted around the facility. Additional lighting would be provided by new floodlights mounted on the LandIR structure to provide a minimum average of 21.6 lumen/square meter (2 foot candles) lighting throughout the basin area. Swimmer access ladders/stairs would be provided around the perimeter for use by divers who may enter the water to assist with recovery should the CEV fill with water and sink. The ladders would also allow for easy exit in the unlikely event that personnel were to accidentally fall into the basin. Additionally, LaRC would ensure that personnel handling and adding the water treatment chemicals are properly trained and wear the appropriate personal protective equipment. Therefore, the Proposed Action would not result in significant impacts to the health and safety of LaRC personnel.

4.6.2 No-Action

Under the No-Action alternative, LaRC would not build the Hydro-Impact Basin, and there would be no change in the health and safety impacts on LaRC personnel.

4.7 AIR QUALITY

4.7.1 Proposed Action

The excavation and construction activities associated with the Proposed Action would result in a slight increase in emissions from vehicle/equipment exhaust and from fugitive dust. These effects would be minor and short term during the construction phase of the project. In relation to the large number of personal and Government vehicles operating on the Center, the additional emissions resulting from vehicles and from equipment would be negligible. In addition, fugitive dust would be minimized by using control methods outlined in the Virginia Regulations for the Control and Abatement of Air Pollution (9 Virginia Administrative Code 5-50-90). These precautions may include the use of water for dust control, covering of open equipment for conveying materials, prompt removal of spilled or tracked dirt from paved streets, and removal of dried sediments resulting from soil erosion. Stockpiled soil excavated from the Hydro-Impact

Basin could be a source of fugitive dust, but dust emissions would be minimized by sowing native grasses and plants on the stockpiled soil mounds.

The Proposed Action would not involve open burning.

The Proposed Action is not subject to the General Conformity Rule of the Clean Air Act because emissions of applicable pollutants would not exceed annual de minimis thresholds, nor are they regionally significant (i.e. 10% of regional emissions inventory). Since the Hampton Roads Air Quality Control Region (AQCR) is an ozone maintenance area, the emissions of ozone precursor pollutants (VOCs and NO_x) were calculated for the excavation and construction associated with the Hydro-Impact Basin. LaRC's calculations of the estimated emissions for the excavation/construction compared to de minimis and regional emissions inventories are displayed in Table 4-2.

Table 4-2. Air Conformity Applicability

Pollutant	Maximum Emissions from Proposed Action	De Minimis Threshold	10% of Regional Emissions Inventory
NO_x	0.03 tons per year	100 tons per year	715.2 tons per year
VOCs	0.00 tons per year	100 tons per year	879 tons per year

Source: US Air Force Conformity Applicability Model (ACAM) 4.3.3

No new stationary air emission sources are associated with the Hydro-Impact Basin project, so there would be no revisions to LaRC's Stationary Source Permit to Operate from the Virginia DEQ. LaRC would ensure that all activities associated with the Hydro-Impact Basin project would comply with the Federal Clean Air Act as enforced by the Virginia State Implementation Plan and the State Air Control Board (Code of Virginia § 10-1.1300). Therefore the Proposed Action would be consistent with the enforceable air management policies of the Coastal Zone Management Act. As such, implementation of the Proposed Action would result in minimal impact on air quality at LaRC.

4.7.2 No-Action

Under the No-Action alternative, LaRC would not build the Hydro-Impact Basin, and there would be no change in air quality at LaRC.

4.8 SOILS AND GEOLOGY

4.8.1 Proposed Action

Construction of the Hydro-Impact Basin would involve ground disturbance associated with excavating a large amount of soil. The basin, at a depth of 7.6 meters (25 feet), would extend through the surface soil layer of clayey sand which reaches an approximate depth of 2.4 meters (8 feet). The basin would extend into the layer of silt-like sand with shell fragments which reaches a depth of 10.7 meters (35 feet). The excavated soil would be stockpiled nearby for the duration of CEV hydro-impact testing. In the event that petroleum contaminated soils or groundwater were discovered during the excavation or construction activities, LaRC would properly characterize and dispose of such materials at an appropriately permitted waste management facility. Although it is not anticipated that de-watering wells would be required, in

the event that wells were later needed to alleviate groundwater pressure, up to 8 wells would be drilled to a depth of 24 meters (50 feet). LaRC would be responsible for ensuring appropriate permits were secured prior to well installation, and that construction and operation of the wells complied with applicable well construction codes and permit requirements. Upon completion of the hydro-impact testing, the Hydro-Impact Basin would be backfilled with the stockpiled soil and graded to match existing surroundings. As such, implementation of the Proposed Action would have a minor impact on the local geology and soils.

4.8.2 No-Action

Under the No-Action alternative, LaRC would not initiate the Hydro-Impact Basin project, and there would be no change in soils or geology at LaRC.

4.9 WATER RESOURCES

4.9.1 Surface Waters

4.9.1.1 Proposed Action

In accordance with Virginia's Department of Conservation and Recreation (DCR), construction activities at LaRC that disturb equal to or greater than 0.4 hectares (one acre) require coverage under the General Permit for Discharges of Stormwater From Construction Activities. Additionally, since LaRC is within a Chesapeake Bay Preservation locality, construction activities larger than 232 square meters (2,500 square feet) require coverage. Since the overall footprint of the Hydro-Impact Basin is 743 square meters (8,000 square feet), a permit would be required prior to beginning the project. LaRC would ensure that the contractors obtain the appropriate permits and prepare the required plans in accordance with DCR's construction site stormwater permit requirements.

The Proposed Action would result in minimal impact to the surface water resources of LaRC and the surrounding environment. Soil excavation and construction activities could produce a minor and temporary increase in suspended solids in the stormwater reaching the outfalls that drain the affected areas (primarily Outfall 5). Concrete and asphalt removed from the facility prior to excavation would be promptly transported off-Center in order to minimize the potential for contaminated runoff from stockpiled debris. Additionally, the excavated soil that would be stockpiled during the use of the Hydro-Impact Basin would be seeded with native grasses to minimize erosion. Silt fences, storm drain inlet and outlet protection, and other appropriate standard construction practices would be implemented in accordance with the erosion and sediment control requirements of Virginia's DCR.

The Hydro-Impact Basin would be filled with 4.5 million liters (1.2 million gallons) of potable water from the city of Newport News. This would allow LaRC to best meet the clarity requirements for impact-testing data retrieval. The water would be maintained in a clear enough state to support underwater photography to a distance of about 7.6 meters (25 feet) vertically and 10.7 meters (35 feet) horizontally by use of a chemical treatment plan. A chemical treatment plan would be utilized to maintain water quality such that:

- copper sulfate shall be maintained in the range from 0.2 to 0.8 ppm (parts per million),
- phosphates less than 300 ppb (parts per billion),

- PH in the range from 6.8 to 7.4,
- calcium hardness at a minimum of 150 ppm,
- alkalinity in the range from 70 to 100, and
- turbidity less than 10 ntu (Nephelometric Turbidity Units).

The chemicals that would be used are calcium carbonate, hydrochloric acid, sodium bicarbonate, calcium chloride, copper sulfate, lanthanum chloride, lanthanum sulfide, and polydiallyldimethyl ammonium chloride. The water would be tested once a month with the appropriate levels of chemicals added as necessary to maintain the expected water clarity and water quality. Although discharge of the water is not anticipated, the Hydro-Impact Basin would be added to LaRC's VPDES permit in the unlikely event that the basin requires draining to the storm sewer. LaRC would sample and analyze the water in accordance with the permit requirements and obtain approval from DEQ prior to discharging. Additionally, the water level in the basin would be maintained at a height to avoid overflow of water during significant rain events; as such, there would be no long-term impact to the quality or quantity of stormwater drainage to the outfalls.

The Virginia Coastal Zone Management Program (CZMP) maintains enforceable policies related to point source and non-point source water pollution. Additionally, the CZMP requires that soil-disturbing projects be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the State's waters. With the exception of groundwater dewatering operations, no large volume discharges are expected from the Hydro-Impact Basin during construction and operation. Although some water may splash or overspray outside the basin during drop testing activities, it is anticipated that the majority of the water would land on the concrete pad surrounding the basin and subsequently evaporate. In the event that dewatering wells are required to alleviate groundwater pressure on the walls of the basin, best management practices (BMPs) and erosion control would be implemented to minimize impacts to local surface waters. Such BMPs include:

- Minimizing dewatering discharge velocity to avoid scouring the receiving area;
- Filtering the discharge through geotextile fabric bags;
- Maintaining vegetated buffer/filter strips to prevent sediment from leaving the site;
- Designing structural controls, such as sediment basins or sumps to reduce sediment.

Construction of the Hydro-Impact Basin would adhere to the standards of Center's current VPDES permit (General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems) that requires LaRC to implement BMPs mitigating stormwater pollution from Center activities. These BMPs include employee training, preventive maintenance, visual inspections, spill prevention and response, sediment and erosion control, good housekeeping, and record keeping and reporting. Since LaRC would implement appropriate BMPs to reduce erosion and pollution, the Proposed Action would be consistent with the CZMP. A separate Consistency Determination was submitted by LaRC to DEQ on October 30, 2008 (See Appendix B).

As such, implementation of the Proposed Action would result in minor impacts to water resources at LaRC.

4.9.1.2 No-Action

Under the No-Action alternative, LaRC would not initiate the Hydro-Impact Basin project, and there would be no change in surface water resources at LaRC.

4.9.2 Wetlands.

4.9.2.1 Proposed Action

The Proposed Action would take place south and east of identified forested wetlands as shown in Figure 3-3. LaRC would minimize the risk of affecting the wetlands during excavation and construction activities by roping off the area to ensure heavy equipment is restricted from entering the wetlands area. During the water impact tests of the Orion CEV, minor overspray from the basin may occur that could reach the edge of the wetlands, however, since there are only five proposed testing events, the impact on the wetlands would be very minor.

4.9.2.2 No-Action

Under the No-Action alternative, LaRC would build the Hydro-Impact Basin, and there would be no impact on wetlands.

4.9.3 Floodplains

4.9.3.1 Proposed Action

The Hydro-Impact Basin would be constructed within the identified 100-year floodplain. LaRC has determined that the Hydro-Impact Basin would be compatible with the Center's floodplain management requirements in accordance with EO 11988 and NASA floodplain regulations. Due to the relatively small size of the project and the nature of the structure (i.e. below ground), LaRC does not anticipate that the floodplain would be adversely affected by the Proposed Action.

4.9.3.2 No-Action

Under the No-Action alternative, LaRC would not build the Hydro-Impact Basin, and there would be no change in LaRC's use of floodplains.

4.10 ECOLOGICAL RESOURCES

4.10.1 Threatened and Endangered Species

4.10.1.1 Proposed Action

It is anticipated that no Federal or State-listed threatened or endangered species (T & ES) would be adversely affected by the Proposed Action as no T & ES are known to inhabit LaRC. It is possible that some of the T & ES identified in the adjacent City of Hampton could also inhabit LaRC, although these species would not be anticipated in the Hydro-Impact Basin project area. Most of Hampton's identified T & ES are aquatic or beach-dwelling species: several sea turtles, the Northeastern beach tiger beetle, the upland sandpiper and the piping plover. The other T & ES found in Hampton, (two shrikes, the peregrine falcon, a salamander and a rattlesnake) would not be anticipated to inhabit the Hydro-Impact Basin area because it has experienced heavy development and high levels of human activity.

4.10.1.2 No-Action

Under the No-Action alternative, LaRC would not build the Hydro-Impact Basin, and there would be no change to the current state of LaRC's threatened or endangered species.

4.10.2 Wildlife

4.10.2.1 Proposed Action

Disturbance resulting from the Proposed Action would be limited to the local project site. The activity and noise generated from excavation and construction activities could temporarily displace animals from the immediate vicinity of the project area. A small number of less mobile wildlife and soil-dwelling species could be destroyed during the soil excavation and removal. The occasional use of the Hydro-Impact Basin for testing events could also temporarily displace some wildlife species due to increased noise or overspray into the surrounding area. The effect of the testing events on wildlife would be temporary, minor, and localized to the immediate project area. The basin would be equipped with a barrier to prevent large animals, such as LaRC's deer population, from entering the facility or falling into the basin. With deactivation of the facility and refilling of the Hydro-Impact Basin, a small number of soil-dwelling creatures living in the stockpiled mounds could be harmed. It is expected that the impacts to LaRC's wildlife resources caused by the Hydro-Impact Basin activities would be very minor.

4.10.2.2 No-Action

Under the No-Action alternative, LaRC would not build the Hydro-Impact Basin, and there would be no change to the current state of LaRC's wildlife resources.

4.10.3 Vegetation

4.10.3.1 Proposed Action

The Hydro-Impact Basin project would occur in a previously developed location at the LandIR facility, and the only vegetation affected by the Proposed Action would be maintained grass. Some maintained grass would be excavated for the construction of the basin and the adjoining concrete pad. An additional grassy spot would be used for stockpiling the excavated soil. No wild vegetation or wooded areas would be impacted. Following deactivation of the Hydro-Impact Basin, the areas would be reseeded, and the vegetation would be restored. Therefore the Proposed Action would have minor impacts on LaRC's vegetation resources.

4.10.3.2 No-Action

Under the No-Action alternative, LaRC would not build the Hydro-Impact Basin, and there would be no change to LaRC's current vegetation.

5.0 CUMULATIVE EFFECTS

The CEQ regulations require that all Federal agencies include cumulative impacts in their environmental analyses (40 CFR 1508.25(c)). Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). This includes those that may be "individually minor but collectively significant actions taking place over time" (40 CFR 1508.7).

Cumulative effects are most likely to arise when a relationship exists between a proposed action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in close proximity to the proposed action would be expected to have more potential for a relationship than actions that may be geographically separated. Similarly, actions that coincide, even partially, in time would tend to offer a higher potential for cumulative effects. The scope of the cumulative impacts analysis involves both the geographic extent of the effects and the timeframe in which the effects could be expected to occur.

The geographic extent for the environmental resources analyzed in this EA is limited to the local LaRC West Area because the region of influence for potential environmental impacts from the proposed project is largely confined within the LaRC fence line. The timeframe includes recent past and present actions continuing into the foreseeable future at LaRC. An effort has been made to generally identify actions that are being considered and that are in the planning phase at this time.

5.1 PAST, PRESENT AND REASONABLY FORESEEABLE ACTIONS

As an active research facility, LaRC undergoes continual change in order to align its capabilities with the Agency's overall mission. Like any major research installation, LaRC requires new construction, facility improvements and infrastructure upgrades to ensure the Center's resources are appropriate for carrying out its research. Many of LaRC's recent past, present and foreseeable future actions are related to an overarching NASA objective to streamline the Center's infrastructure and restructure and modernize the Center's facilities. To meet NASA's developing mission requirements, LaRC continues to pursue projects that transform the Center into a more modern, efficient, and technologically advanced Center. Given the age of LaRC's infrastructure and the changes in NASA's mission, many facilities have outlived their useful life and require extensive renovation or deconstruction. The projects below comprise the major past, present, and reasonably foreseeable future actions at NASA LaRC.

Between 2004 and 2006, LaRC demolished fourteen dilapidated and abandoned buildings in order to reduce the Center's unneeded and unused infrastructure. Architectural surveys were performed on the facilities and the surveys determined that none of the buildings were culturally or historically significant. Based on the EA prepared for the project, LaRC determined that minimal environmental impacts would result from the demolitions, and a Finding of No Significant Impact (FONSI) was issued.

In 2008 LaRC deconstructed Building 1212B, the 7x10-Foot High Speed Tunnel. NASA closed the facility in 1994 due to lack of need and because duplicate or superior testing capabilities exist at other NASA facilities. Since Building 1212B was determined eligible for listing in the National Register, LaRC developed a Memorandum of Agreement with the SHPO to minimize the adverse effect of deconstruction. In accordance with Section 106 of the National Historic Preservation Act and the mitigation stipulations of the Memorandum of Agreement, LaRC prepared Level 1 Historic American Engineering Record documentation on the facility, and developed a public interpretation website. After Section 106 consultation was complete, LaRC prepared an EA that determined no substantial environmental impacts would occur as a result of the deconstruction, and a FONSI was issued.

LaRC is planning to deconstruct thirteen abandoned or under-utilized buildings throughout the Center during the 2008-09 timeframe. The purpose of the proposed deconstruction is to streamline LaRC's infrastructure by removing deteriorating facilities that are no longer operational and/or needed to support NASA's mission. Four of the buildings are potentially eligible for listing in the National Register as contributing resources to LaRC's proposed historic district. LaRC is performing Section 106 consultation with the regarding deconstruction of these four buildings to minimize the adverse effects of the project.

LaRC is planning to deconstruct four closed wind tunnels between 2009 and 2012. The facilities are Building 640 (the 8-Foot Transonic Pressure Tunnel), Building 641 (the 8-Foot High Speed Tunnel), Building 643 (the Full Scale Tunnel), and Building 1146 (the 16-Foot Transonic Tunnel). The decision to deconstruct the facilities is based on the determination of no current or future government need to use the tunnels and no viable plans from non-governmental entities (industry, universities, etc.) to operate or adaptively reuse the facilities. The project would result in an adverse effect to LaRC's cultural resources since two of the facilities are National Historic Landmarks (NHLs) and two are eligible for listing in the National Register, both individually and as contributing resources to a proposed historic district. In order to mitigate the loss of the NHLs, NASA fulfilled the consultation and mitigation requirements of the NHL PA and is in the process of developing a MOA for the two National Register eligible properties. LaRC prepared an EA for the project and a FONSI was issued in June of 2008.

Beginning in 2009 and continuing over the next 15 years, LaRC is proposing to implement a major five-phase modernization and upgrade project called New Town. Site improvements would include construction of five new buildings, the renovation of two existing buildings, and the deconstruction of 22 abandoned and unneeded buildings; as well as upgrades to roadwork, parking lots, and utilities. The project would modernize the center core of LaRC, better align LaRC's capabilities with the future direction of the NASA mission, and significantly reduce the Center's operations and maintenance costs. This initiative would remove aging and inefficient facilities to be replaced by modern offices and research laboratories. The new facilities and modifications to existing facilities would meet the Leadership in Energy and Environmental Design (LEED) silver standards for building design. The New Town project would result in an adverse effect to several of LaRC's cultural resources. However, LaRC plans to mitigate the adverse effect through performing mitigation measures included in a center-side PA, currently under development with the SHPO and the ACHP. LaRC is currently preparing an EA to

evaluate the environmental impacts of the New Town project and to afford the public an opportunity to comment on the undertaking.

As described in Section 1.3 the Agency's evolving mission, especially the Constellation Program to return humans to the moon and beyond, could continue to affect the activities and operations at the NASA field Centers. LaRC's contribution to the Constellation project including leading the Launch Abort System integration project requires the introduction of various new research and development activities at the Center. NASA assessed these effects in the agency-wide Programmatic Environmental Impact Statement. The current and reasonably foreseeable activities that would occur at LaRC in support of Constellation would be similar to ongoing research activities conducted at LaRC in support of existing programs. If major activities not anticipated in the PEIS are proposed for implementation at LaRC, appropriate NEPA documentation would be prepared.

5.2 ANALYSIS OF CUMULATIVE IMPACTS

LaRC has examined the impacts on the environment that could result from the incremental impact of the Proposed Action when added to the actions described above. The analysis examined whether such a relationship would result in potentially significant impacts not identified when the Proposed Action is considered alone.

LaRC has determined that the projected cumulative effect of the Proposed Action, coupled with the other past, present, and future actions occurring at LaRC would result in minimal cumulative impacts to the resources analyzed in this EA.

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7.0 LARC PREPARERS AND CONTRIBUTORS

The LaRC Environmental and Logistics Branch prepared this EA. Individuals listed below contributed to the completion of the document by writing portions of the text, contributing background and supporting information, or providing technical review/comment on the draft.

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APPENDIX A

DRAWINGS OF HYDRO IMPACT BASIN

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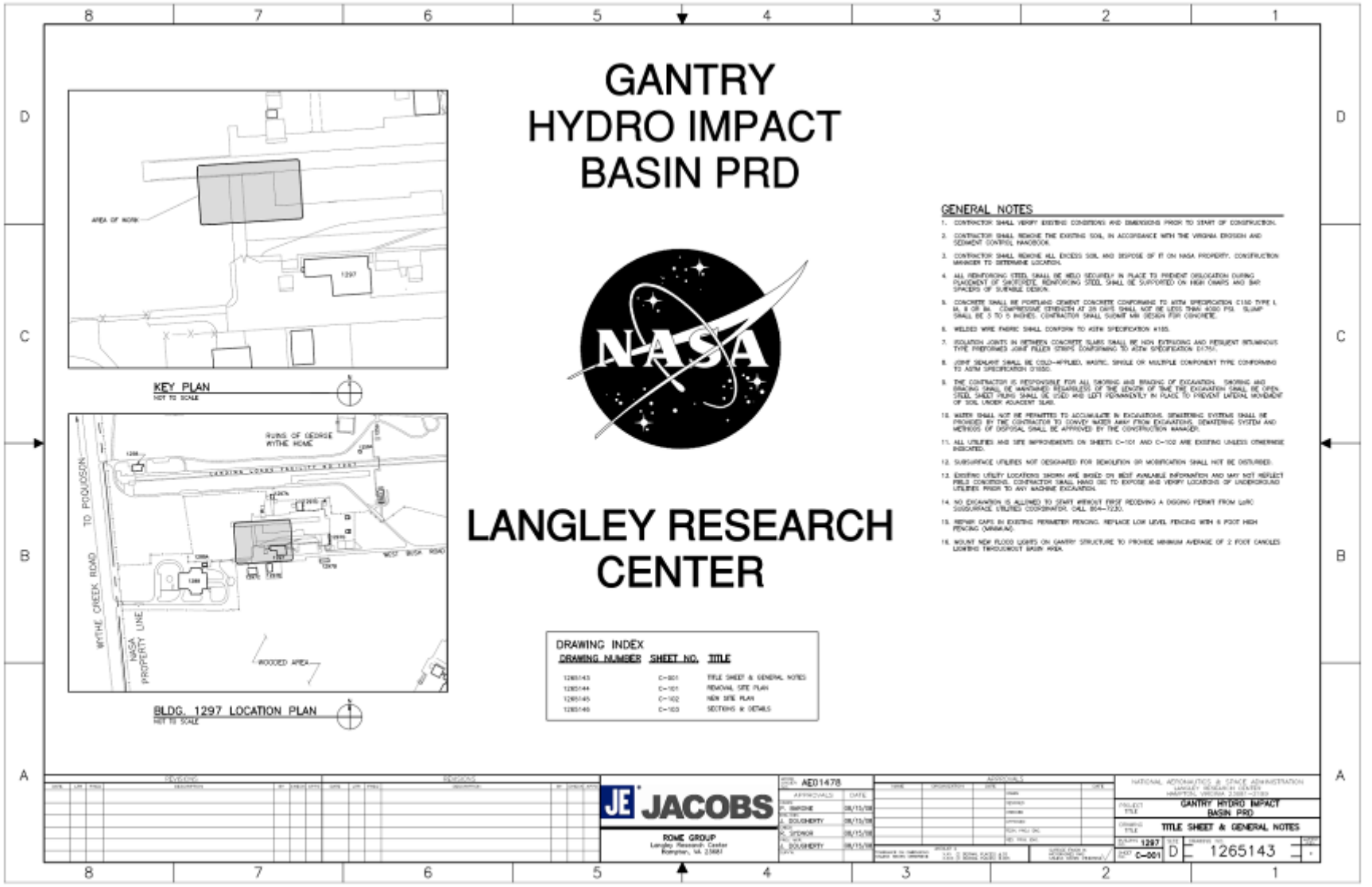
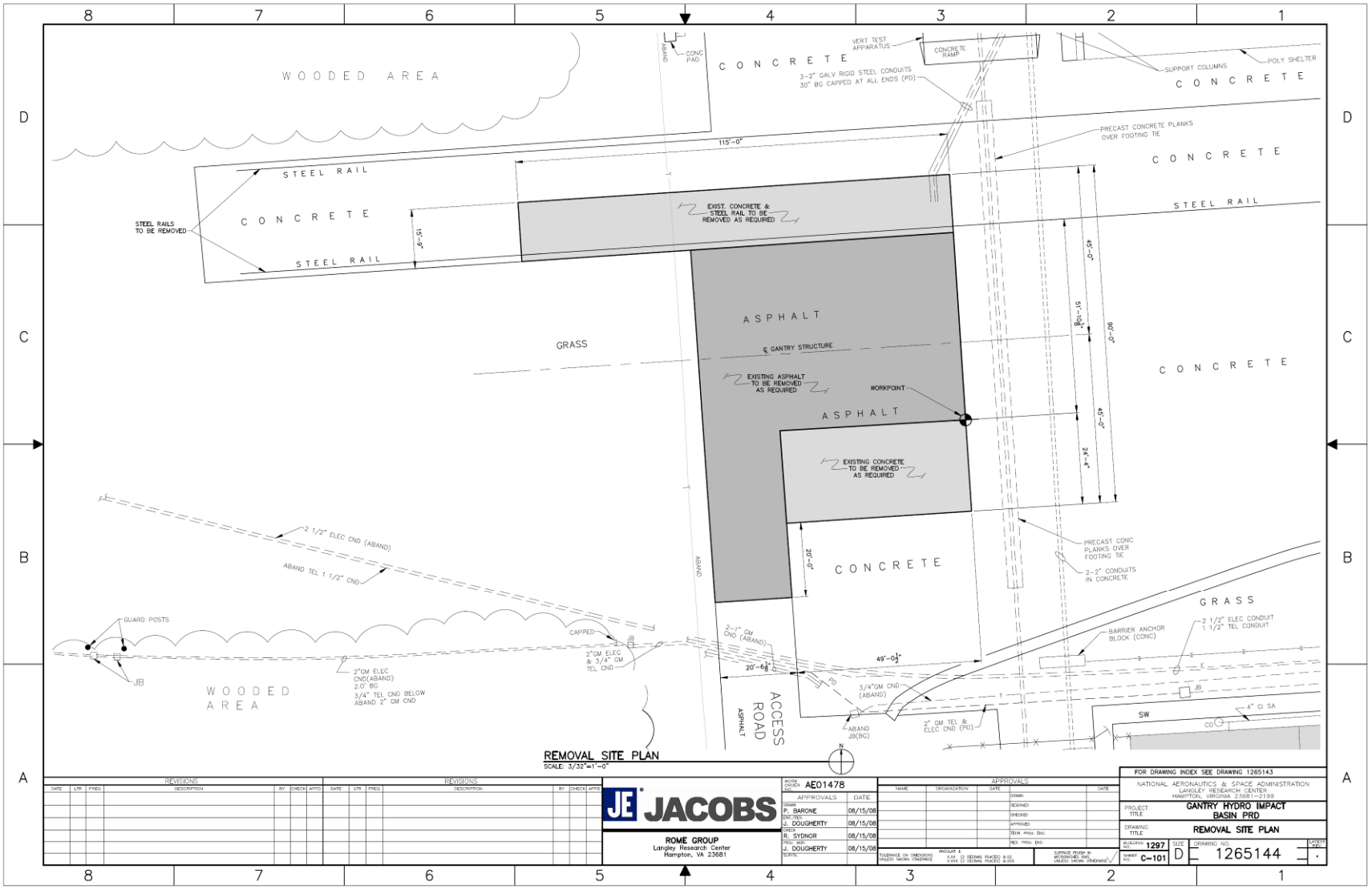
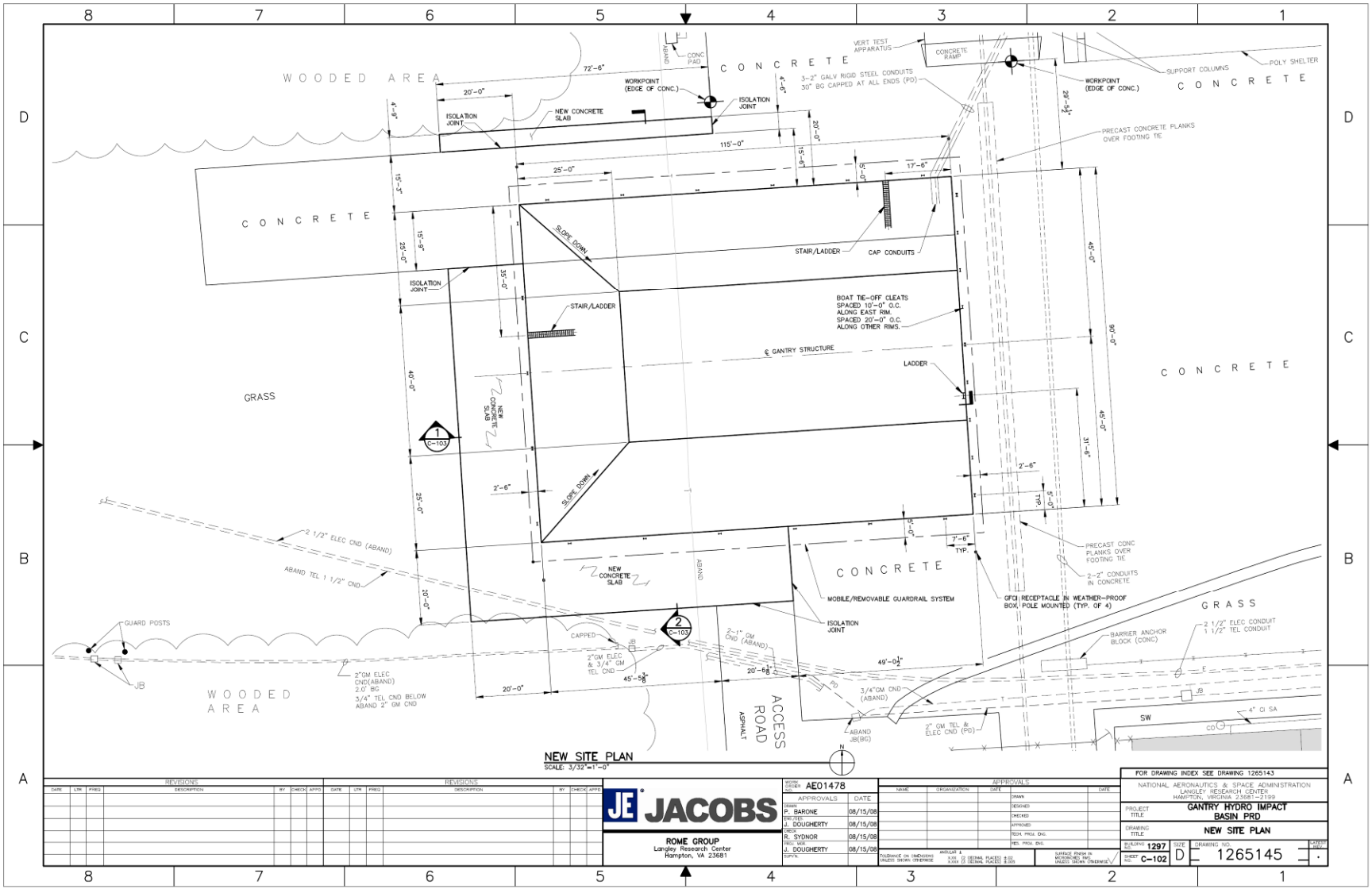
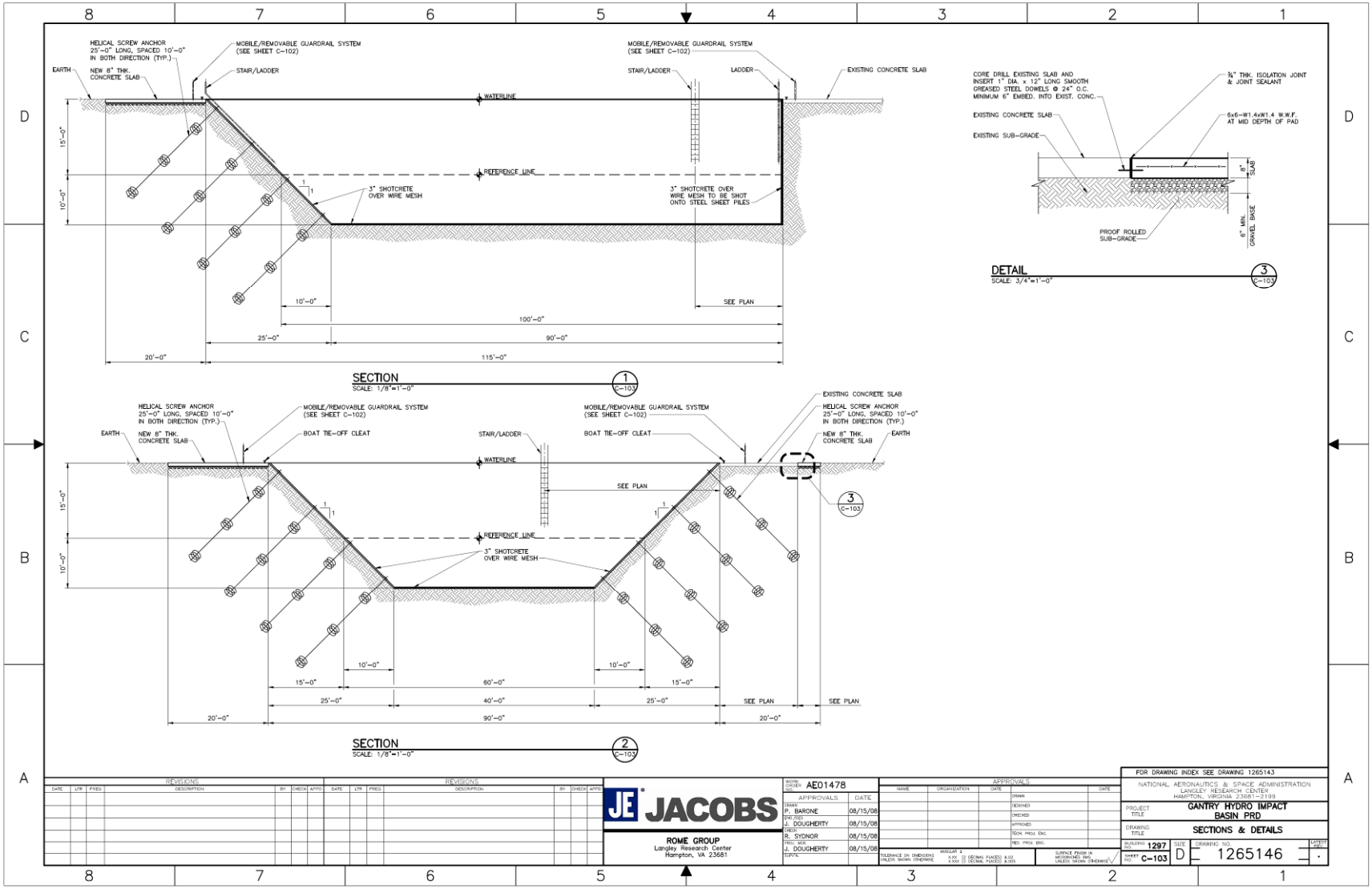

GANTRY
HYDRO IMPACT
BASIN PRD
LANGLEY RESEARCH
CENTER
KEY PLAN
NOT TO SCALE
BLDG. 1297 LOCATION PLAN
NOT TO SCALE
RUINS OF GEORGE WYTHE HOME
WYTHE CREEK ROAD
TO POQUOSON
NASA PROPERTY LINE
WOODED AREA
WEST BUSH ROAD
GENERAL NOTES
1. CONTRACTOR SHALL VERIFY EXISTING CONDITIONS AND DIMENSIONS PRIOR TO START OF CONSTRUCTION.
2. CONTRACTOR SHALL REMOVE THE EXISTING SOIL IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK.
3. CONTRACTOR SHALL REMOVE ALL EXCESS SOIL AND DISPOSE OF IT ON NASA PROPERTY. CONSTRUCTION MANAGER TO DETERMINE LOCATION.
4. ALL REINFORCING STEEL SHALL BE HELD SECURELY IN PLACE TO PREVENT DISLOCATION DURING PLACEMENT OF SHOTCRETE. REINFORCING STEEL SHALL BE SUPPORTED ON HIGH CHAIRS AND BAR SPACERS OF SUITABLE DESIGN.
5. CONCRETE SHALL BE PORTLAND CEMENT CONCRETE CONFORMING TO ASTM SPECIFICATION C150 TYPE I, IA, II OR IIA. COMPRESSIVE STRENGTH AT 28 DAYS SHALL NOT BE LESS THAN 4000 PSI. SLUMP SHALL BE 5 TO 5 INCHES. CONTRACTOR SHALL SUBMIT MIX DESIGN FOR CONCRETE.
6. WELDED WIRE FABRIC SHALL CONFORM TO ASTM SPECIFICATION A185.
7. ISOLATION JOINTS IN BETWEEN CONCRETE SLABS SHALL BE NON EXTRUDING AND RESILIENT BITUMINOUS TYPE PREFORMED JOINT FILLER STRIPS CONFORMING TO ASTM SPECIFICATION D1751.
8. JOINT SEALANT SHALL BE COLD-APPLIED, MASTIC, SINGLE OR MULTIPLE COMPONENT TYPE CONFORMING TO ASTM SPECIFICATION D1850.
9. THE CONTRACTOR IS RESPONSIBLE FOR ALL SHORING AND BRACING OF EXCAVATION. SHORING AND BRACING SHALL BE MAINTAINED REGARDLESS OF THE LENGTH OF TIME THE EXCAVATION SHALL BE OPEN. STEEL SHEET PILING SHALL BE CUED AND LEFT PERMANENTLY IN PLACE TO PREVENT LATERAL MOVEMENT OF SOIL UNDER ADJACENT SLAB.
10. WATER SHALL NOT BE PERMITTED TO ACCUMULATE IN EXCAVATIONS. DEWATERING SYSTEMS SHALL BE PROVIDED BY THE CONTRACTOR TO CONVEY WATER AWAY FROM EXCAVATIONS. DEWATERING SYSTEM AND METHODS OF DISPOSAL SHALL BE APPROVED BY THE CONSTRUCTION MANAGER.
11. ALL UTILITIES AND SITE IMPROVEMENTS ON SHEETS C-101 AND C-102 ARE EXISTING UNLESS OTHERWISE INDICATED.
12. SUBSURFACE UTILITIES NOT DESIGNATED FOR DEMOLITION OR MODIFICATION SHALL NOT BE DISTURBED.
13. EXISTING UTILITY LOCATIONS SHOWN ARE BASED ON BEST AVAILABLE INFORMATION AND MAY NOT REFLECT FIELD CONDITIONS. CONTRACTOR SHALL HAND DIG TO EXPOSE AND VERIFY LOCATIONS OF UNDERGROUND UTILITIES PRIOR TO ANY MACHINE EXCAVATION.
14. NO EXCAVATION IS ALLOWED TO START WITHOUT FIRST RECEIVING A DIGGING PERMIT FROM LaRC SUBSURFACE UTILITIES COORDINATOR, CALL 864-7230.
15. REPAIR GAPS IN EXISTING PERIMETER FENCING. REPLACE LOW LEVEL FENCING WITH 6 FOOT HIGH FENCING (MINIMUM).
16. MOUNT NEW FLOOD LIGHTS ON GANTRY STRUCTURE TO PROVIDE MINIMUM AVERAGE OF 2 FOOT CANDLES LIGHTING THROUGHOUT BASIN AREA.
DRAWING INDEX
DRAWING NUMBER SHEET NO. TITLE
1265143 C-001 TITLE SHEET & GENERAL NOTES
1265144 C-101 REMOVAL SITE PLAN
1265145 C-102 NEW SITE PLAN
1265146 C-103 SECTIONS & DETAILS
JACOBS
ROME GROUP
Langley Research Center
Hampton, VA 23681
AE01478
GANTRY HYDRO IMPACT BASIN PRD
TITLE SHEET & GENERAL NOTES
1297
C-001
D
1265143


WOODED AREA
CONCRETE
CONC PAD
VERT TEST APPARATUS
CONCRETE RAMP
SUPPORT COLUMNS
POLY SHELTER
3-2" GALV RIGID STEEL CONDUITS 30" BG CAPPED AT ALL ENDS (PD)
PRECAST CONCRETE PLANKS OVER FOOTING TIE
115'-0"
STEEL RAIL
STEEL RAILS TO BE REMOVED
EXIST. CONCRETE & STEEL RAIL TO BE REMOVED AS REQUIRED
ASPHALT
GRASS
℄ GANTRY STRUCTURE
EXISTING ASPHALT TO BE REMOVED AS REQUIRED
WORKPOINT
EXISTING CONCRETE TO BE REMOVED AS REQUIRED
45'-0"
90'-0"
24'-4"
20'-0"
PRECAST CONC PLANKS OVER FOOTING TIE
2-2" CONDUITS IN CONCRETE
2 1/2" ELEC CND (ABAND)
ABAND TEL 1 1/2" CND
GUARD POSTS
JB
2"GM ELEC CND(ABAND) 2.0' BG 3/4" TEL CND BELOW ABAND 2" GM CND
CAPPED
2"GM ELEC & 3/4" GM TEL CND
2-1" GM CND (ABAND)
3/4"GM CND (ABAND)
ABAND JB(BG)
2" GM TEL & ELEC CND (PD)
BARRIER ANCHOR BLOCK (CONC)
2 1/2" ELEC CONDUIT 1 1/2" TEL CONDUIT
SW
4" CI SA
ACCESS ROAD
REMOVAL SITE PLAN
SCALE: 3/32"=1'-0"
JACOBS
ROME GROUP
Langley Research Center
Hampton, VA 23681
AE01478
FOR DRAWING INDEX SEE DRAWING 1265143
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-2199
GANTRY HYDRO IMPACT BASIN PRD
REMOVAL SITE PLAN
1297
C-101
1265144


NEW SITE PLAN
SCALE: 3/32"=1'-0"
WOODED AREA
CONCRETE
GRASS
ACCESS ROAD
ASPHALT
NEW CONCRETE SLAB
ISOLATION JOINT
WORKPOINT (EDGE OF CONC.)
STAIR/LADDER
CAP CONDUITS
BOAT TIE-OFF CLEATS SPACED 10'-0" O.C. ALONG EAST RIM. SPACED 20'-0" O.C. ALONG OTHER RIMS.
LADDER
MOBILE/REMOVABLE GUARDRAIL SYSTEM
GFCI RECEPTACLE IN WEATHER-PROOF BOX, POLE MOUNTED (TYP. OF 4)
PRECAST CONC PLANKS OVER FOOTING TIE
2-2" CONDUITS IN CONCRETE
PRECAST CONCRETE PLANKS OVER FOOTING TIE
SUPPORT COLUMNS
POLY SHELTER
VERT TEST APPARATUS
CONCRETE RAMP
3-2" GALV RIGID STEEL CONDUITS 30" BG CAPPED AT ALL ENDS (PD)
BARRIER ANCHOR BLOCK (CONC)
2 1/2" ELEC CONDUIT 1 1/2" TEL CONDUIT
GUARD POSTS
JB
2" GM ELEC CND(ABAND) 2.0' BG 3/4" TEL CND BELOW ABAND 2" GM CND
2 1/2" ELEC CND (ABAND)
ABAND TEL 1 1/2" CND
2"GM ELEC & 3/4" GM TEL CND
3/4"GM CND (ABAND)
2" GM TEL & ELEC CND (PD)
ABAND JB(BG)
4" CI SA
SW
CO
SLOPE DOWN
SLOPE DOWN
FOR DRAWING INDEX SEE DRAWING 1265143
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-2199
PROJECT TITLE: GANTRY HYDRO IMPACT BASIN PRD
DRAWING TITLE: NEW SITE PLAN
BUILDING NO. 1297
SIZE D
DRAWING NO. 1265145
SHEET NO. C-102
JACOBS
ROME GROUP
Langley Research Center
Hampton, VA 23681
PROJECT NO. AE01478
APPROVALS DATE
P. BARONE 08/15/08
J. DOUGHERTY 08/15/08
R. SYDNOR 08/15/08
J. DOUGHERTY 08/15/08


HELICAL SCREW ANCHOR 25'-0" LONG, SPACED 10'-0" IN BOTH DIRECTION (TYP.)
MOBILE/REMOVABLE GUARDRAIL SYSTEM (SEE SHEET C-102)
EARTH
NEW 8" THK. CONCRETE SLAB
STAIR/LADDER
WATERLINE
REFERENCE LINE
3" SHOTCRETE OVER WIRE MESH
3" SHOTCRETE OVER WIRE MESH TO BE SHOT ONTO STEEL SHEET PILES
LADDER
EXISTING CONCRETE SLAB
SEE PLAN
SECTION
SCALE: 1/8"=1'-0"
BOAT TIE-OFF CLEAT
CORE DRILL EXISTING SLAB AND INSERT 1" DIA. x 12" LONG SMOOTH GREASED STEEL DOWELS @ 24" O.C. MINIMUM 6" EMBED. INTO EXIST. CONC.
¾" THK. ISOLATION JOINT & JOINT SEALANT
EXISTING SUB-GRADE
6x6-W1.4xW1.4 W.W.F. AT MID DEPTH OF PAD
8" SLAB
6" MIN. GRAVEL BASE
PROOF ROLLED SUB-GRADE
DETAIL
SCALE: 3/4"=1'-0"
JACOBS
ROME GROUP
Langley Research Center
Hampton, VA 23681
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-2199
GANTRY HYDRO IMPACT BASIN PRD
SECTIONS & DETAILS
1265146

APPENDIX B

CONSULTATION LETTERS AND CORRESPONDENCE

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National Aeronautics and
Space Administration
Langley Research Center
Hampton, VA 23681-2199

November 20, 2006

Reply to Attn of 300

Advisory Council on Historic Preservation
Mr. Thomas McCulloch
Historic Preservation Specialist
1100 Pennsylvania Ave., NW, Ste. 803
Washington, DC 20004

SUBJECT: Modifications to the Lunar Lander Facility at NASA Langley Research Center

Dear Mr. McCulloch,

NASA Langley Research Center (LaRC), located in Hampton, VA, is planning to make several minor modifications to its Lunar Lander Facility (commonly referred to as "the Gantry"). As you know, the Gantry is one of LaRC's five National Historic Landmarks, and is thus covered by the Programmatic Agreement (PA) among NASA, the National Conference of State Historic Preservation Officers (NCSHPO), and the Advisory Council on Historic Preservation (ACHP).

You will recall that the Gantry was closed in 2004 and placed on a list of facilities that NASA proposed to demolish. Due to an adaptive re-use opportunity that recently materialized in the wake of the Agency's new Manned Exploration (Moon and Mars) initiative, the Gantry was removed from the demolition list and reopened. To summarize, NASA senior management has elected to re-utilize the Gantry to conduct tests associated with the development of the Crew Exploration Vehicle (CEV), recently named ORION. This is a use that is remarkably similar to the original purpose of the Gantry - the testing of the LEM (Apollo Lunar Excursion Module).

As a result of this new direction, NASA is planning to make some minor modifications to the Gantry that will permit the facility to accommodate this new mission. They will consist of the following:

- Installation of a new parallel winch system to support full-scale ORION testing and increase the facility's testing capabilities.
- Structural assessment study and repair of the bridge which is needed to rate it to its original full capacity of 30,000 lbs vertical and inertia loads.

- Demolition of existing elevator that was shut down in fall of 2005 due to operational and safety concerns. A condition assessment performed in 2000 determined it is too costly to repair to acceptable code, the housing is not water tight, and there is major structural corrosion.
- Installation of new elevator to replace the old elevator and allow test personnel access to the top of the Gantry. Personnel currently have to climb the stairs which generates health and safety issues.

- Installation of a new splashdown pool underneath the Gantry which is needed for water landing simulation. The Agency has not yet determined if the CEV landing will be via land or water, as such, this project is not confirmed.

The modifications listed above are still in the preliminary design phase. NASA will ensure that the modifications are compatible with the existing structure, purpose, and operation of the facility. It is anticipated that the installation of the parallel winch system will be the first modification to the facility, with the elevator work following soon after.

NASA LaRC has determined that the modifications to the Gantry will have no adverse effect on the historic property.

In accordance with Stipulation I.B. of the existing PA, NASA is notifying you of the proposed modifications. Additionally, as required in Stipulation III.A. of the PA, NASA has completed Level I Historic American Engineering Record (HAER) documentation of the facility in accordance with the Secretary of the Interior's *Standards for Architectural Engineering Documentation*. A non-archival copy of the HAER document is included as an attachment to this letter. A similar notification letter has been sent to the National Park Service and the ACHP along with the HAER documentation.

Should you have any questions or require additional information regarding this notification of no adverse effect, please do not hesitate to contact me at 757-864-6118.

Respectfully,

Rodney T. Harris
Center Master Planner
Historic Preservation Officer

Enclosures

National Aeronautics and
Space Administration
Langley Research Center
Hampton, VA 23681-2199

November 20, 2006

Reply to Attn of: 300

Virginia Department of Historic Resources
Office of Review and Compliance
ATTN: Joanna Wilson and Kristin Kirchen
2801 Kensington Avenue
Richmond, Virginia 23221

SUBJECT: Modifications to the Lunar Lander Facility at NASA Langley Research Center

Dear Ms. Wilson and Ms. Kirchen,

NASA Langley Research Center (LaRC), located in Hampton, VA, is planning to make several minor modifications to its Lunar Lander Facility (commonly referred to as "the Gantry"). As you know, the Gantry is one of LaRC's five National Historic Landmarks, and is thus covered by the Programmatic Agreement (PA) among NASA, the National Conference of State Historic Preservation Officers (NCSHPO), and the Advisory Council on Historic Preservation (ACHP).

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Respectfully,

Rodney T. Harris
Center Master Planner
Historic Preservation Officer

Enclosures

National Aeronautics and
Space Administration
Langley Research Center
Hampton, VA 23681-2199

November 20, 2006

Reply to Attn of: 300

National Park Service
Mr. William Bolger
Architectural Historian
200 Chestnut Street
Philadelphia, PA 19106

SUBJECT: Modifications to the Lunar Lander Facility at NASA Langley Research Center

Dear Mr. Bolger,

NASA Langley Research Center (LaRC), located in Hampton, VA, is planning to make several minor modifications to its Lunar Lander Facility (commonly referred to as "the Gantry"). As you know, the Gantry is one of LaRC's five National Historic Landmarks, and is thus covered by the Programmatic Agreement (PA) among NASA, the National Conference of State Historic Preservation Officers (NCSHPO), and the Advisory Council on Historic Preservation (ACHP).

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Respectfully,

Rodney T. Harris
Center Master Planner
Historic Preservation Officer

Enclosures

COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221

Kathleen S. Kilpatrick
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
TDD: (804) 367-2386
www.dhr.virginia.gov

December 14, 2006

Mr. Rodney Harris
Historic Preservation Officer
National Aeronautics and Space Administration
Langley Research Center
Hampton, VA 23681-2199

Re: Modifications to the Lunar Lander Facility
DHR File # 2006-1847

Dear Mr. Harris:

We have received the above referenced project for our review and comment. Our staff has completed the review of the materials submitted. Based upon the information provided, we have determined that there will be *no adverse effect* to the Lunar Lander Facility ("the Gantry") as a result of planned activities. Please consult with our office regarding any modifications or additions to this scope of work.

If you have any questions about the Section 106 review process or our comments, please call me at (804) 367-2323, Ext. 140.

Sincerely,

Joanna Wilson, Archaeologist
Office of Review and Compliance

Administrative Services
10 Courthouse Avenue
Petersburg, VA 23803
Tel: (804) 863-1624
Fax: (804) 862-6196

Capital Region Office
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Tidewater Region Office
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Newport News, VA 23608
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Fax: (757) 886-2808

Roanoke Region Office
1030 Penmar Ave., SE
Roanoke, VA 24013
Tel: (540) 857-7585
Fax: (540) 857-7588

Winchester Region Office
107 N. Kent Street, Suite 203
Winchester, VA 22601
Tel: (540) 722-3427
Fax: (540) 722-7535

National Aeronautics and
Space Administration
Langley Research Center
Hampton, VA 23681-2199

October 20, 2008

Reply to Attn of: 300

Virginia Department of Historic Resources
Office of Review and Compliance
ATTN: Joanna Wilson and Ron Grayson
2801 Kensington Avenue
Richmond, Virginia 23221

RE: Final Phase I Cultural Resource Survey of the Hydro Impact Basin, NASA Langley Research Center, Hampton, Virginia, VDHR File # 2008-1051

Dear Ms. Wilson and Mr. Grayson,

Enclosed are two copies of the final Phase I Cultural Resource Survey for the proposed installation of a Hydro Impact Basin at the Landing Impacts Research (LandIR) facility at NASA Langley Research Center. The results of the survey determined that no further work is recommended at the site.

If you have any questions, please do not hesitate to contact me at 757-864-6118.

Sincerely,

Rodney Harris
Center Master Planner
Historic Preservation Officer

Enclosures

COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221-0311

Kathleen S. Kilpatrick
Director

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www.dhr.virginia.gov

November 14, 2008

Mr. Rodney Harris
NASA Langley Research Center
Hampton, VA 23681-2199

Re: Final Phase I Cultural Resources Survey Review
Hampton Virginia
DHR File #: 2008-1051
Date Received: October 20, 2008

Dear Mr. Harris:

We have received for review a copy of the report *A Phase I Cultural Resource Survey of Hydro Impact Basin At NASA Langley Research Center, Hampton, Virginia* (Fesler et all: 2008) for our review and comment. We are pleased to inform you that the report meets the Secretary of the Interior's *Standards and Guidelines for the Documentation of Archaeological Sites* (48 FR 44734-44742) and our Department's *Survey Guidelines* (revised 2001).

Thank you for providing our office an opportunity to comment on this report. If you have any questions about our comments, please contact me at: ron.grayson@dhr.virginia.gov or (804) 367-2323, Ext. 105.

Sincerely,

Ronald Grayson, RPA, Archaeologist
Office of Review and Compliance

Administrative Services
10 Courthouse Avenue
Petersburg, VA 23803
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Fax: (540) 857-7588

Northern Region Office
5357 Main Street
PO Box 519
Stephens City, VA 22655
Tel: (540) 868-7031
Fax: (540) 868-7033

October 30, 2008

213

Ms. Ellie L. Irons
Environmental Impact Review Program Manager
Department of Environmental Quality
629 East Main Street
Richmond, Virginia 23219

Dear Ms. Irons:

NASA Langley Research Center (LaRC) is located within the coastal zone as defined under DEQ's Virginia Coastal Resources Management Program (VCP). Therefore, LaRC is required to determine the consistency of its proposed activities with the VCP. This Federal Consistency Determination (FCD) is addressed in a forthcoming *Draft Environmental Assessment for the Hydro-Impact Basin Project at NASA Langley Research Center*. LaRC is submitting a FCD separately to DEQ in advance of the Draft EA in an effort to have the respective 60 and 30 day review and comment periods for both the Consistency and NEPA reviews conclude coincidently.

Coastal Zone Management Act (CZMA) Consistency Determination

This document provides the Commonwealth of Virginia with NASA LaRC's Consistency Determination under CZMA section 307(c)(1) [or (2)] and 15 CFR Part 930, sub-part C, for the Hydro-Impact Basin project. The information in this Consistency Determination is provided pursuant to 15 CFR Section 930.39.

Based on the following information, data, and analysis, NASA finds that the Hydro-Impact Basin project at LaRC would be consistent with the enforceable and advisory policies of the Virginia Coastal Resources Management Program.

Description of Federal Activity

The project consists of constructing a Hydro-Impact Basin to the west of NASA LaRC's LandIR (the "gantry") facility, Building 1297. A map and photo of the project location are attached. The proposed water-filled basin would add full scale water-impact testing to the LandIR's current ground-impact capabilities and allow for simulated Orion CEV ocean splashdown recovery research in support of the Agency's Constellation Program.

The rectangular shaped basin would have a maximum depth of 25 feet with length and width dimensions of 115 feet by 90 feet at the surface waterline. A schematic of the

basin is shown in Figure 1. Three of the four walls would be sloped 45 degrees and stabilized with helical soil anchors, geotextile fabric and steel mesh wire. The soil

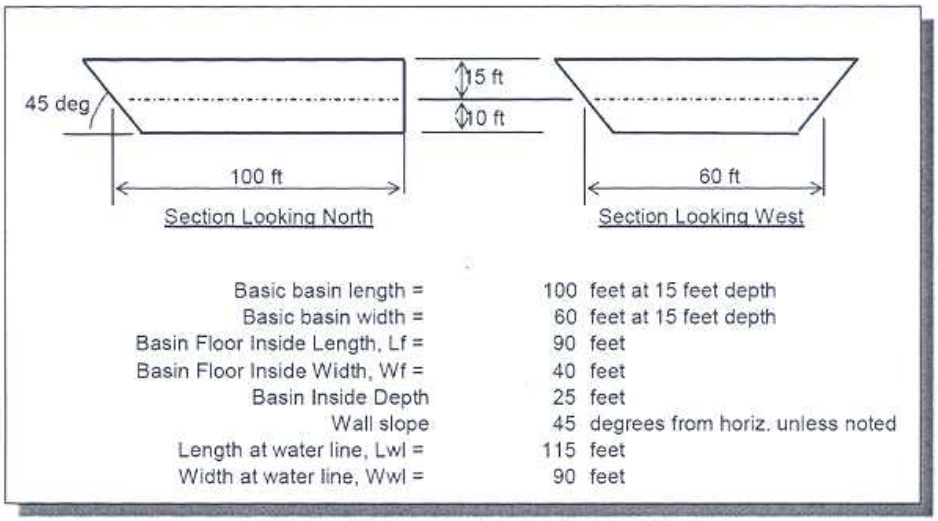


Figure 1 – Schematic of Hydro-Impact Basin

anchors would be embedded at a minimum depth of 25 feet below the face of the slope and spaced a minimum of 10 feet apart. The surface of the walls would be finished with 3 inches of spray-on concrete, also known as shotcrete. The east wall closest to the LandIR would be vertical and constructed of driven steel sheet piles. This wall, as well as the floor of the basin, would be reinforced with steel mesh wire and shotcrete. An eco-friendly, water-proof coating of polyurethane elastomer may be sprayed on just underneath the shotcrete to ensure groundwater does not leak in to the basin. The basin floor would measure 90 feet long by 40 feet wide. The perimeter of the basin would be surrounded by 20 feet of concrete pads to support vehicle access, as models dropped during impact testing would be removed by a truck-mounted crane rented for this purpose during periods of test activity. Sections of the LandIR facility perimeter fencing would be extended to close gaps and increased in height for added security. Additionally, temporary warning signs with barrier pipe posts and about 410 feet of chain would be erected as a barricade around the basin.

The excavated soil would be stockpiled in the grassy areas to the west of the LandIR facility, and the soil mounds would be planted with native plants and grasses in order to control erosion and fugitive dust emissions. While not currently included in the design plans, up to 8 de-watering wells may be installed at a later date to reduce the inward pressure of groundwater on the walls of the basin. Should they be needed, the wells would be drilled to 15 meters (50 feet) and each would pump approximately 20 gallons of water per day.

The Hydro-Impact Basin would be filled with approximately 1.2 million gallons of potable water. Chemical treatment would be used to maintain the water in a clear enough state to support underwater photography to a distance of about 25 feet and 35 feet. The water treatment would be used to maintain pond water quality and would consist of the following chemicals:

- calcium carbonate, for pH control
- hydrochloric acid, for pH control
- sodium bicarbonate, for alkalinity control
- calcium chloride, to raise hardness
- copper sulfate, for algae control
- lanthanum chloride and lanthanum sulfate, for phosphate reduction
- polydiallyldimethyl ammonium chloride, for phosphate reduction

The water would be tested once a month with the appropriate levels of chemicals added as necessary to maintain the expected water clarity and quality to established standards for copper sulfate, phosphates, pH, calcium hardness, alkalinity and turbidity.

Analysis of Effects

The following VCP enforceable policies are *not applicable* to the location of the proposed Hydro Impact Basin.

- Fisheries Management. The project would have no effect on the conservation and enhancement of finfish and shellfish resources or the promotion of commercial and recreational fisheries.
- Subaqueous Lands Management. The project would not involve encroachment into, on or over state-owned subaqueous lands.
- Dunes Management. There are no sand covered beaches or sand dunes in the vicinity of the project location.
- Shoreline Sanitation. The project would not include interconnections to the sewer system and no septic tanks would be installed.
- Coastal Lands Management. The proposed location of the Hydro Impact Basin is a previously developed site and is not located in an area managed by the Chesapeake Bay Preservation Act.

The remaining VCP enforceable policies that *are applicable* to the proposed project relate to air and water pollution. They are addressed below:

- *Tidal and Nontidal Wetlands Management.* The project area is approximately 85 feet to the south and east of identified forested wetlands. LaRC would minimize the risk of affecting the wetlands during excavation and construction activities by temporarily fencing the area to ensure that heavy equipment is restricted access to the wetlands. During the water impact tests of the Orion CEV, minor overspray from the basin may occur that could reach the edge of the wetlands, however,

since there are only five proposed testing events, the impact on the wetlands would be very minor and consistent with the policies of the CZMA.

- *Non-Point Source Pollution Control.* Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. The soil excavation and construction activities of the project could produce a minor and temporary increase in suspended solids in the stormwater reaching the outfalls that drain the affected areas. Concrete and asphalt removed from the facility prior to excavation would be promptly transported off-Center in order to minimize the potential for contaminated runoff from stockpiled debris. Additionally, the excavated soil that would be stockpiled during the use of the Hydro-Impact Basin would be seeded with native grasses to minimize erosion. Silt fences, storm drain inlet and outlet protection, and other appropriate standard construction practices would be implemented in accordance with the erosion and sediment control requirements of Virginia's DCR. As such, the project would not involve non-point source pollution of the local waterways and the action would be consistent with the enforceable water management policies of the CZMA.

- *Point Source Pollution Control.* NASA LaRC operates under VPDES permit #VA0024741 which regulates discharges from storm water runoff and industrial operations. The project would involve filling the basin with 1.2 million gallons of potable water. The water would be chemically treated and tested once a month with the appropriate levels of treatment chemicals added as necessary to maintain water clarity and water quality in a clear enough state to support underwater photography to a distance of about 25 feet vertically and 35 feet horizontally.

  Although large volume discharge of water from the basin is not anticipated, the Hydro-Impact Basin would be added to LaRC's VPDES permit in the unlikely event that the basin requires draining to the storm sewer. LaRC would sample and analyze the water according to the permit limits and obtain approval from DEQ prior to discharging. Additionally, the water level in the basin would be maintained at a height to avoid overflow of water during significant rain events; as such, there would be no long-term impact to the quality or quantity of stormwater drainage to the outfalls. Although some water may splash or overspray outside the basin during drop testing activities, it is anticipated that the majority of the water would land on the concrete pad surrounding the basin and subsequently evaporate.

  In the event that dewatering wells are required to alleviate groundwater pressure on the walls of the basin, best management practices and erosion control would be implemented to minimize impacts to local surface waters. Such BMPs include:

  - Minimizing dewatering discharge velocity to avoid scouring the receiving area;
  - Filtering the discharge through geotextile fabric bags;

- Maintaining vegetated buffer/filter strips to prevent sediment from leaving the site;
- Designing structural controls, such as sediment basins or sumps to reduce sediment.

LaRC would be responsible for ensuring appropriate permits were secured prior to well installation, and that construction and operation of the wells complied with applicable well construction codes and permit requirements. Additionally the project would adhere to the standards of Center's current VPDES permit (General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems) that requires LaRC to implement Best Management Practices (BMPs) mitigating stormwater pollution from Center activities. These BMPs include employee training, preventive maintenance, visual inspections, spill prevention and response, sediment and erosion control, good housekeeping, and record keeping and reporting. Since LaRC would implement appropriate BMPs to reduce erosion and pollution, the project would be consistent with the CZMA.

❖ *Air Pollution Control.* The excavation and construction activities associated with the project would result in a slight increase in emissions from vehicle/equipment exhaust and from fugitive dust. These effects would be minor and short term during the construction phase of the project. In relation to the large number of personal and Government vehicles operating on the Center, the additional emissions resulting from vehicles and from equipment would be negligible. In addition, fugitive dust would be minimized by using control methods outlined in the Virginia Regulations for the Control and Abatement of Air Pollution (9 Virginia Administrative Code 5-50-90). These precautions may include the use of water for dust control, covering of open equipment for conveying materials, prompt removal of spilled or tracked dirt from paved streets, and removal of dried sediments resulting from soil erosion. Stockpiled soil excavated from the Hydro-Impact Basin could be a source of fugitive dust, but dust emissions would be minimized by sowing native grasses and plants on the stockpiled soil mounds.

The excavation and construction activities would not involve point source air pollution, so the action would be consistent with the enforceable air management policies of the CZMA.

Based upon the above information, data, and analysis, NASA finds that the Hydro-Impact Basin project is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Resources Management Program.

Pursuant to 15 CFR § 930.41, the Virginia Coastal Resources Management Program has 60 days from the receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension under 15 CFR § 930.41(b).

Virginia's concurrence will be presumed if its response is not received by the NASA LaRC on the 60th day from receipt of this determination. The State's response should be sent to:

Philip McGinnis, P.E.
Environmental & Logistics Branch
Mail Stop 213
NASA Langley Research Center
Hampton, VA 23681-2199

If you have any questions, please contact me at (757) 864-2073.

Cordially,

Philip McGinnis
Environmental Branch/COD

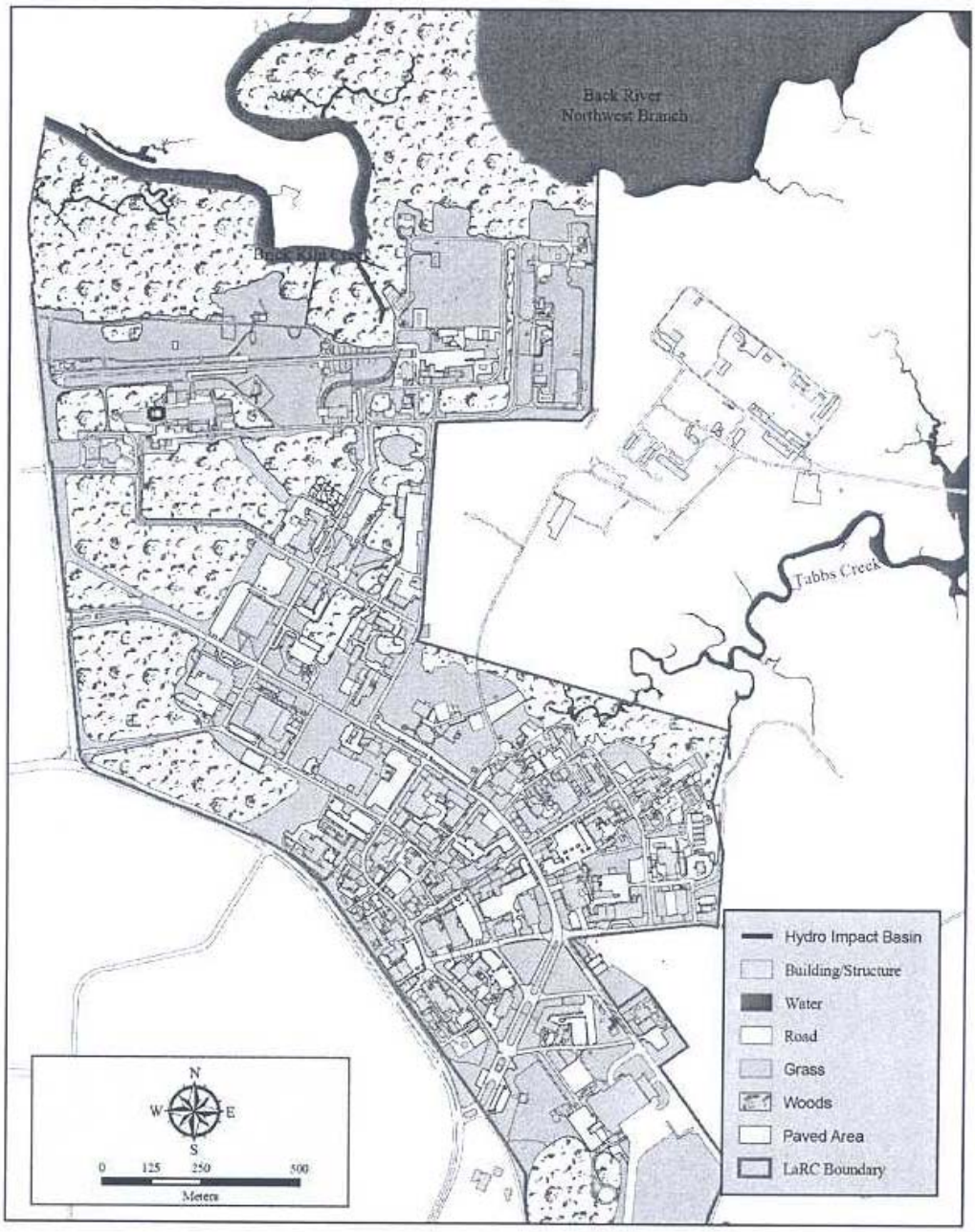
Enclosures

cc:
213/ELB
213/P. McGinnis

213/PMcGinnis:pdi 10-21-08 (4-2073)

241/CAM

7



Proposed Location of Hydro-Impact Basin

8

Aerial Photo of Hydro Basin Footprint

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APPENDIX C

METRIC/BRITISH CONVERSION TABLES

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Length Conversions

Metric Unit	British Unit
Centimeter	0.39 inches
Meter	3.28 feet
Meter	1.09 yards
Kilometer	0.621 miles

British Unit	Metric Unit
Inch	25.4 millimeters
Foot	0.305 meters
Yard	0.914 meters
Mile	1.61 kilometers

Area Conversions

Metric Unit	British Unit
Square meter	10.764 square feet
Square meter	1.195 square yards
Hectare	2.47 acres
Square kilometers	0.386 square miles

British Unit	Metric Unit
Square foot	0.093 square meters
Square yard	0.836 square meters
Acre	0.405 hectares
Square mile	2.59 square kilometers

Volume Conversions

Metric Unit	British Unit
Liter	2.1 pints
Liter	0.26 gallons

British Unit	Metric Unit
Pint	0.47 liters
Gallon	3.8 liters

Luminance Conversions

Luminance Conversions

Metric Unit	British Unit
Lumen/square meter	0.092 footcandles

British Unit	Metric Unit
Footcandle	10.76 lumens/square meter

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